Realflo

Reference and User Manual

5/19/2011

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Important Safety Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result** in death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result** in minor or moderate.

CAUTION

CAUTION used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result** in equipment damage..

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved.

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

CAUTION

UNINTENDED EQUIPMENT OPERATION

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment

Failure to follow these instructions can result in death, serious injury or equipment damage.

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and grounds, except those grounds installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove ground from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About The Book

At a Glance

Document Scope

This manual describes the Realflo programming environment for SCADAPack controllers.

Validity Notes

This document is valid for all versions of Realflo.

Product Related Information

⚠WARNING
UNINTENDED EQUIPMENT OPERATION The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter and apply this product. Follow all local and national safety codes and standards. **Failure to follow these instructions can result in death, serious injury or equipment damage.**

User Comments

We welcome your comments about this document. You can reach us by e-mail at technicalsupport@controlmicrosystems.com.

Introduction

Overview

Realflo is a Man-Machine Interface to the Control Microsystems Gas Flow Computer. The Gas Flow Computer runs on any of the SCADAPack controllers (4202 DR, 4202 DS, 4203 DR or 4203 DS), SCADAPack 32, SCADAPack 300, SCADAPack, SCADAPack 100: 1024K, SCADAPack LP controllers and SolarPack 410. Realflo allows editing of the flow computer configuration parameters with configuration dialogs for process inputs, contract specifications, compressibility calculations, and flow calculations for each meter run. The operator may write configuration data to the flow computer or read it back. parameter checking is provided on user entries.

The flow computer is an electronic natural gas flow computer providing the following industry standard calculations:

- AGA-3 (1992) for gas volume calculation with orifice meters;
- AGA-7 for gas volume calculation with turbine meters;
- AGA-11 for gas volume calculations with Coriolis meters (this calculation type is not supported on 16-bit controllers);
- V-Cone for gas volume calculation with V-Cone gas flow meters;
- AGA-8 Detailed calculation for gas compressibility calculation; and
- NX-19 for gas compressibility calculation in legacy applications.

Realflo displays the flow computer current readings, historical logs, alarm logs, and event logs for each meter run. Realflo supports having multiple configuration and display windows open simultaneously to display data from multiple views.

Realflo can be used to configure and calibrate the SCADAPack 4000, 4202, and 4203, as well as Rosemount MVT transmitters. The gas flow computer automatically polls the MVT transmitter for sensor information used in the gas flow calculations.

Realflo generates customized reports for configuration data, historical data logs, gas quality historical data logs, event logs, alarm logs, and calibrations.

Realflo can save configuration parameters, current readings, historical data logs, and event logs to spreadsheet files in csv format or in Flow-Cal cfx format.

Realflo provides wizard-style dialogs to guide you through the configuration, maintenance and calibration procedures.

The flow computer integrates with SCADA systems using Modbus-compatible communications. You can access data, configuration, and calculation factors over a SCADA network as well as locally at the flow computer. This manual describes the configuration and operation procedures for these systems.

The flow computer supports Enron Modbus protocol. This protocol is used widely in the Oil and Gas industry to obtain data from electronic flow measurement devices. The protocol is a de-facto standard in many industries.

The flow computer supports PEMEX Modbus protocol. This protocol is used in the Oil and Gas industry to obtain data from electronic flow measurement devices.

Users may integrate the flow calculation capability with user applications written in Ladder Logic, IEC 61131-3 or C/C++.

System Requirements

Realflo 6.70 is supported on the following operating systems (32- and 64-bit platforms):

- Microsoft Windows 2000 Professional
- Microsoft Windows XP Professional
- Microsoft Windows Vista Ultimate on 32-bit and 64-bit platforms
- Microsoft Windows Vista Enterprise on 32-bit and 64-bit platforms

The Realflo program requires the following minimum system configuration.

- Pentium 133MHz or better.
- Minimum screen resolution supported is 1024 by 768.
- Minimum 32 MB of RAM, 64MB recommended.
- Mouse or compatible pointing device.
- Hard disk with approximately 35 Mbytes of free disk space.

Organization of the Manual

New users should read the sections in order, to gain an understanding of underlying concepts before tackling detailed material.

The Realflo Installation Procedure section describes how to install Realflo.

The Realflo Maintenance Mode section describes how to use Realflo in the Maintenance Mode.

The Realflo Expert Mode section describes how to use Realflo in the Expert Mode.

The Realflo Wizards section describes how to use the configuration wizards available in Realflo.

The Measurement Units section describes the available units of measure.

The Creating Custom Realflo Applications section describes modifying the flow computer application.

The following sections describe communication with a SCADA system. If you are using Realflo alone these sections are not needed.

The TeleBUS Protocol Interface section describes interfacing the flow computer with a SCADA host.

Flow Computer Register Grouping section describes how to group commonly read data from a SolarPack 410 flow computer.

Flow Computer Application ID section describes the configuration registers that provide useful information on the flow computer, logic applications, and controller used in a Realflo application.

The **E**nron Modbus Protocol Interface section describes interfacing the flow computer with an Enron Modbus host.

The PEMEX Modbus Protocol Interface section describes interfacing the flow computer with a PEMEX Modbus host.

The D**NP3 User Manual** section describes interfacing the flow computer with a DNP host.

Additional Documentation

The ***Contr***ol Microsystems Hardware User Manual is a complete reference to Flow Computer and 5000 I/O modules.

The Telepace Ladder Logic Reference and User Manual describes the creation of application programs in the Ladder Logic language.

The ISaGRAF User and Reference Manual describes the creation of application programs using IEC 61131-3 languages.

The TeleBUS Protocols User Manual describes communication using Modbus compatible protocols.

The TeleBUS DF1 Protocol User Manual describes communication using DF1 compatible protocols.

Installation

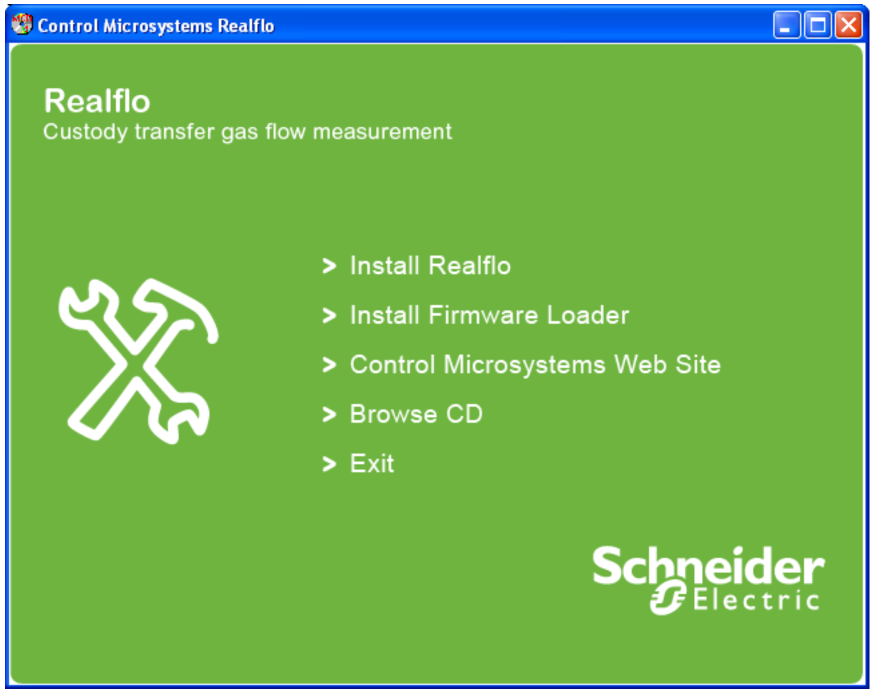
Before using Realflo, you need to install the Realflo program on your system. The installation is automated and takes only a few minutes.

- Some virus checking software may interfere with Setup. If you experience any difficulties with Setup, disable your virus checker and run Setup again.

To install Realflo, follow these steps:

(1) Insert the Realflo setup CD into CD drive. The CD loads automatically.

Realflo and Firmware Loader need to be installed.



(2) Select **Install Realflo** to start the Realflo install wizard.

(3) Select **Install Firmware Loader** to start the Firmware Loader install wizard.

(4) Select **Install Adobe Reader** to install the Adobe Acrobat reader.

(5) Select **Control Microsystems** Web Site to open the CD version of the website.

(6) Select **Browse CD** to open Windows Explorer and view the CD contents.

(7) Select **Exit** to close the Realflo install menu.

Flow computers used with Realflo need to have 1024K RAM and have the Flow Run option enabled. Contact Control Microsystems to purchase a memory upgrade or flow run option.

Version Release Notes

New Features in Realflo 6.77

Realflo 6.77 includes the following new features and enhancements.

- When restoring a configuration after a flow computer upgrade any forced values used in the configuration can be restored.
- The Enron Modbus Gas Analysis history is now available. Gas Quality History is available when the Gas Transmission option bit is enabled for the controller.
- Time stamping of Enron Modbus can be defined as time leads data or time lags data for flow data.
- Support for polling sensors for 10 runs in a SCADAPack 32 flow computer is added. Sensors and Coriolis meters can be polled using multiple serial ports and the flow computer manages the polling so that a 1 second poll of each sensors is achieved.
- Acknowledging of Alarms and Events is now configurable so the Host SCADA system can have control over how alarms and events are acknowledged.
- The selection of forward or reverse sensing is added. The direction status register can now be configured for the On status, i.e. forward indicated by On or reverse indicated by On.
- An indication of a configuration change in the flow computer density calculation is added. Registers provide the time and date of configuration changes to the AGA-8 calculation. This includes changes to the gas composition.

New Features in Realflo 6.76

AGA-11, Coriolis Mass Flow Meter Support

A new flow calculation type, AGA-11, is added to Realflo. The AGA-11 calculation supports the Endress and Hauser Promass 83 Coriolis meter.

Bi-Directional Flow Support

Realflo supports bi-directional flow. Flow direction, forward or reverse, is indicated by a value or status allowing flow rates and accumulation to be done for each flow direction.

New Features in Realflo 6.75

Windows7 Support Added

Realflo Supports for Windows 7 OS.

New Features in Realflo 6.74

Realflo 6.74 includes the following new features and enhancements.

- When gas ratios are written to the flow computer using the Write Configuration command or the Set AGA8 command the new gas ratios are updated in the Configuration Proposed registers and in the Configuration Actual registers. This allows a Realflo user or SCADA host to immediately confirm the new ratios were written to the flow computer. The new gas ratios are not used by the flow computer until a new density calculation is started.

- The writing of Real Time Clock, AGA-8 and Orifice plate configuration changes from a host to the flow computer has been simplified with the addition of the Modbus Mapping Settings. Using Modbus Mapping run configuration changes can be written to the flow computer as a single block of registers without the need of TeleBUS Command sequences.
- Operator response time is significantly improved over previous versions of Realflo. This results in significant time savings when an operator first goes online with a flow computer and when monitoring online.
- Measurement Canada approval for SCADAPack 4203, SCADAPack 314/330/334, SolarPack 410 and SCADAPack 32 is added.

New Features in Realflo 6.73

Wet gas correction factor is added for the two models of the V-Cone device: the V-Cone and the Wafer Cone.

New Features in Realflo 6.72

Support for the SCADAPack 314 controller is added.

New Features in Realflo 6.71

The V-Cone calculation is improved to include the Wafer Cone device. The V-Cone configuration now includes a selection for adiabatic expansion factor type when either V-Cone or Wafer Cone devices are used.

New Features in Realflo 6.70

Realflo version 6.70 includes the following new features and enhancements:

PEMEX Modbus Protocol Support

- New data columns to display the start time for the period, events logged during the period, and alarms logged during the period.
- New Volume PEMEX column on the Hourly and Daily History tables displays the corrected volume for a flow when PEMEX is configured. Realflo provides one set of base conditions for temperature and pressure as part of the contract configuration for a specific run. PEMEX Modbus requests a second default set of base conditions (secondary conditions). The default set of base conditions is:

  20°C (68°F) and 1 kg/cm2 (14.22334 psi)
- The hourly history Volume PEMEX column displays the corrected volume for the flow.
- New Up-Time column added to the PEMEX Hourly and Daily History tables shows the measurement time (in minutes) in the contract day.
- New Average Heating Value column added to the PEMEX Hourly and Daily History tables displays the average heating value accumulated during the contract period.
- New Quality column added to the PEMEX Hourly and Daily History tables to indicate if there are alarms during the period.
- New Hourly and Daily History tables to display PEMEX-specific data.

Gas Quality Control History

The Gas Quality Control History feature has been added to the View menu. This feature includes the following:

- Gas Quality History feature now provides a method to record and store the average value of natural gas components in the hourly history event log.
- Flow Computer Report Quality History feature now provides a method to create, store, and print gas quality history reports for the calculations of the natural gas components in the hourly event history log.
- Realflo Display Quality History feature provides a method to display gas quality history reports for the calculations of the natural gas components in the hourly event history log.
- Realflo Display Quality History feature provides a method to read gas quality history reports of the natural gas components in the hourly event history log.
- Realflo Display Quality History feature provides a method to export gas quality history reports of the natural gas components in the hourly event history log.

New Features in Realflo 6.51

Realflo version 6.51 includes the following new features and enhancements:

Flow Computer Register Grouping

Register grouping provides a method to group commonly read data from a SolarPack 410 flow computer. The data that is commonly read is in scattered register locations in the flow computer. Register grouping enables the SCADA Host to read a sequential block of data in a single read command. The start address for the register group is user defined.

New Features in Realflo 6.50

Realflo version 6.50 includes the following new features and enhancements:

Support for SCADAPack 330 and SCADAPack 334 Controllers

The SCADAPack 330 and SCADAPack 334 controllers support up to four meter runs. The Flow Computer Information and Replace Flow Computer dialogs are displayed differently when the SCADAPack 330, SCADAPack 334 and SCADAPack 350 controller is used. These dialogs display the multiple C/C++ programs that can execute in the SCADAPack 330, SCADAPack 334 and SCADAPack 350 controller.

New Features in Realflo 6.42

Realflo version 6.42 includes the following new features and enhancements:

Enron General Purpose Registers Added

Using fixed register mapping the flow computer mirrors standard Modbus registers into Enron Modbus registers. This allows the host to read and write data to Enron Modbus registers not directly associated with the flow computer.

Remove AGA-3 (1985) Flow Calculations

AGA-3 (1985) calculation type is removed for SCADAPack 5203/4, SCADAPack LP, SCADAPack 100 and SCADAPack 4202 flow computers.

The following Modbus register commands have been removed.

- 351 Get AGA-3 (1985) Configuration
- 353 Set AGA-3 (1985) Configuration

The following changes have been made to the Enron Modbus handler.

- Register 7101 and 7351: Flow calculation type 2 = AGA-3 (1985) is recognized by SCADAPack 5203/4, SCADAPack LP, SCADAPack 100 and SCADAPack 4202 flow computers up to version 6.41.
- Register 7151 to 7161 and 7401 to 7411: These registers read and write configuration for AGA-3 (1985 and 1992). For flow calculation type 2 = AGA-3 (1985) for SCADAPack 5203/4, SCADAPack LP, SCADAPack 100 and SCADAPack 4202 flow computers up to version 6.41.

New Features in Realflo 6.41

Realflo version 6.41 includes the following new features and enhancements:

Support for Application Identifier

SCADAPack and SCADAPack 32 controllers are compatible with older firmware that does not provide the application identifier feature.

Flow computers enable the register mapping feature. This is not compatible with older firmware for SCADAPack 32, SCADAPack 300, SolarPack 410, and SCADAPack 4203 controllers, or ISaGRAF applications that used these registers, for any controllers. Logic applications need to disable the mapping if they wish to use the registers for other uses.

SCADAPack 300, SCADAPack 4203, and SolarPack 410 flow computers with the application identifier feature will not load on firmware that does not support the feature. The firmware needs to be updated to a version supporting the application identifier.

New Features in Realflo 6.40

Realflo version 6.40 includes the following new features and enhancements:

Support for SolarPack 410 Controllers

The SolarPack 410 is a solar-powered one-run flow computer. This unit brings integrated solar power, intelligent battery charging and spread-spectrum communication to remote EFM installations.

New Features in Realflo 6.30

Realflo version 6.30 includes the following new features and enhancements:

Support for SCADAPack 4203 Controllers

The SCADAPack 4203 controllers (4203 DR and 4203 DS), is now supported in Realflo. These controllers support up to two meter runs, are physically identical to the SCADAPack 4202 DR and 4202 DS), but are based on a 32-bit ARM7-TDMI processor.

New Features in Realflo 6.21

Realflo version 6.21 includes the following enhancements:

Changes to the Wet Gas Meter Parameter

The Wet Gas Meter Factor can now be changed while the calculations are running. The calculations need to be stopped before any change in other the settings can be accepted.

For Realflo versions 6.01 To 6.20, changing Wet Gas Meter Factor requires a new contract day to be started, as the flow calculation has to be stopped. For Realflo version 6.21 and later, changing the Wet Gas Meter Factor can be accomplished without stopping the flow calculations. This means that a new a new contract day does not have to be started when this parameter needs to be changed.

AGA-7 Uncorrected Flow Volume- Turbine Meter Factor

The AGA7 Uncorrected Flow Volume now has the option to include or exclude the turbine meter factor. The AGA-7 property page in Realflo includes an option to determine whether the M factor is included in the calculation of the Uncorrected Flow Volume. The default option is to include the M factor in the calculation. This option has no effect on corrected flow totals.

CSV and CSX Export Enhancements

The Export to File and Print commands now include the following parameters in the file and printed reports:

- The date and time that the report was exported or printed.
- The date and time of the last flow calculation update.
- The orifice tap, flange or pipe location, configuration.
- The lower range limit and upper range limit of the transmitter's sensor for each meter run input that uses a transmitter.
- The calculated, or entered, relative density.
- The calculated, or entered, heating value.
- The wet gas meter factor.

New Features in Realflo 6.20

Realflo version 6.20 includes the following new features and enhancements:

Support for SCADAPack 350

The SCADAPack 350 controller is now supported in Realflo. The SCADAPack 350 controller supports up to four meter runs. The Flow Computer Information and Replace Flow Computer dialogs are displayed differently when the SCADAPack 350 controller is used. These dialogs display the multiple C/C++ programs that can execute in the SCADAPack 350 controller.

Flow Accumulator Time Stamps

The time stamp of the flow accumulators is updated whenever the flow computer run is running, regardless of whether there is flow or not. This is so that under typical conditions that the time stamp of hourly and daily records will correspond to the end of the hour, the exception being configuration events that produce breaks in the records during the hours.

New Features in Realflo 6.00

Realflo version 6.0 included the following features and enhancements:

4000 Transmitter Display Enhancements

Custom items may now be added to the MVT display. Registers can be in the range 1 to 9999, 10001 to 19999, 30001 to 39999 and 40001 to 49999. A seven character description string is displayed below the value for the first half of the display period. A seven character units string is displayed below the value for the second half of the display period. This string may be scrolled to allow a scaling exponent to be displayed.

Absolute / Gage Configuration of 4000 Transmitters

Realflo now provides configuration of either absolute or gage mode for the SCADAPack transmitters. When gage mode is selected an entry is provided for the local atmospheric pressure.

AGA-8 Composition Editing for Hexane Plus Added

Realflo now allows the entering of a single value for hexane and higher components (n-Hexane, n-Heptane, n-Octane, n-Nonane, and n-Decane). For hexane and higher components, Realflo allows entering of the percent of the combined value used for each component.

AGA-8 Heating Value and Specific Gravity

Heating value and specific gravity may be calculated, as is currently done, or they may be entered as configuration parameters.

CFX Export Enhancements

Realflo provides an option to export **one record per hour**, rather than one record per period measured by the by the flow computer. When this option is selected Realflo merges records produced by the flow computer within a single hour into a single record.

Realflo now provides an option to export data in a **time leads data format**. The time stamp on exported records is the time at the start of the hour containing the records.

Realflo now provides an option to set the **live value flags** for gas analysis, energy, or gravity. The CFX file snapshot section contains four flags describing if certain values are live or static. Realflo does not provide a way to obtain live values for gas analysis, energy, or gravity and these flags are set to false in the CFX export. A user may write an application program to obtain the live values for gas analysis, energy, or gravity.

Flow-Cal cannot accept file names longer than 30 characters. Previous versions of Realflo suggested file names that were longer than 30 characters in some cases. Realflo provides a number of options for the file name. A display window shows an example of the selected file name.

Previous versions of Realflo would load the Run # (1, 2, 3, etc.) into the meter number and the Run ID was loaded into the meter name in the CFX file. Realflo now provides an option to use the Run ID for the meter number and to set the meter name to none.

CSV Export Enhancements

Realflo provides an option to export data in a time leads data format. The time stamp on exported records is the time at the start of the hour containing the records.

Maintenance Mode

Realflo Maintenance mode provides quick and easy access to commonly used functions. The Realflo application starts in Maintenance mode when first installed but can be configured to start in Expert Mode thereafter.

Flow Computer Configuration Templates

Realflo can save a configuration as a template file for new flow computers. Files can be created from a template using the New File wizard. A template is used to create a new flow computer from a pre-set configuration. The template specifies what data is pre-set and what needs to be entered when the template is used.

Improved Flow Computer Setup Dialog

The Flow Computer Setup dialog is now divided into four separate dialogs to improve setup and information functions.

The **Flow Computer Setup** dialog defines the flow computer type, number of flow runs, and the Flow Computer ID.

The **Flow Computer Information** dialog displays information about the flow computer.

The **Read Configuration** dialog reads configuration from the flow computer.

The **Write Configuration** wizard writes configuration to the flow computer.

Forcing of Flow Calculation Inputs

Realflo allows users to force an input to a flow calculation. Realflo indicates the input is forced on the Current Readings view and shows the forced value. Realflo displays live value of the input, while it is forced, on the Current Readings view.

Improved History Download and Archive

Realflo provides a wizard to automate the history download and archive process (Maintenance Mode only). Realflo allows the user to download new history data only. Realflo reads the information needed to archive the history, including information on the Current Readings view that is required for CFX exports.

Improved Transmitter and Run Integration

In previous versions of Realflo the MVT and Flow Run configurations were very much separate configurations. Some configuration was required to be entered in both the MVT configuration and the Run configuration.
In this version of Realflo when a MVT transmitter is selected in the Run configuration Input Type selection for Temperature, Static Pressure or Differential Pressure the zero and full-scale entries are disabled and the

values are forced to the MVT Lower Operating Limit and Upper Operating Limit respectively.

New File Wizards

New File wizards have been added to improve the creation of new files.

Improved Plate Change Wizard Information

The plate change wizard is enhanced to work with single and dual chamber orifices and to allow Back and Cancel operations to improve usability.

Improved Process I/O Destination Restrictions

Realflo displays an error if a destination register for Process I/O is reserved. Registers depend on the configured Flow Computer Type. SCADAPack LP, SCADAPack 100: 1024K, and SCADAPack 4200 or 4300 transmitter types assume two flow runs. Other 16-bit SCADAPack types assume three flow runs. 32-bit SCADAPack types assume ten flow runs.

Improved Run ID length

Realflo allows a Run ID of up to 32 characters.

Improved Time Weighted Averages of DP, P, and T

Realflo provides time-weighted averages of the static pressure and temperature during low DP (or low pulse) cutoff. The differential pressure (or meter pulses) is considered zero since it is the typical reason for halting flow accumulation.

The hourly history Temperature column displays the average temperature in the period. When the Flow Time is zero, the value will be the average temperature for the entire hour or hour fragment.

The hourly history Pressure column displays the average pressure in the period. When the Flow Time is zero, the value will be the average pressure for the entire hour or hour fragment.

Calibration Reports

Realflo creates, stores, and can print a calibration report for each calibration session performed.

Current and Previous month totals

Realflo displays the accumulated flow volume and flow time for the current month and the previous month. Data is copied from the current month (This Month) to the previous month (Last Month) at the end of the contract day at the end of the month, as measured by the real time clock.

AGA-7 uncorrected flow

Realflo displays the accumulated uncorrected flow volume for the current month and the previous month. Data is copied from the current month (This Month) to the previous month (Last Month) at the end of the contract day at the end of the month, as measured by the real time clock.

Analog Measurement Rate

Analog input measurements are taken every second regardless the number of flow runs. For SCADAPack flow computers the flow calculations are done every second for one run and every two seconds for two runs. The average value of the analog input measurement is used for each calculation.

History Restore

When a flow computer is replaced Realflo allows the user to read the flow history and logs from the existing flow computer and then initialize the new flow computer with the flow history and data.

New I/O Module Support

5506 Analog Input module.

5505 RTD Input module.

5606 I/O module.

Wet Gas Meter Factor (Realflo 6.10 and later)

The Wet Gas Meter Factor is used when there is water in the flow. Realflo now allows an entry in the Contract Configuration for a Wet Gas Meter. This factor is used when there is water in the flow. Volume, mass and energy values will be adjusted according to this factor. For example the Wet Gas Meter Factor would be set to 0.95 when the water content is 0.05 (5 %).

Realflo Firmware Compatibility

The following table shows the relationship between Realflo and flow computer and the required version of firmware needed for the target controller.

In the following table:

SCADAPack includes SCADAPack, SCADAPack Plus, SCADAPack Light, SCADAPack LP, Micro16 and SCADAPack 4200 controllers.

SCADAPack 32 includes SCADAPack 32 and SCADAPack 32P controllers.

If you have any questions concerning the compatibility of Realflo applications and firmware versions, contact Control Microsystems Technical Support at TechnicalSupport@controlmicrosystems.com or phone 888-226-6876.

Realflo and Flow Computer	Controller Firmware
Version 2.02	SCADAPack firmware 1.40 and 1.42
Version 2.03	SCADAPack firmware 1.43
Version 2.05	SCADAPack firmware 1.45
Version 3.00	SCADAPack firmware 1.45
Version 3.10	SCADAPack firmware 1.47
Version 4.00	SCADAPack firmware 1.47 and 1.49
Version 4.10	SCADAPack firmware 1.50, 1.52 and 1.53 SCADAPack 32 firmware 1.10, 1.11, 1.13, 1.14 and 1.15
Version 4.50	SCADAPack firmware 1.55 SCADAPack 32 firmware 1.16
Version 4.51	SCADAPack firmware 1.55 and 1.56 SCADAPack 32 firmware 1.16, 1.17 and 1.18

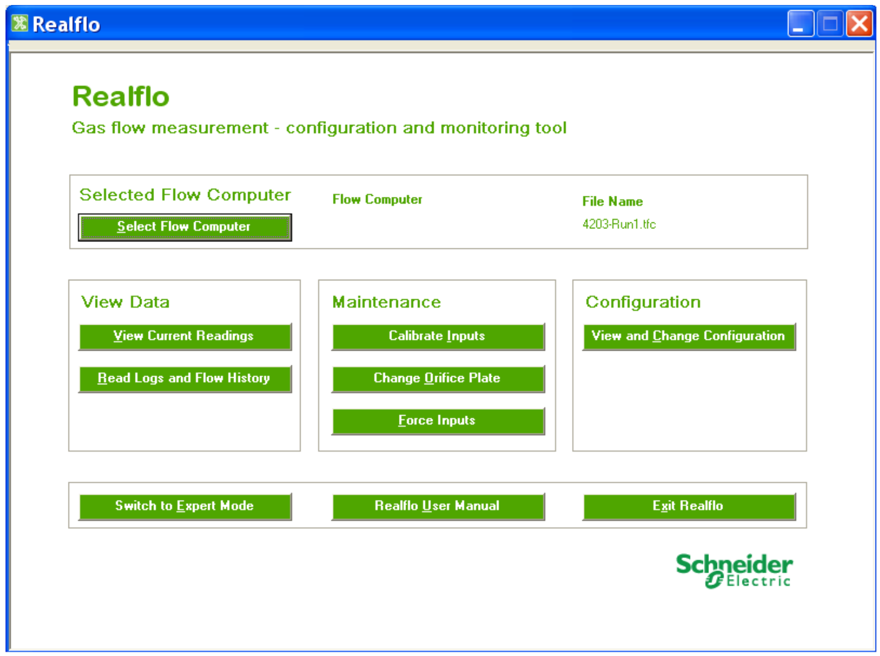
Realflo and Flow Computer	Controller Firmware
Version 5.01	SCADAPack firmware 1.57 and 1.58 SCADAPack 32 firmware 1.19 and 1.20
Version 5.02	SCADAPack firmware 1.58 SCADAPack 32 firmware 1.20
Version 5.10	SCADAPack firmware 1.59 SCADAPack 32 firmware 1.21
Version 5.11	SCADAPack firmware 1.59 and 1.60 SCADAPack 32 firmware 1.21 and 1.22
Version 5.12	SCADAPack firmware 1.61 and 1.62 SCADAPack 32 firmware 1.23
Version 5.14	SCADAPack firmware 1.62 SCADAPack 32 firmware 1.23
Version 5.14a	SCADAPack firmware 1.63 SCADAPack 32 firmware 1.23
Version 5.15	SCADAPack firmware 1.63 and 1.64 SCADAPack 32 firmware 1.23
Version 5.16	SCADAPack firmware 1.64 SCADAPack 32 firmware 1.23
Version 5.20	SCADAPack firmware 1.64 SCADAPack 32 firmware 1.24
Version 5.21	SCADAPack firmware 1.64 SCADAPack 32 firmware 1.24 and 1.25
Version 5.22	SCADAPack firmware 1.64 and 1.65 SCADAPack 32 firmware 1.25
Version 5.23	SCADAPack firmware 1.65 and 1.80 SCADAPack 32 firmware 1.31, 1.32 and 1.40
Version 5.24	SCADAPack firmware 1.80, 1.81, 1.82 and 2.00 SCADAPack 32 firmware 1.40
Version 5.26	SCADAPack firmware 2.00 and 2.10 SCADAPack 32 firmware 1.40
Version 5.27	SCADAPack firmware 2.11, 2.12, 2.20 and 2.21 SCADAPack 32 firmware 1.40, 1.42, 1.50 and 1.51
Version 6.00	SCADAPack firmware 2.21 and 2.30 SCADAPack 32 firmware 1.51 and 1.60
Version 6.01	SCADAPack firmware 2.30 SCADAPack 32 firmware 1.60
Version 6.10	SCADAPack firmware 2.30 SCADAPack 32 firmware 1.70 and 1.75
Version 6.11	SCADAPack firmware 2.31 SCADAPack 32 firmware 1.79
Version 6.20	SCADAPack firmware 2.31 SCADAPack 32 firmware 1.79 SCADAPack 350/SCADAPack 4203 firmware 1.10
Version 6.21	SCADAPack firmware 2.31 SCADAPack 32 firmware 1.79 SCADAPack 350/SCADAPack 4203 firmware 1.10
Version 6.22	SCADAPack firmware 2.31 SCADAPack 32 firmware 1.79

Realflo and Flow Computer	Controller Firmware
	SCADAPack 350/SCADAPack 4203 firmware 1.10
Version 6.30	SCADAPack firmware 2.31 SCADAPack 32 firmware 1.79 SCADAPack 350/SCADAPack 4203 firmware 1.20
Version 6.31	SCADAPack firmware 2.41 SCADAPack 32 firmware 1.80 SCADAPack 350/SCADAPack 4203 firmware 1.20
Version 6.32	SCADAPack firmware 2.41 SCADAPack 32 firmware 1.80 SCADAPack 350/SCADAPack 4203 firmware 1.21
Version 6.33	SCADAPack firmware 2.41 SCADAPack 32 firmware 1.80 SCADAPack 350/SCADAPack 4203 firmware 1.21
Version 6.34	SCADAPack firmware 2.41 SCADAPack 32 firmware 1.80 SCADAPack 350/SCADAPack 4203 firmware 1.21
Version 6.35	SCADAPack firmware 2.41 SCADAPack 32 firmware 1.80 SCADAPack 350/SCADAPack 4203 firmware 1.21
Version 6.40	SCADAPack firmware 2.43 SCADAPack 32 firmware 1.90 SCADAPack 350/SCADAPack 4203 firmware 1.24 SolarPack 410 firmware 1.30
Version 6.41	SCADAPack firmware 2.44 SCADAPack 32 firmware 1.92 SCADAPack 350/SCADAPack 4203 firmware 1.25 SolarPack 410 firmware 1.32
Version 6.42	SCADAPack firmware 2.44 SCADAPack 32 firmware 1.92 SCADAPack 350/SCADAPack 4203 firmware 1.25 SolarPack 410 firmware 1.32
Version 6.50	SCADAPack firmware 2.44 SCADAPack 32 firmware 1.92 SCADAPack 350/SCADAPack 4203 firmware 1.40 SCADAPack 33x firmware 1.40 SolarPack 410 firmware 1.40
Version 6.70	SCADAPack firmware 2.44 SCADAPack 32 firmware 2.12 SCADAPack 350/SCADAPack 4203 firmware 1.45 SCADAPack 33x firmware 1.45 SolarPack 410 firmware 1.45
Version 6.71	SCADAPack 300, SCADAPack 4203, and SolarPack 410 flow computers require firmware 1.45 or newer. SCADAPack 32 PEMEX and GOST flow computers require firmware 2.12 or newer. SCADAPack 32 standard flow computers require firmware 2.10 or newer.
Version 6.72	SCADAPack firmware 2.50

Realflo and Flow Computer	Controller Firmware
	SCADAPack 32 firmware 2.10 SCADAPack 314, 33x, and 350 firmware 1.47 SCADAPack 4203 firmware 1.47 SolarPack 410 firmware 1.47
Version 6.73	SCADAPack firmware 2.50 SCADAPack 32 firmware 2.10 SCADAPack 314, 33x, and 350 firmware 1.47 SCADAPack 4203 firmware 1.47 SolarPack 410 firmware 1.47
Version 6.74	SCADAPack firmware 2.50 SCADAPack 32 firmware 2.16 SCADAPack 314, 33x, and 350 firmware 1.51 SCADAPack 4203 firmware 1.51 SolarPack 410 firmware 1.51

Realflo Maintenance Mode Reference

Realflo opens in Maintenance Mode when you start it on your computer. Maintenance Mode provides an interface into the commonly used functions associated with the maintenance of a flow computer installation. The Realflo Maintenance Mode main screen is shown below.



The main screen displays a number of buttons grouped into sections. The buttons in each section let you to perform typical flow computer maintenance actions such as:

- Selecting or Creating a Flow Computer file.
- Viewing data and reading logs and history from the flow computer.
- Performing calibration and orifice plate change operations for the flow computer.
- Viewing and modifying the configuration of the flow computer.

Tip: Each button on the screen has a tool tip. Moving your mouse pointer over the button will cause the tool tip to be displayed.

The maintenance actions are explained in the following sections:

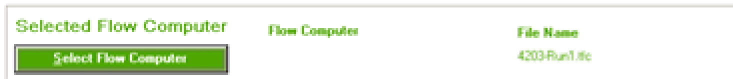
- **Selected Flow Computer** on page 21.
- **View Current Readings** on page 121.
- **Read Logs and Flow History** on page 127.
- **Calibrate Inputs** on page 146.
- **Change Orifice Plate** on page 175.

- **Force Inputs** on page 187.
- **View and Change Configuration** on page 194.
- **Switch to Expert Mode** on page 201.
- **Realflo User Manual** on page 201.
- **Exit Realflo** on page 201.

Selected Flow Computer

The topmost section of the Maintenance Mode screen is the Selected Flow Computer section. The section contains a ***Select Flow Computer*** button and display windows that will display the ***Flow Computer ID*** and the ***File Name*** of the flow computer you select for use.

When you start Realflo, the Flow Computer ID and File Name display windows are blank as shown below.



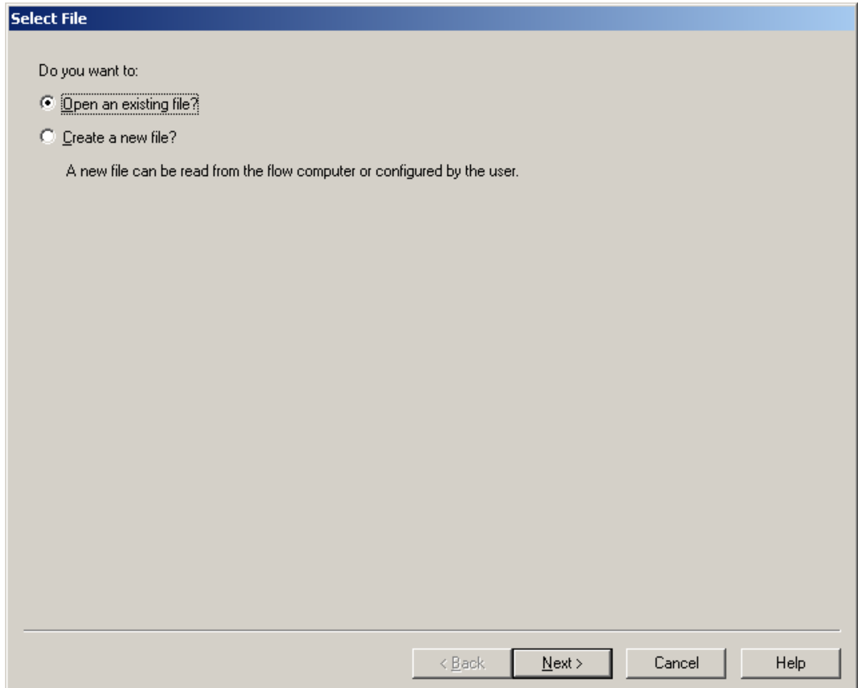
Click the **Select Flow Computer** button to start the Select Flow Computer wizard. The wizard leads you through the steps to open an existing flow computer file, create new flow computer file, or to read the flow computer file from an existing flow computer.

Each step of in the wizard opens a dialog so that you can enter the parameters for that step. Each dialog contains four buttons to allow navigation through the wizard.

- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Cancel** cancels the operation and closes the wizard. Steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.
- **Help** opens the user manual.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.

Select Flow Computer Wizard

The Select Flow Computer wizard starts with the following dialog.



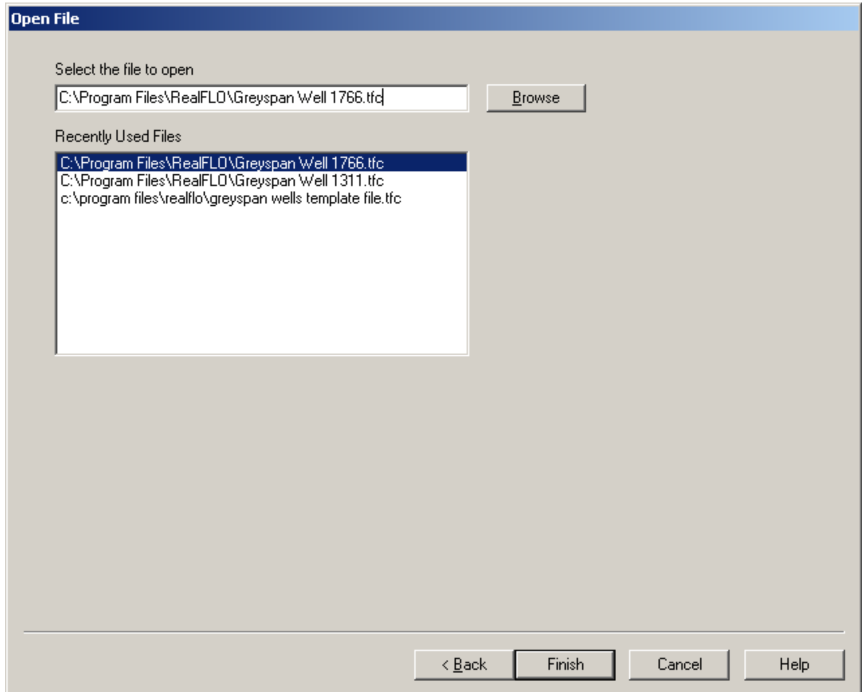
The wizard offers two selections for selecting a file: (1) ***Open an existing file*** or (2) ***Create a new file***.

- Select the ***Open an existing file*** option if you have a copy of the flow computer file on your PC or available on a CD or other media. See the **Open an Existing File** section below.
- Select the ***Create a new file*** option if you want to read the flow computer configuration from a flow computer, create a new configuration file using a template or create a new configuration file step-by-step. See the **Create a New File Wizard** section below.

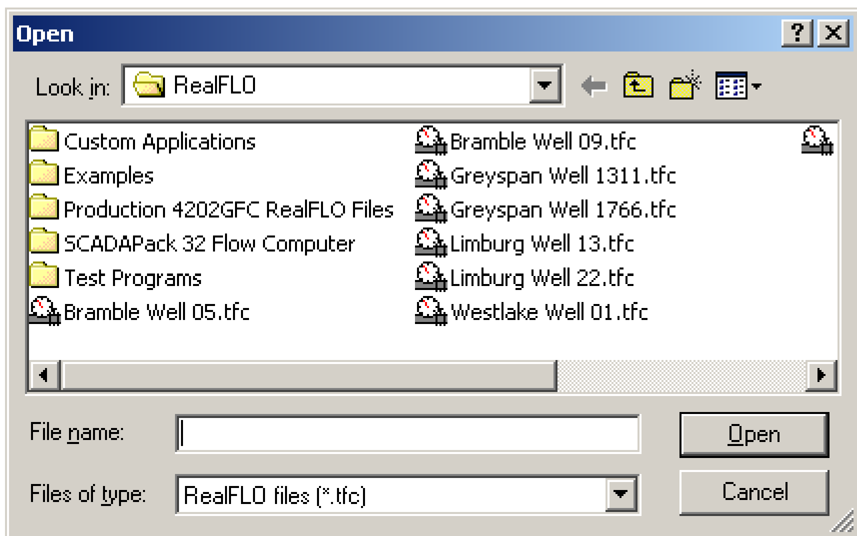
When you have selected an option, click ***Next>*** to move to the next step. The wizard advances through the necessary steps depending on the option you select. The following sections describe each option.

Open an Existing File

The default option for selecting a flow computer is to ***Open an existing file.*** When you click **Next>** the ***Open File*** dialog opens. You can select a local flow computer file to open using the using the ***Browse*** button or to open a recently used file from the ***Recently Used Files*** list.



The ***Browse*** button opens the File Open dialog as shown below.



Use the ***Look in:*** dropdown selector to locate the flow computer file you wish to use.

When the file has been located, click on the file to highlight it. The file name will be displayed in the **File name:** window.

- Click the **Open** button to close the dialog and return to the Open File dialog.
- Click the ***Finish*** button to close the Open File dialog and return to the Maintenance Mode main screen.

The ***Recently Used Files*** list contains the last 10 flow computer files that have been used.

To open one of these files:

- Click on the file name to highlight it. The complete file name and path are displayed in the **Select File to Open** edit box.
- Click ***Finish*** to close the dialog and return to the Maintenance Mode main screen.

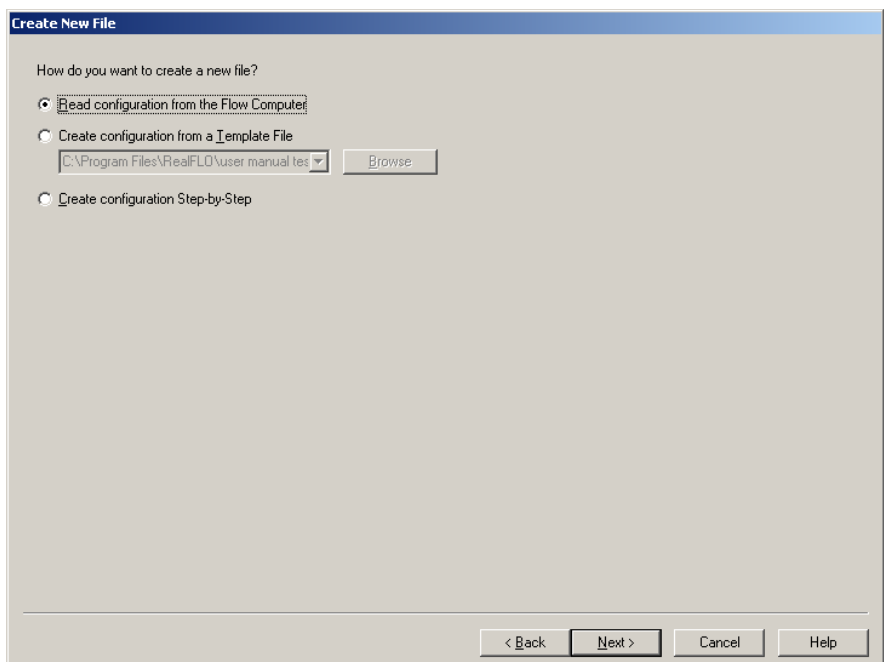
The Flow Computer ID and File Name displays now contain flow computer information as shown in the example below.

Create a New File Wizard

To create a new flow computer file, select the Create a new file radio button, click **Next>**. The Create New File wizard opens. The Create New File dialog offers you three choices to create a new flow computer file:

- Read the configuration from the target flow computer (default selection).
- Create a new configuration from a template file.
- Create a new configuration step-by-step.

The Create New File dialog is shown below.



The **How do you want to create a new file?** selections determine how the new file is created.

Select **Read Configuration from the Flow Computer** to read the configuration of an existing flow computer. Realflo will connect to the flow computer, read configuration parameters, and save the file.

- Follow the wizard steps described in the **Read Configuration From the Flow Computer** section when you select this option.

Select **Create Configuration From a Template File** to create a new configuration file based on a template. A template contains pre-defined settings requiring you to fill in configuration data specific this flow computer.

- Select the template file from the dropdown list. The last ten recently used templates are shown. The recently used template is selected by default.

The selection edit box is blank if no recently used templates are available.

- Click **Browse** to choose another template file. A File Open dialog appears which allows you to select any template file.

Template files are created in the Expert Mode. When templates are created some flow computer configuration parameters are preset and are not displayed in the Create Configuration from Template wizard steps.

- Follow the wizard steps described in the **Create Configuration Step-by-Step** section to configure the flow computer step by step.

Read Configuration From the Flow Computer

The Read Configuration from Flow Computer option enables you to connect to the flow computer and read the existing configuration from the flow computer. A communication link needs to exist between Realflo and the flow computer to use this option. The wizard prompts you for default communication settings or allows you to select new communication settings.

When Realflo reads configuration from a 32-bit flow computer, Realflo reads the flowing fields for each flow run:

- Use Value on Sensor Fail (see section **Value on Sensor Fail**)
- Differential Pressure default value (see section ***Differential Pressure Tab*****)**
- Static Pressure default value (see section ***Static Pressure Tab***)
- Temperature default value (see section ***Temperature Tab*****)**

For flow computers not supporting this feature, Realflo reads the following fields for each flow run:

- Use Value on Sensor Fail = Last Known Good Value (see section **Value on Sensor Fail)**
- Differential Pressure default value = 0 (see section ***Differential Pressure Tab***)
- Static Pressure default value = 0 (see section ***Static Pressure Tab***)
- Temperature default value = 0 (see section ***Temperature Tab***)

When the Read Configuration from Flow Computer option is selected, the Connect to Flow Computer wizard leads you through the necessary steps. The sequence of steps to read the configuration from a flow computer is:

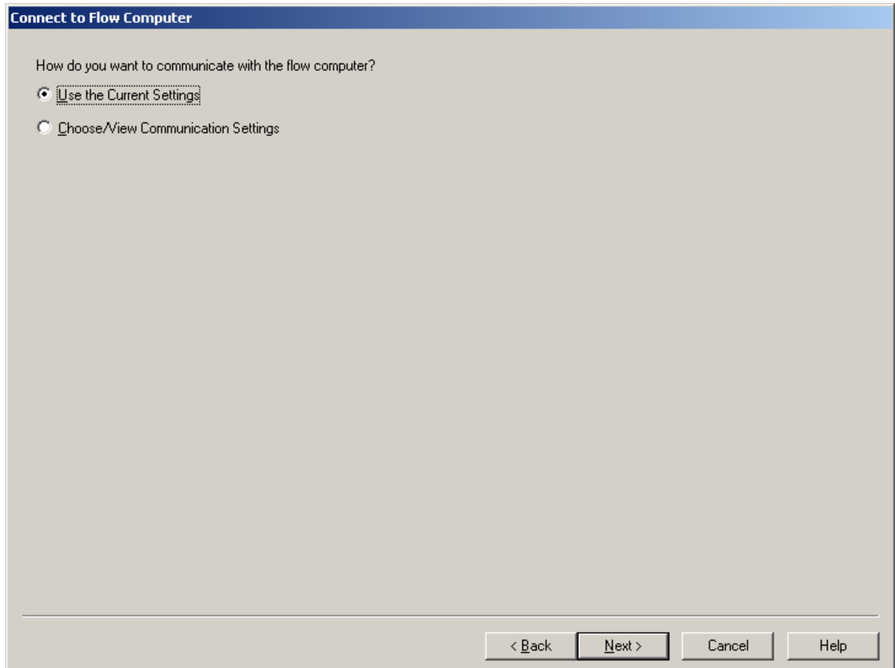
- Connect to Flow Computer wizard step.
- Read Configuration from Flow Computer wizard step.
- Save Configuration wizard step.

Open File

The **Open File** step lets you select the step

Connect to Flow Computer

The **Connect to Flow Computer** step defines the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two selections.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo. (The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are:

- COM 1 (serial port on the PC)
- 9600 baud, no parity
- 8 Data bits
- 1 Stop bit

The default Modbus address Realflo will connect to is station 1.

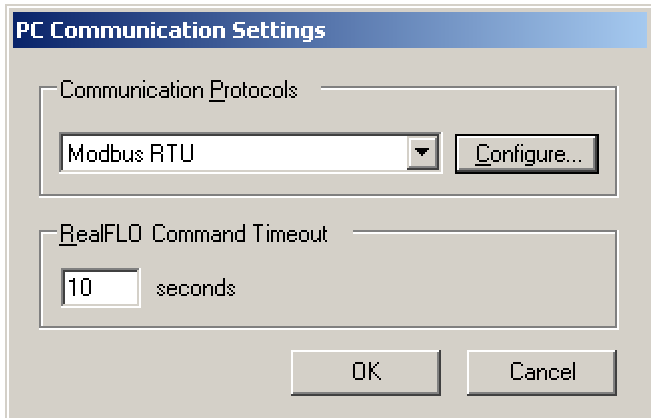
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click the **Next>** button to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

See the section **Communication Menu** >> **PC Communications Settings Command** in the **Realflo Expert Mode Reference** section of this manual for complete details on the parameter settings in this dialog.

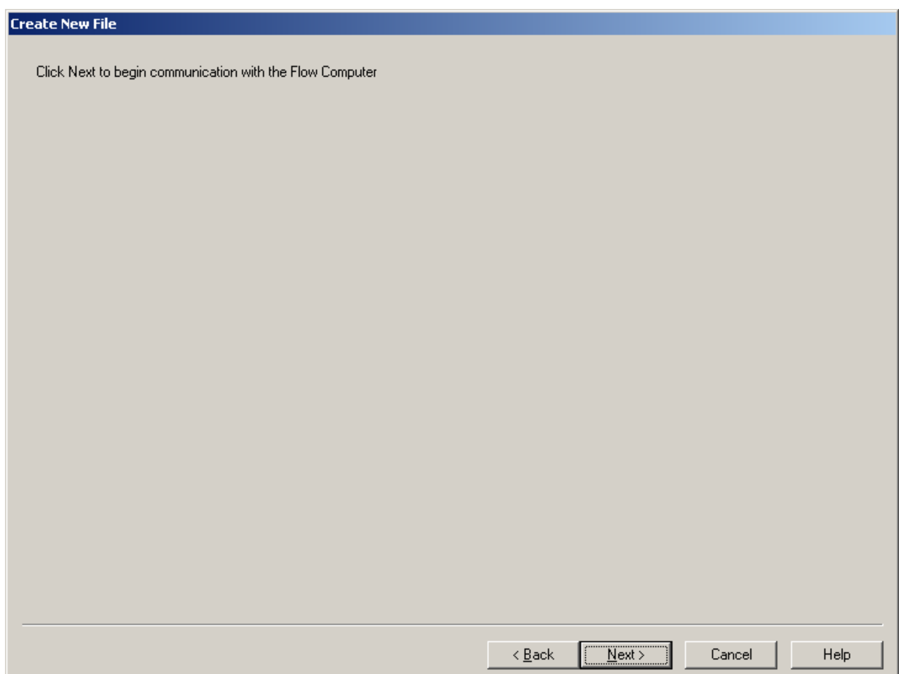
You need to know the communication settings for the connection to the flow computer to use this step.



- Once the communication settings have been selected click the **OK>** button to close the dialog and begin communication with the flow computer.

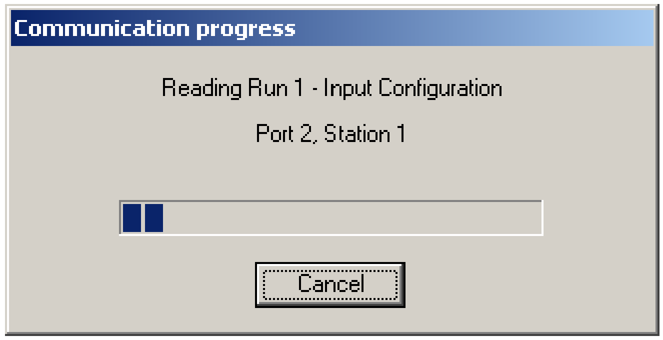
Read Configuration from the Flow Computer

The Read Configuration from Flow Computer step starts with the Create New File window as shown below.



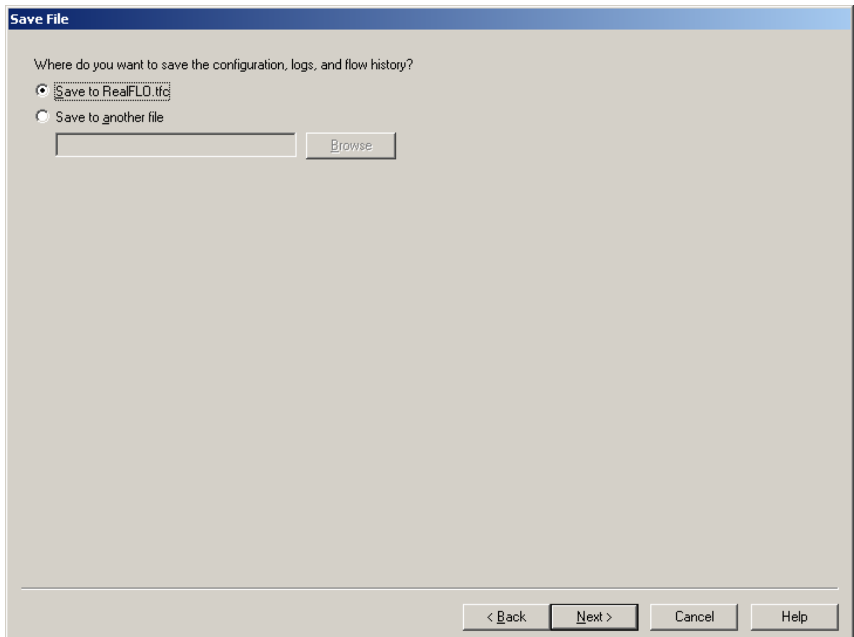
- Click the **Next>** button to begin reading the flow computer configuration form the flow computer.

The **Communication progress** displays the status of the reading of the configuration.



Save Configuration File

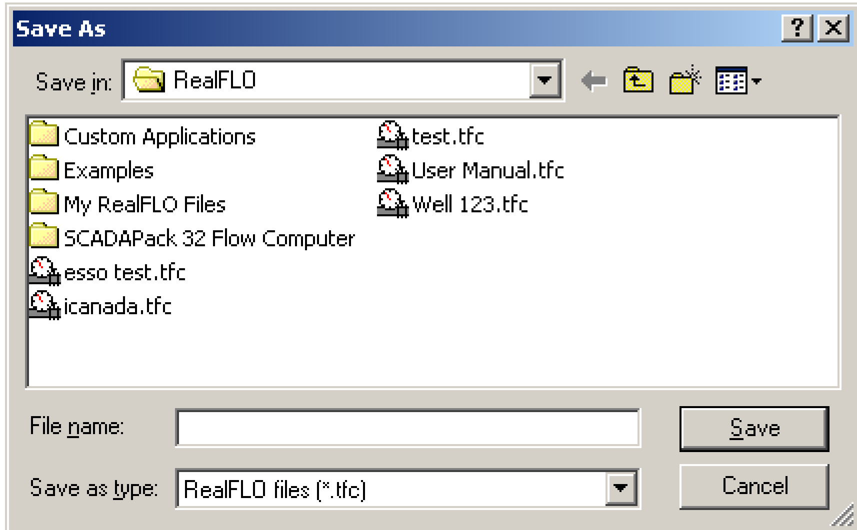
Once the configuration has been read from the flow computer the **Save File** dialog is opened to prompt for a file name to save the configuration to.



Select the **Save to Realflo.tfc** to save the configuration to the default Realflo.tfc file. This file will be located in the folder Realflo was installed in.

- Click the **Next>** button to save the configuration and move to the next step.

Select the **Save to another file** to save the file to a specified name and location. When this option is selected the Save As dialog is opened as shown below.



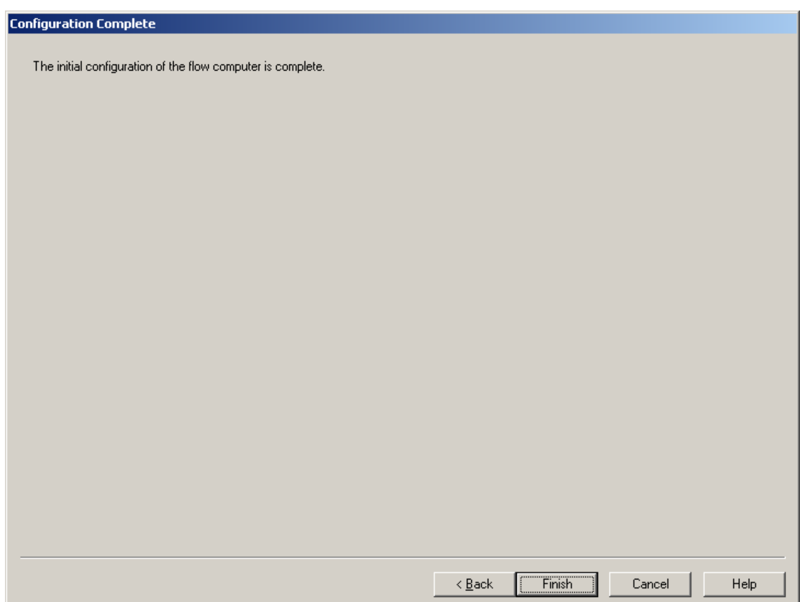
Select the folder to save the file in the **Save in:** window. Use the dropdown selector to browse the available folders on your PC. Enter the file name in the **File name:** window. The file will automatically be saved with the Realflo **.tfc** extension.

- Click the **Save** button to save the configuration file and close the Save As dialog.
- Click the **Next>** button to move to the next step.

Configuration Complete

The Configuration Complete dialog is the last step in the Read Configuration from Flow Computer wizard.

- Click the **Finish** button to complete the wizard.



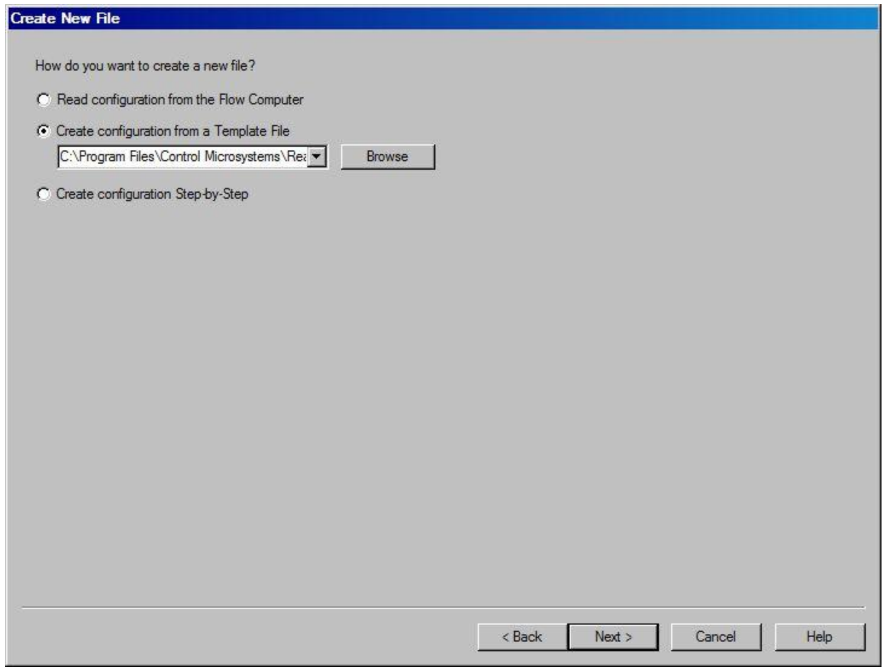
Create Configuration From a Template File

When you choose to configure the flow computer using a template file, the Create New File wizard prompts you through the steps needed.

- Select **File >> New** from the Realflo command menu.

The Create New File dialog is displayed and the wizard will lead you through the steps to create a congiuration file from a temple.

Create New File Dialog



(1) Select the **Create Configuration from a Template File** radio button.

(2) Do one of the following:

  a. Select the template file from the dropdown list. The last ten recently used templates are shown. The recently used template is selected by default.

  b. Click **Browse** to choose another template file. A File Open dialog appears which allows you to select any template file.

(3) Click **Next >** to continue.

Template files are created in the Expert Mode. When templates are created some flow computer configuration parameters are preset and are not displayed in the Create Configuration from Template wizard steps.

Follow the wizard steps described in the following sections to configure the flow computer using the selected template.

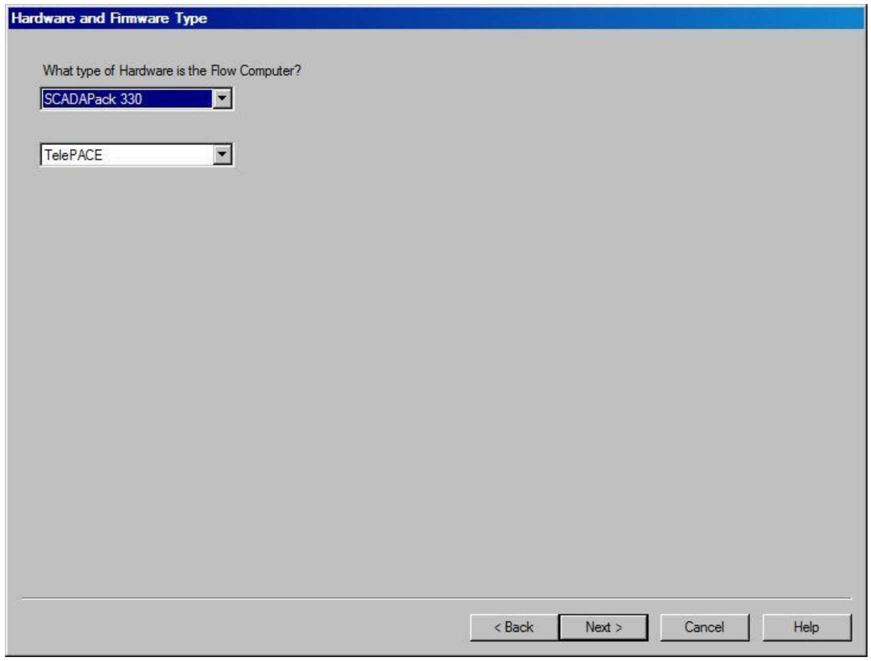
Flow Computer Information

Flow Computer Status Dialog

When configuring the flow computer using a template file, select **No** when the Flow Computer Status dialog opens. This lets you choose the hardware type and firmware type manually.

Hardware and Firmware Type Step

The Hardware and Firmware Type Dialog opens when you select **No** in the Flow Computer Status dialog.



First, select the **Hardware Type** from the dropdown list. The template selected determines the default value when creating the configuration using a template. The options from which you can select are:

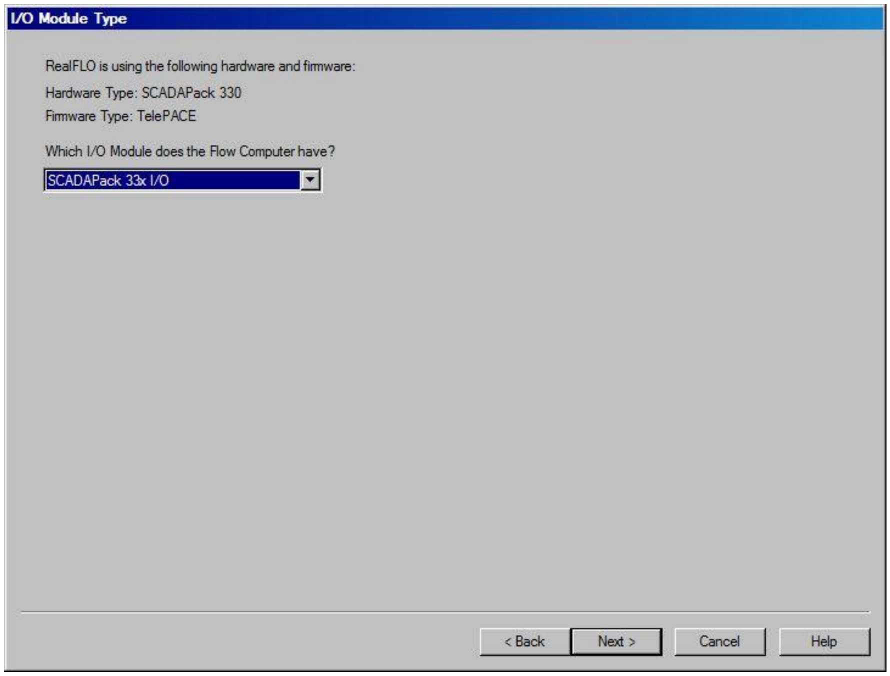
- Micro16
- SCADAPack
- SCADAPack Plus
- SCADAPack Light
- SCADAPack LP
- SCADAPack 32
- SCADAPack 32P
- 4202 DR
- SCADAPack 100: 1024K
- 4202 DS
- SCADAPack 314
- SCADAPack 330
- SCADAPack 334
- SCADAPack 350
- 4203 DR
- 4203 DS
- SolarPack 410

Second, select the **Firmware Type** from the dropdown list. The template selected determines the default value (either Telepace or ISaGRAF).

If the firmware selected is Telepace, the I/O Module Type dialog opens, followed by the Flow Computer ID dialog. If the firmware type selected is ISaGRAF, the Flow Computer ID dialog opens.

I/O Module Type Step

This step selects the I/O module to use for the selected Hardware type. The register assignment in the new file is set to the default register assignment for the selected hardware type.



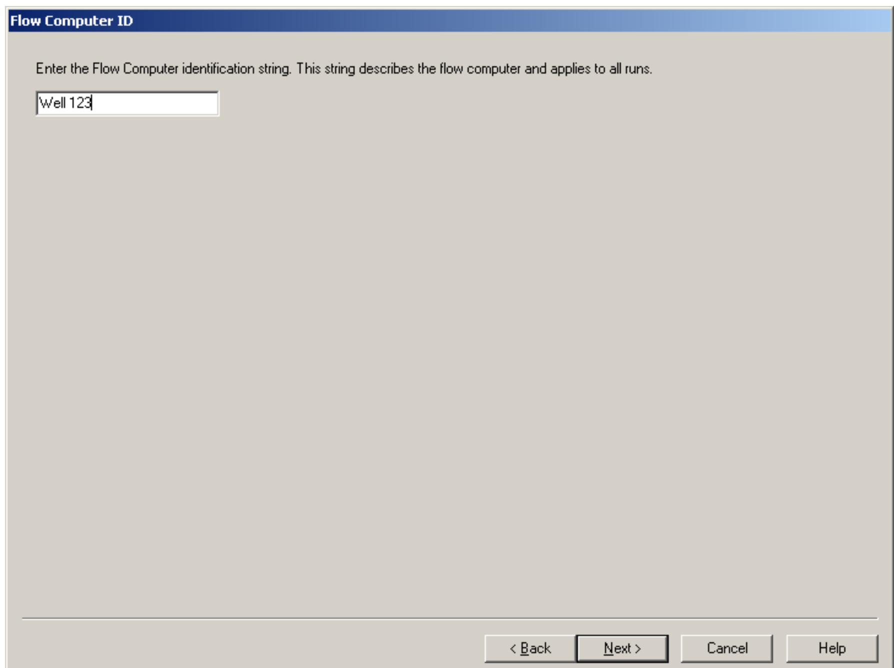
Select the I/O module for the flow computer from the dropdown list. Selections displayed in the list depend on the flow computer hardware type.

Hardware Type	I/O Modules Available
Micro16	Controller I/O only or Backwards compatible modules.
SCADAPack	5601 I/O Module, 5604 I/O Module, or 5606 I/O Module
SCADAPack Plus	5601 I/O Module, 5604 I/O Module, or 5606 I/O Module
SCADAPack Light	5602 I/O Module
SCADAPack LP	SCADAPack LP I./O
SCADAPack 32	5601 I/O Module 5604 10V/40mA I/O module 5604 5V/20mA I/O module , 5604 I/O Module, or 5606 I/O Module
SCADAPack 32P	SCADAPack 32P I/O
4202 DR	4202 DR or 4202 DR Extended/4203 DR I/O
SCADAPack 100: 1024K	SCADAPack 100: 1024K I/O

Hardware Type	I/O Modules Available
4202 DS	4202/4203 DS I/O
SCADAPack 314	SCADAPack 314/33x I/O
SCADAPack 330	SCADAPack 330 Controller.
SCADAPack 334	SCADAPack 33x I/O
SCADAPack 350	SCADAPack 350 10V/40mA I/O SCADAPack 350 5V/20mA I/O
4203 DR	4202 DR Extended/4203 DR I/O
4203 DS	4202/4203 DS I/O
SolarPack 410	

Flow Computer ID Step

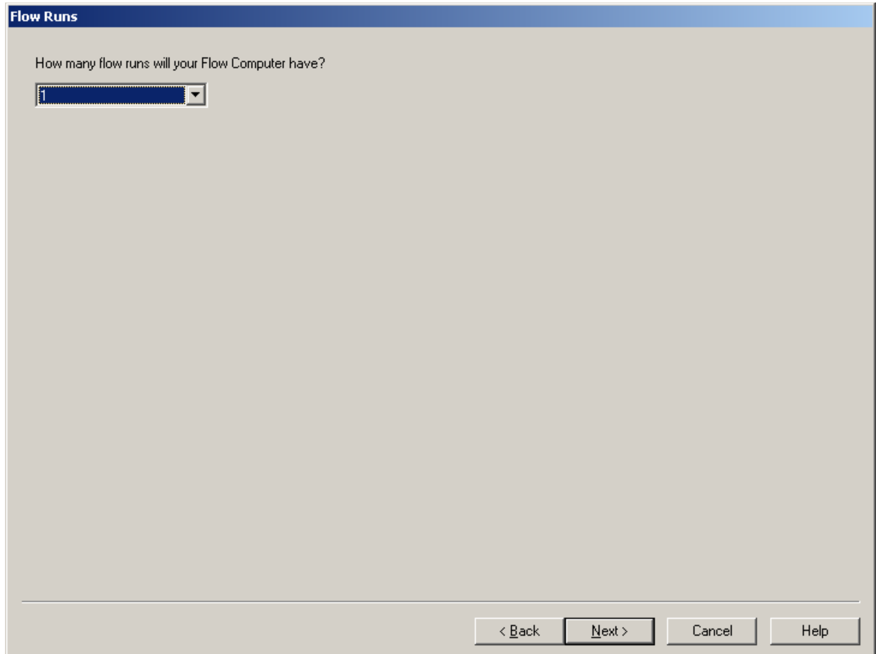
This step sets the Flow Computer ID.



Type the Flow Computer ID string in the edit box. This unique ID stops accidental mixing of data from different flow computers. The maximum length of the Flow Computer ID is eight characters. Any characters are valid. You can leave the Flow Computer ID edit box blank.

Number of Flow Runs Step

This step selects the number of flow runs in the flow computer. The wizard will step through the configuration of the first run and then each subsequent run if more than one run is selected.



Select the number of flow runs with the dropdown list. Valid values depend on the hardware type and the number of flow runs enabled for the flow computer. The template determines the default value when using a template.

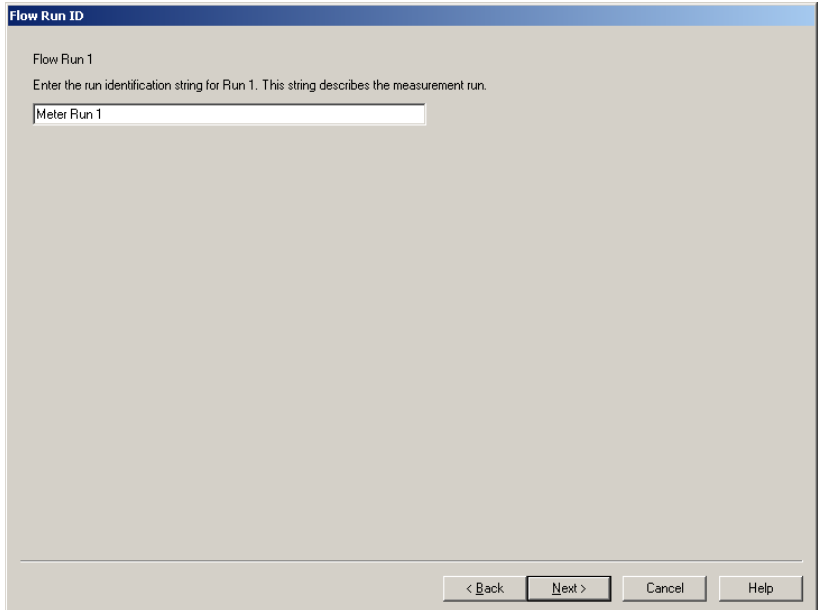
- For Micro16, SCADAPack, SCADAPack Light and SCADAPack Plus Flow Computers, the maximum number of meter runs is three.

The selection of three meter runs is available for older flow computers that could be enabled for three meter runs.

- For SCADAPack LP and SCADAPack (4202 and 4203) Flow Computers, the maximum number of meter runs is two.
- For SCADAPack 100: 1024K and SolarPack 410 Flow Computers, the maximum number of meter runs is one.
- For SCADAPack 314/330/334 and SCADAPack 350 Flow Computers the maximum number of meter runs is four.
- For SCADAPack 32 and SCADAPack 32P Flow computers the maximum number of runs you can select is ten.

Flow Run ID Step

This step sets the Flow Run ID for the meter run. This is the first step of a flow run configuration. The wizard will step you through the flow run configuration steps for the first run and then each subsequent run if you select more than one run.



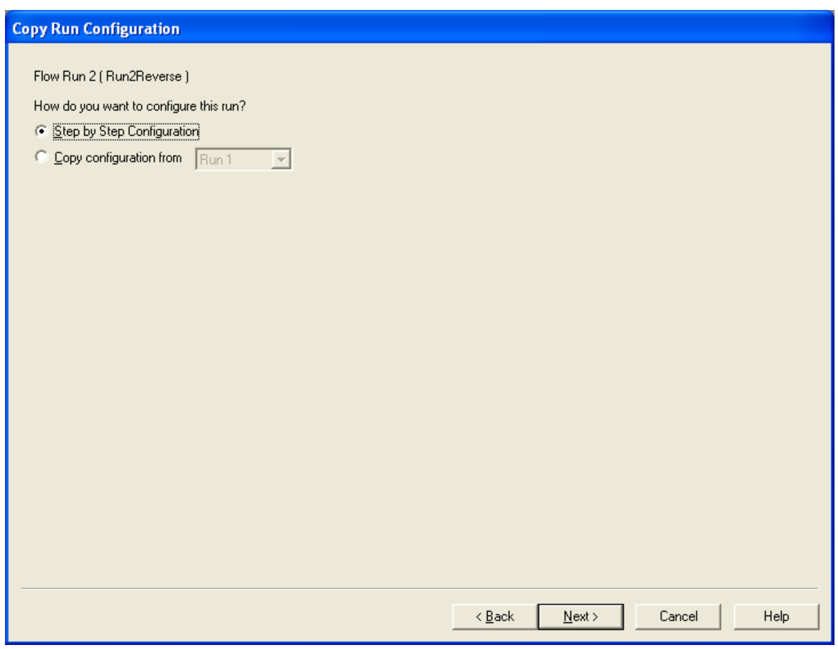
The **Flow Run ID** helps to identify the flow run. Type a string up to 32 characters long. Any characters are valid. You can leave the Flow Run ID edit box blank.

Older flow computers allow a string up to 16 characters. See the TeleBUS Protocol Interface section.

For run 1 the next step is **Flow and Compressibility *Calculations*** **.**

Copy Run Step

This step controls how multiple runs are configured once the first run has been configured.



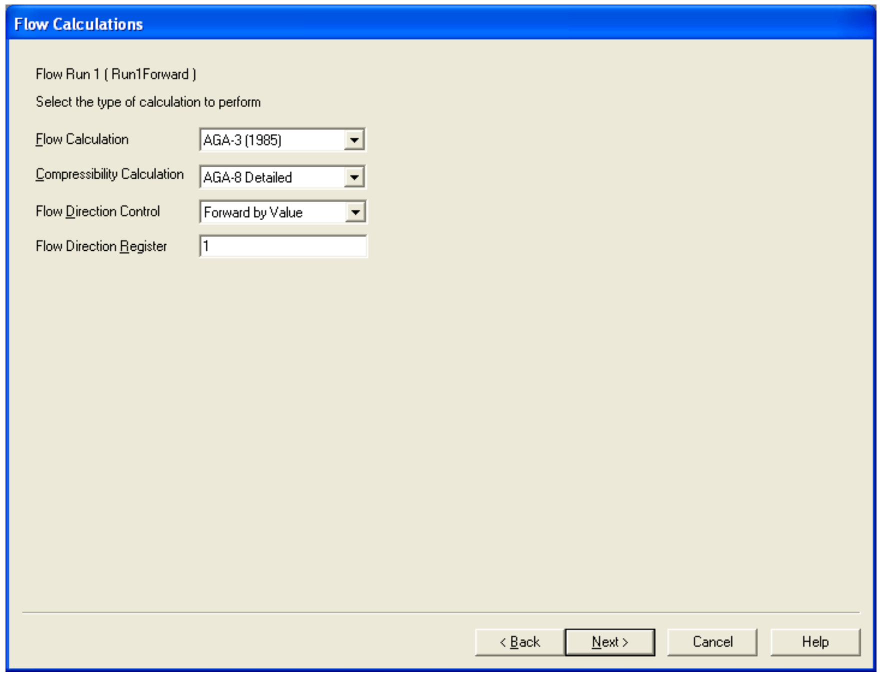
The **Step by Step Configuration** radio button selects that the run will be configured step by step as was the previous run. Parameters for each step are configured one at a time.

The **Copy configuration from** radio button selects that the run will be configured the same as the run selected in the drop down window.

Flow Calculation Configuration

Flow and Compressibility Calculations Step

This step selects the flow and compressibility calculations for the first run.



Flow Calculation selects the type of flow calculation for the meter run. Valid values are:

- AGA-3 (1985 version)
- AGA-3 (1992 version)
- AGA-7
- AGA-11 (not available for 16-bit controllers)
- V-cone calculations

The template selected determines the default value.

Compressibility Calculation selects the type of compressibility calculation for the meter run. Valid compressibility calculation values are:

- AGA-8 Detailed
- NX-19 (Not supported for PEMEX flow computers)

AGA-8 Detailed is the recommended calculation for new systems as it has superior performance compared to NX-19. NX-19 is provided for legacy systems. The template selected determines the default value.

Flow Direction Control selects the direction of flow indication, forward or reverse, for a meter run.

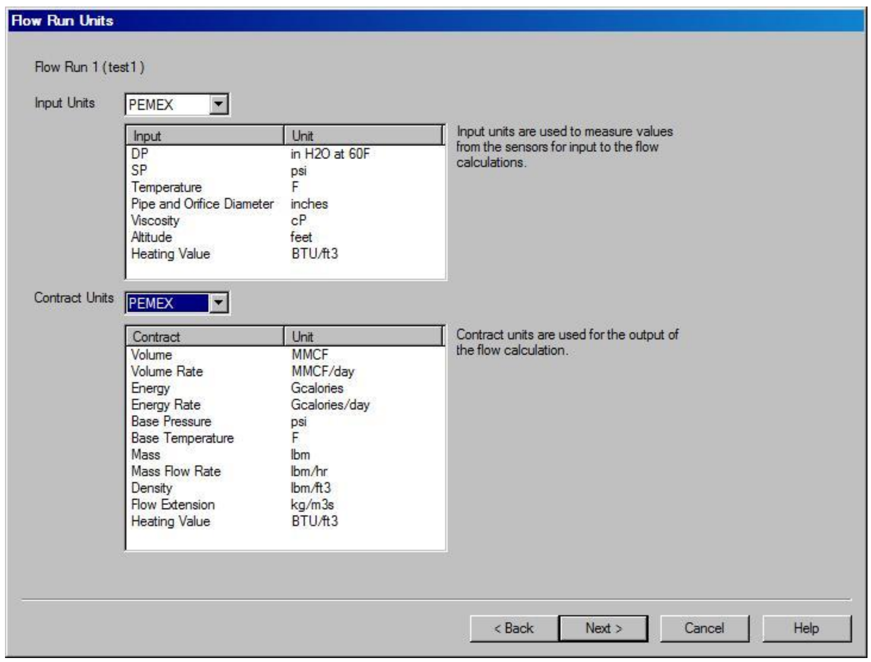
- **Forward by Value** selection indicates the flow direction is forward when the value from a differential pressure (DP) sensor is positive or the mass flow rate value from a Coriolis meter is positive.

- **Reverse by Value** selection indicates the flow direction is reverse when the value from a differential pressure (DP) sensor is negative or the mass flow rate value from a Coriolis meter is negative.
- **Forward by Status** selection indicates the flow direction is forward when the Flow Direction Register has a value of 0 (OFF).
- **Reverse by Status** selection indicates the flow direction is reverse when the Flow Direction Register has a value of 1 (ON).

Flow Direction Register specifies which register indicates the forward or reverse flow direction status. Any valid register for the flow computer controller can be used for this setting. The default register is 1. This edit control is disabled if **Flow Direction Control** selection is Value. This control is hidden in GOST mode flow computers.

Flow Run Units Step

This step lets you select the units that are used for input measurements and contracts.



Input Units selects the units of measurement of input values for the meter run. Inputs may be measured in different units than the calculated results. This allows you to use units that are convenient to you for measuring inputs. A dropdown list allows the selection of the following unit types. The template selected determines the default value.

- US1
- US2
- US3
- IP
- Metric1
- Metric2
- Metric3

- SI
- US4
- US5
- US6
- US7
- US8
- PEMEX

The reference list for the Input Units displays the parameters and units for these parameters:

- DP (Differential pressure)
- SP (Static pressure)
- Temperature
- Pipe and Orifice Diameter
- Viscosity
- Altitude
- Heating Value

Contract Units selects the units of measurement of contract values. These units are used for the calculated results. A dropdown list allows the selection of the following unit types. The template selected determines the default value.

- US1
- US2
- US3
- IP
- Metric1
- Metric2
- Metric3
- SI
- US4
- US5
- US6
- US7
- US8
- PEMEX

The reference list for the Contract Units displays the parameters and units for these parameters when used for the contract. The parameters displayed depend on the contract units selected. The parameters are:

- Volume

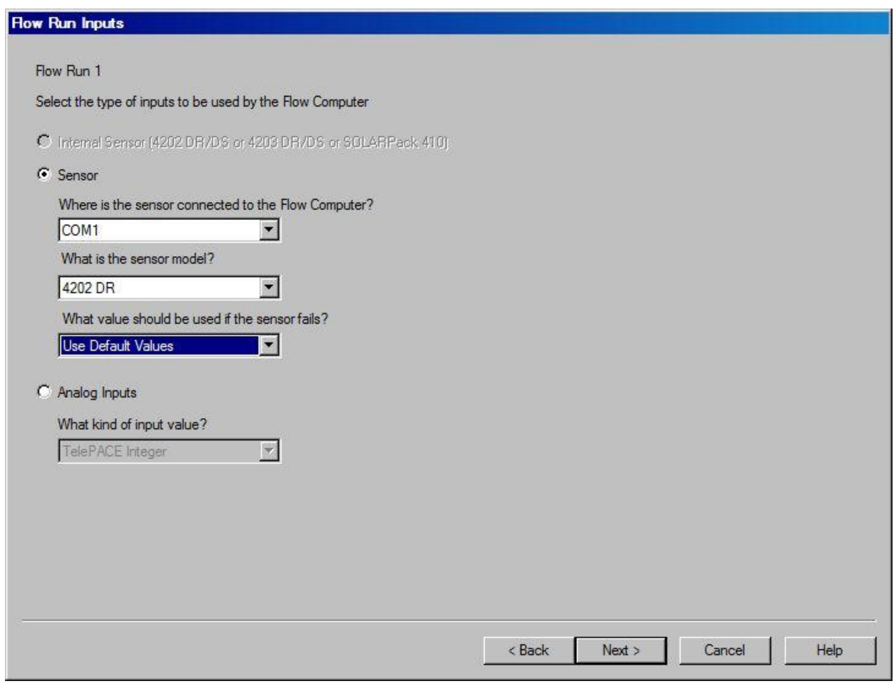
- Volume Rate
- Energy
- Energy Rate
- Base Pressure
- Base Temperature
- Mass
- Mass Flow Rate
- Density
- Flow Extension
- Heating Value

Flow Run Inputs Step

This step lets you configure the flow run inputs. One of two configuration dialogs is presented based on the input type you configure.

- Sensor Inputs
- Analog Inputs

Sensor Inputs



Select Internal Sensor (4202 DR/DS or 4203DR/DS or SolarPack 410) to use a SCADAPack internal transmitter as the input device. The transmitter is the input for pressure, differential pressure, and temperature. This is the only valid selection for run 1 of a SCADAPack flow computer. Other options are disabled.

Select **Sensor** to use a multivariable transmitter as the input device. The transmitter is the input for pressure, differential pressure, and temperature. This is the default selection, except for run 1 of a SCADAPack controller.

The **Where is sensor connected to the Flow Computer** parameter enables the ability to select the serial or LAN port where the sensor is connected to the flow computer. Selections vary according to the flow-computer type. Valid selections can include:

- com1
- com2
- com3
- com4
- LAN

The **What is the sensor model** parameter selects the multivariable transmitter (MVT) type. The selections available are:

- 3095FB
- 4101
- 4102
- 4202 DR
- 4202 DS
- 4203 DR
- 4203 DS

The **What value should be used if the sensor fails** parameter selects the specified value in this field as the live input value when communicating with a sensor. The dropdown list lets you select:

- Use Last Known Good Value
- Use Default Value

When you open a file using an older file format, Realflo sets the default value of the **Values on Sensor Fail** field to **Use Last Known Good.**

When the status to a sensor changes and you select the **Use Default Value** option, this is added to the Event Log.

- For flow computers 6.70 and later, when communication to a sensor fails and the configuration option “Use Last Known Good Value” is set to “Use Default Value,” the flow computer needs to use the specified default value in the configuration in place of a live input value.
- When communication to a sensor is restored and the configuration option for the **Value on Sensor Fail** field is set to use the default value, the flow computer uses the input value from the sensor as the live input value.
- For flow computers prior to 6.70, the value on sensor fail is ``Use Last Known Good Value.”

Analog Inputs

Select **Analog Inputs** to use analog inputs to measure pressure, differential pressure, and temperature.

Valid values are:

- Telepace Integer
- ISaGRAF Integer
- Float
- Raw Float

The template selected determines the default value displayed.

For AGA-7 calculations, the value is fixed and set automatically. The value is Telepace Long if Telepace firmware is running, otherwise it is an ISaGRAF integer if ISaGRAF firmware is running.

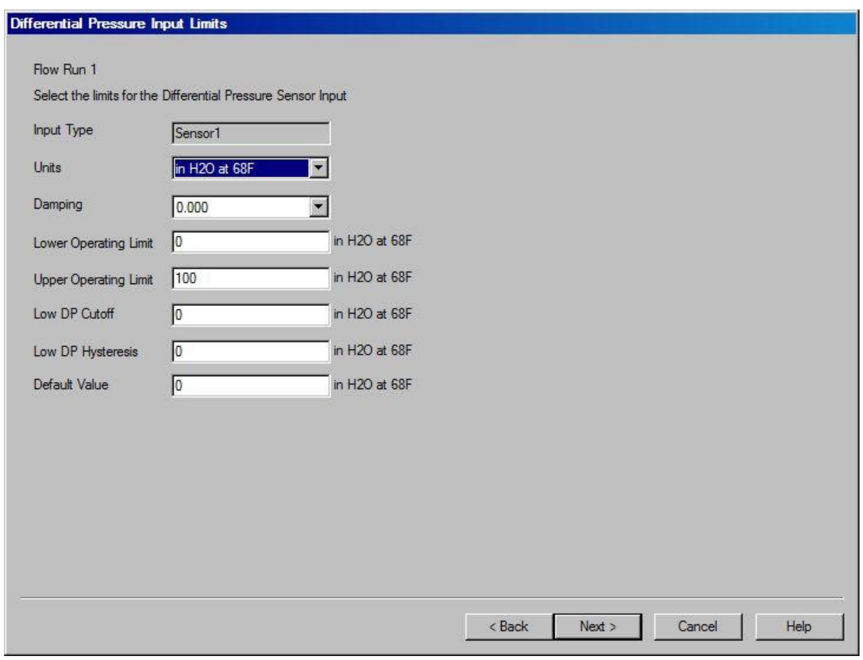
- The next step is **Differential Pressure Settings** if AGA-3 or V-Cone is configured.
- The next step is **Turbine Settings** if AGA-7 is configured.

Differential Pressure Limits Step

This step lets you configure the differential pressure input limits. One of two configuration dialogs is presented based on the input type you configure.

- Sensor Inputs
- Analog Inputs

Sensor Inputs



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

Units are the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display, the transmitter uses these units. Valid values depend on the MVT type:

- For SCADAPack transmtters, valid units are: inches H2O at 68°F, Pascal (Pa) and kiloPascal (kPa). The default is inches H2O at 68°F.
- For the 3095 MVT valid units are: inches H2O at 60°F, Pascal (Pa), kiloPascal (kPa) and inches H2O at 68°F. The default is inches H2O at 60°F.

Damping is the response time of the transmitter. It is used to smooth the process variable reading when there are rapid input variations.

For SCADAPack transmitters the valid values are 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 seconds. The template selected determines the default value displayed.
For the 3095 MVT the valid values are 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824 and 27.648. The default is 0.864.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Low DP Cutoff is the differential pressure where flow accumulation will stop and needs to be less than the UOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

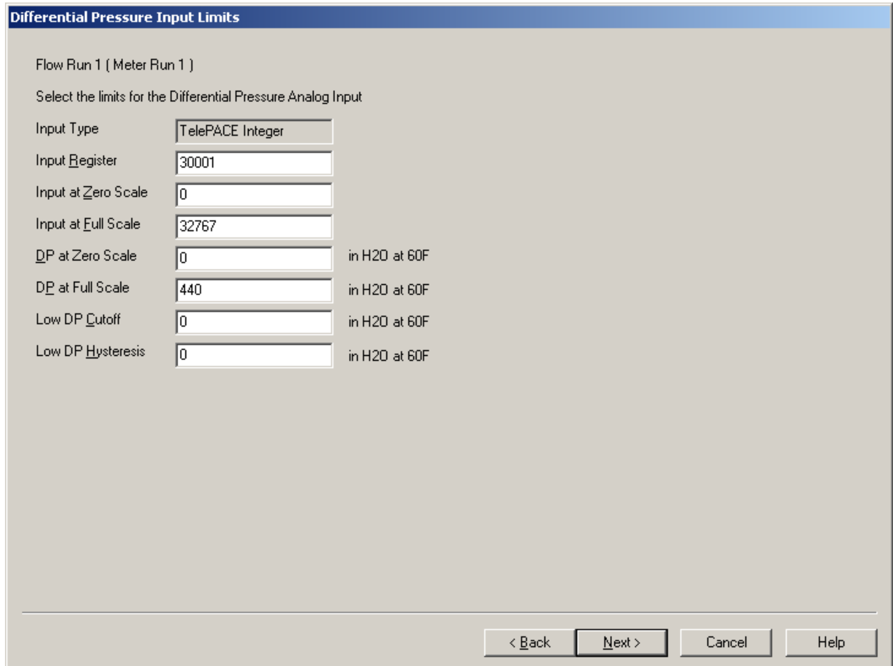
Low DP Hysteresis is the amount by which the differential pressure needs to rise above the Low DP Cutoff for flow accumulation to start. It may be a value using the DP units or may be a percentage of the operating span. The operating span is the difference between the Upper Operating Limit and the Lower Operating limit. Values depend on the transmitter. The flow accumulation level needs to be less than the Upper Operating Limit. The template selected determines the default value displayed.

Default Value is enabled if you configured the field using the Flow Run Inputs dialog. Type the live input value to use when communicating with a sensor. The template selected determines the default value displayed.

If you configured sensor inputs, go to the **Static Pressure** section.

Analog Inputs

The dialog below opens when analog inputs are selected.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

DP at Zero Scale is the pressure that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

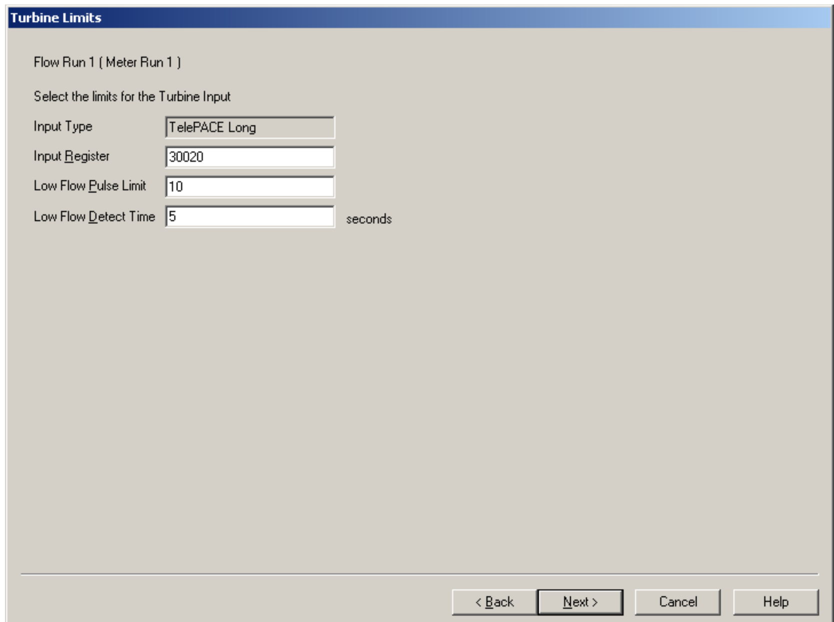
DP at Full Scale is the pressure that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

Low DP Cutoff is the differential pressure where flow accumulation will stop and needs to be less than the UOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Low DP Hysteresis is the amount by which the differential pressure needs to rise above the Low DP Cutoff for flow accumulation to start. It may be a value using the DP units or may be a percentage of the operating span. The operating span is the difference between the Upper Operating Limit and the Lower Operating limit. Values depend on the transmitter. The flow accumulation level needs to be less than the Upper Operating Limit. The template selected determines the default value displayed.

Turbine Limits Step

This step configures the turbine input for AGA-7 calculations.



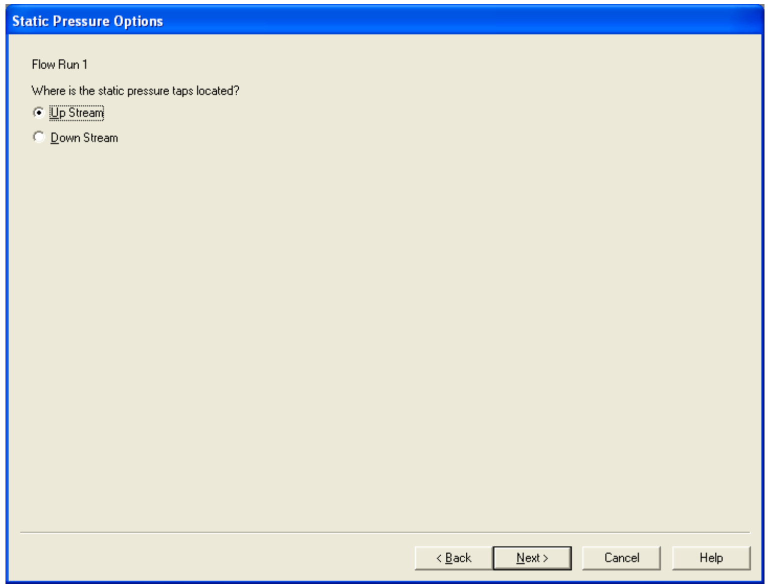
Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Low Flow Pulse Limit is the number of pulses below which a low flow alarm will occur. The template selected determines the default value displayed.

Low Flow Detect Time is the length of time the number of pulses needs to remain below the Low Flow Pulse Limit for a low flow alarm to occur. Valid values are 1 to 5 seconds. The template selected determines the default value displayed.

Static Pressure Measurement Step

This step lets you select how the static pressure is measured.



The pressure tap may be upstream or downstream of the orifice plate for AGA-3.

- Select **Up Stream** for an upstream static pressure tap. This is the default value. The control is disabled for AGA-7 and V-Cone calculations.
- Select **Down Stream** for a downstream static pressure tap. The control is disabled for AGA-7 and V-Cone calculations.

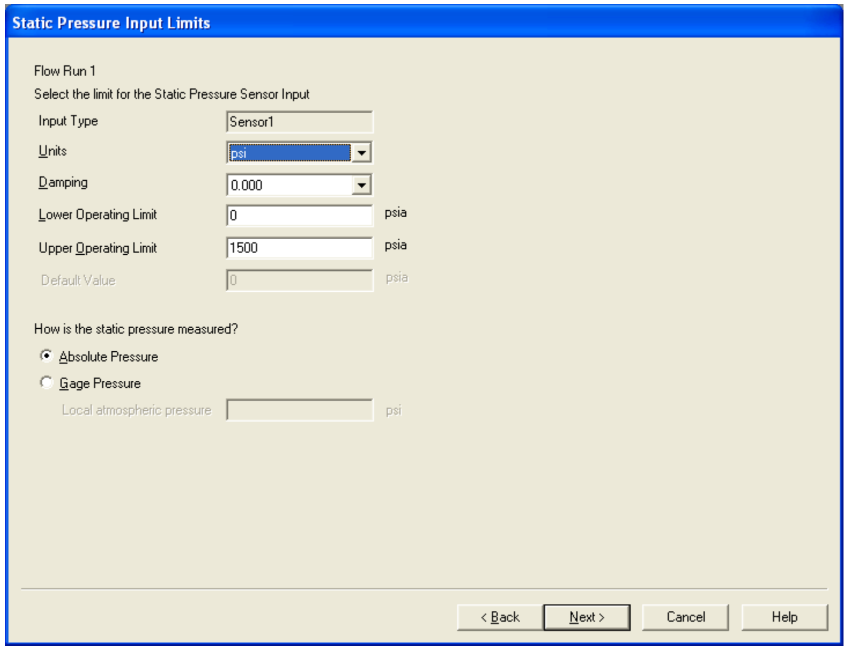
Static Pressure Input Limits Step

This step lets you define the limits for the static pressure input. One of two configuration dialogs is presented based on the Input Type configured for static pressure limits:

- Sensor Inputs
- Analog Inputs

Sensor Inputs

The dialog below is presented when sensor inputs are used.



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

Units is the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display it uses these units. Valid values are kiloPascal, MegaPascal, and psi (pounds per square inch). The default is psi.

Damping is the response time of the transmitter. It is used to smooth the process variable reading when there are rapid input variations.

- For SCADAPack transmitters the valid values are 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 seconds. The template selected determines the default value displayed.
- For the 3095 MVT the valid values are 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824 and 27.648. The default is 0.864.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Default Value is enabled if you gage pressure using the Static Pressure Options. Type the live input value to use when communicating with a sensor. The template selected determines the default value displayed.

The pressure sensor may measure absolute or gage pressure.

- Select **Absolute Pressure** to measure absolute static pressure.
- Select **Gage Pressure** to measure gage static pressure.

- Type the **Atmospheric Pressure** measured at the site. This control is disabled and set to zero if absolute pressure is selected.

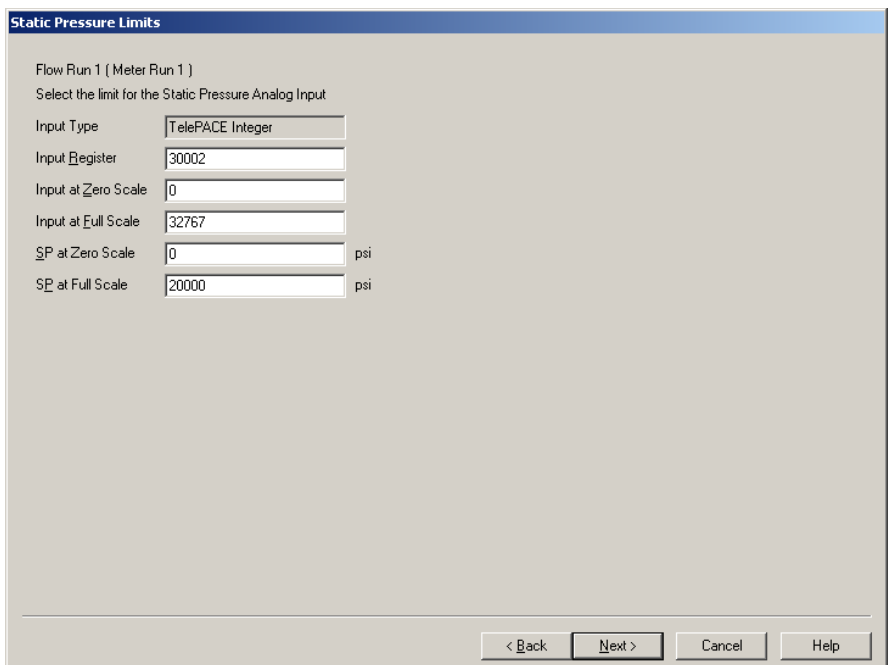
The atmospheric pressure entered needs to be greater than zero. The maximum upper limits for atmospheric pressure are:

30	psi	for US1, US2, US3, US4, US5, US6, US7, US8, and PEMEX units
4320	lbf/ft2	for IP units
207	kPa	for Metric1 units
2.07	bar	for Metric2 units
0.207	MPa	for Metric3 units
207000	Pa	for SI units

If you configured sensor inputs, see the **Static Pressure Compensation** section.

Analog Inputs

The dialog below is presented when analog inputs are used.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float, and ISaGRAF integer types and disabled otherwise.

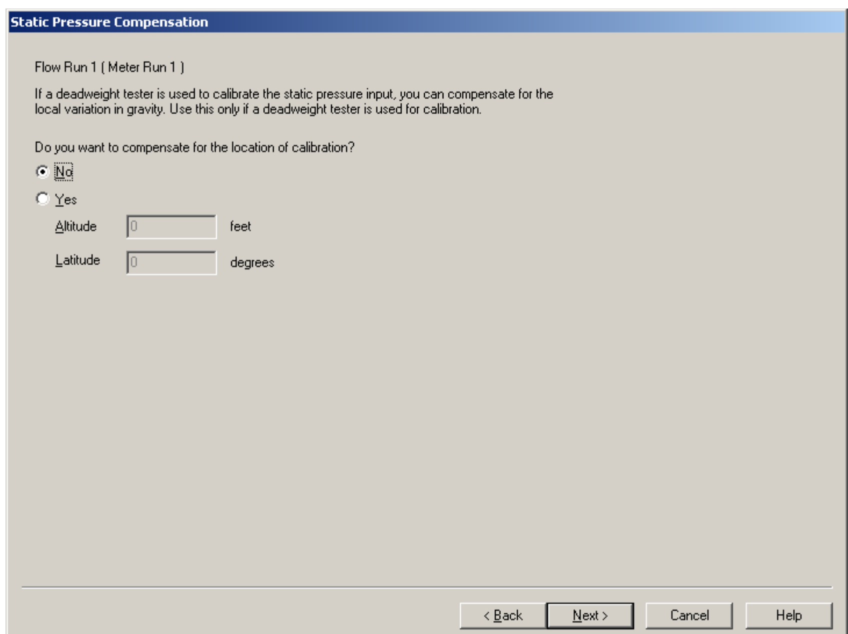
Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

SP at Zero Scale is the pressure that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

SP at Full Scale is the pressure that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

Static Pressure Compensation Step

This step selects if compensation is applied for the location where calibration was performed. If you configured sensors or analog inputs from the Static Pressure Limits dialog, this is the next step in the configuration sequence.



Select **No** if compensation is not required. This is the default value.

Select **Yes** to compensate for the altitude and latitude.

- Type the **Altitude** of the location. Valid values are –30000 to 30000. The template selected determines the default value displayed. This control is disabled if No is selected.
- Type the **Latitude** of the location. Valid values are –90 to 90. The template selected determines the default value displayed. This control is disabled if No is selected.

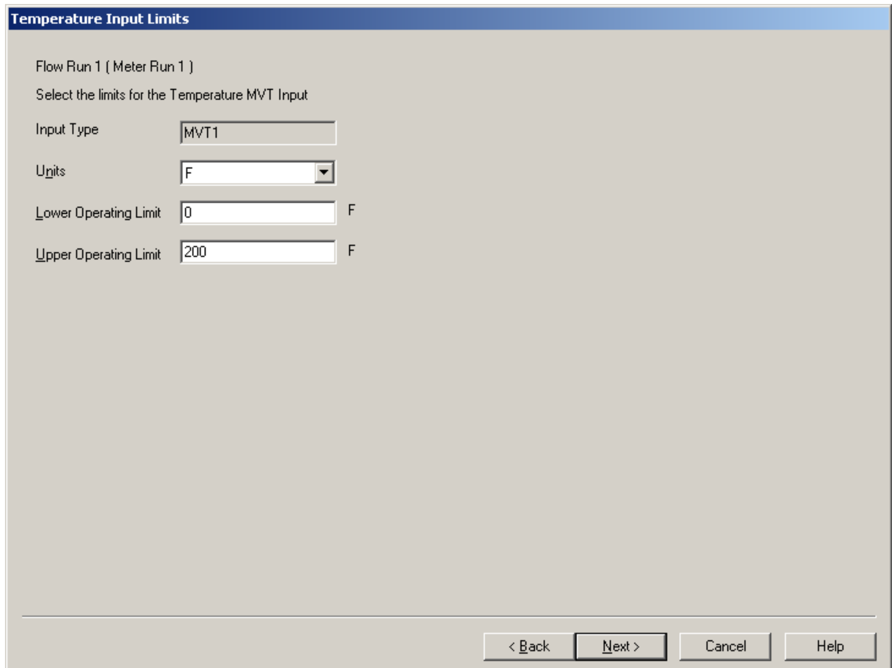
Temperature Limits Step

This step defines the limits for the temperature input. One of two configuration dialogs is presented based on the Input Type configured for static pressure limits:

- Sensor Inputs
- Analog Inputs

Sensor Inputs

The following dialog is presented when sensor (MVT) inputs are used.



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

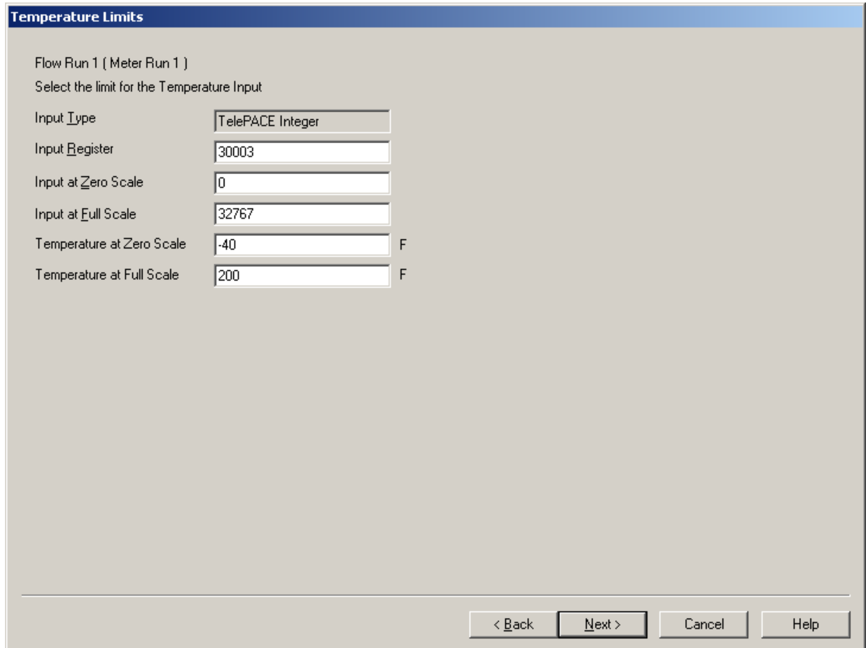
Units is the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display it uses these units. Valid values are kiloPascal, MegaPascal, and psi (pounds per square inch). The default is psi.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Analog Inputs

The following dialog is presented when analog inputs are used.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

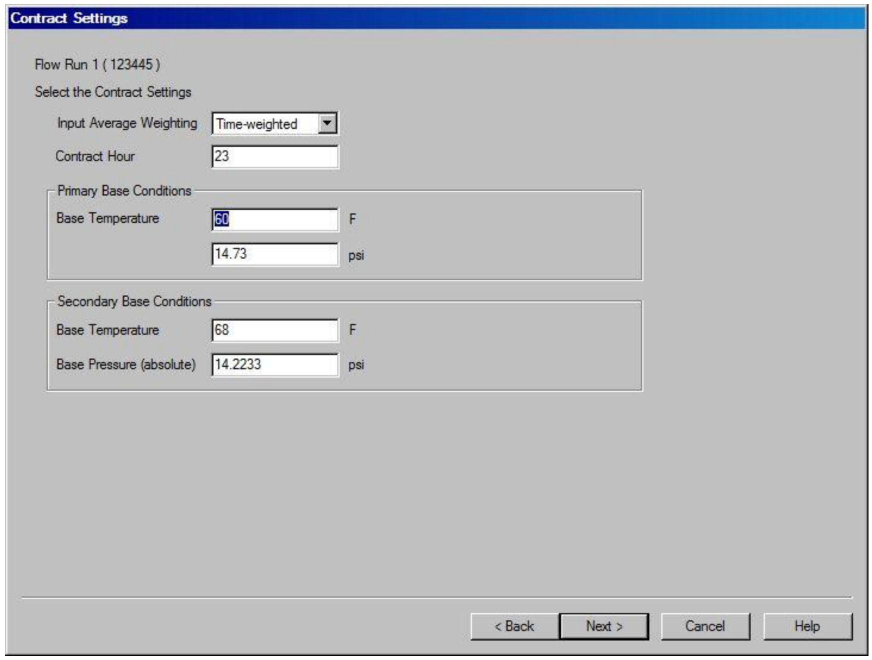
Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

Temperature at Zero Scale is the temperature that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

Temperature at Full Scale is the temperature that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

Contract Settings Step

This step lets you set the contract settings for the run.



Input Average Weighting is the weighting method of the linear inputs. This applies to the differential pressure, static pressure, and temperature. Valid values are time-weighted or flow-weighted (see Input Averaging on page 948 for more information). The template selected determines the default value.

Contract Hour is the hour of the day that starts a new contract day using a 24-hour clock. The contract day begins at 00 minutes and 00 seconds of the specified hour. Valid values are 0 to 23. The template selected determines the default value displayed.

Standard Base Conditions are the default **Base Temperature** and **Base Pressure (absolute)** values.

- **Base Temperature** is the reference temperature to which contract flow values are corrected. Valid values are –40 to 200. The default value is given in the table below.
- **Base Pressure** is the reference pressure to which contract flow values are corrected. The base pressure is measured as absolute pressure (not a gauge pressure). Valid values are 0 to 32000. The default value is given in the table below.

Contract Units	Standard Base Temperature	Standard Base Pressure
US1	60 F	14.73 psi
US2	60 F	14.73 psi
US3	60 F	14.73 psi
IP	60 F	2116.2281 lbf/ft^2
Metric1	15 C	101.325 kPa
Metric2	15 C	1.01325 bar
Metric3	15 C	0.101325 MPa
SI	288.15 K	101325 Pa

Contract Units	Standard Base Temperature	Standard Base Pressure
US4	60 F	14.73 psi
US5	60 F	14.73 psi
US6	60 F	14.73 psi
US7	60 F	14.73 psi
US8	60 F	14.73 psi
PEMEX	60 F	14.73 psi

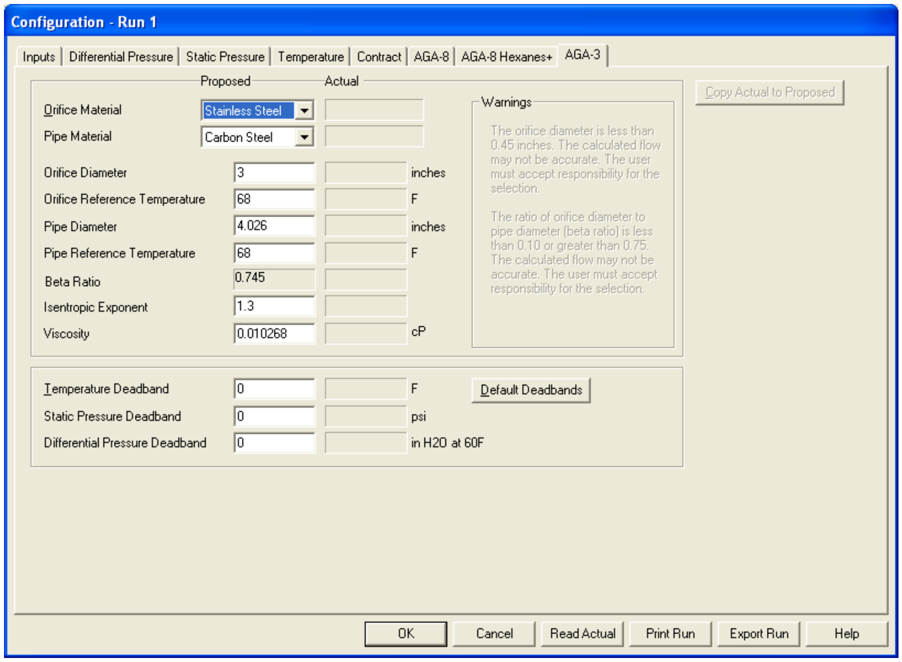
Realflo for PEMEX flow computers provide a second set of base conditions. **PEMEX Base Conditions** are the default **Base Temperature** and **Base Pressure (absolute)** values when Realflo is operating in PEMEX mode.

- **Base Temperature** is the reference temperature to which contract flow values are corrected. The default is listed in the table below for each type of contract unit.
- **Base Pressure** is the reference pressure to which contract flow values are corrected. The base pressure is measured as absolute pressure (not a gauge pressure). Valid values are 0 to 32000. The default values are listed in the table below for each contract unit.

Contract Units	Standard Base Temperature	Standard Base Pressure
US1	60 F	14.73 psi
US2	60 F	14.73 psi
US3	60 F	14.73 psi
IP	60 F	2116.2281 lbf/ft^2
Metric1	15 C	101.325 kPa
Metric2	15 C	1.01325 bar
Metric3	15 C	0.101325 MPa
SI	288.15 K	101325 Pa
US4	60 F	14.73 psi
US5	60 F	14.73 psi
US6	60 F	14.73 psi
US7	60 F	14.73 psi
US8	60 F	14.73 psi
PEMEX	68 F	14.73 psi

AGA-3 Settings Step

This step sets the AGA-3 calculation parameters.



Orifice Material is the material from which the orifice plate for the meter run is made. Valid values are Stainless Steel, Monel, and Carbon Steel. The template selected determines the default value displayed.

Pipe Material is the material from which the meter run pipe is made. Valid values are Stainless Steel, Monel, and Carbon Steel. The template selected determines the default value displayed.

Orifice Diameter is the diameter of the meter run orifice. The template selected determines the default value displayed.

Orifice reference temperature is the temperature at which the diameter of the meter run orifice was measured. The template selected determines the default value displayed.

Pipe Diameter is the measurement of the meter run pipe inside diameter. The template selected determines the default value displayed.

Pipe reference temperature is temperature at which the meter run pipe diameter was measured. The template selected determines the default value displayed.

Beta Ratio is the ratio of orifice diameter to pipe diameter. It is displayed for information purposes only and cannot be edited.

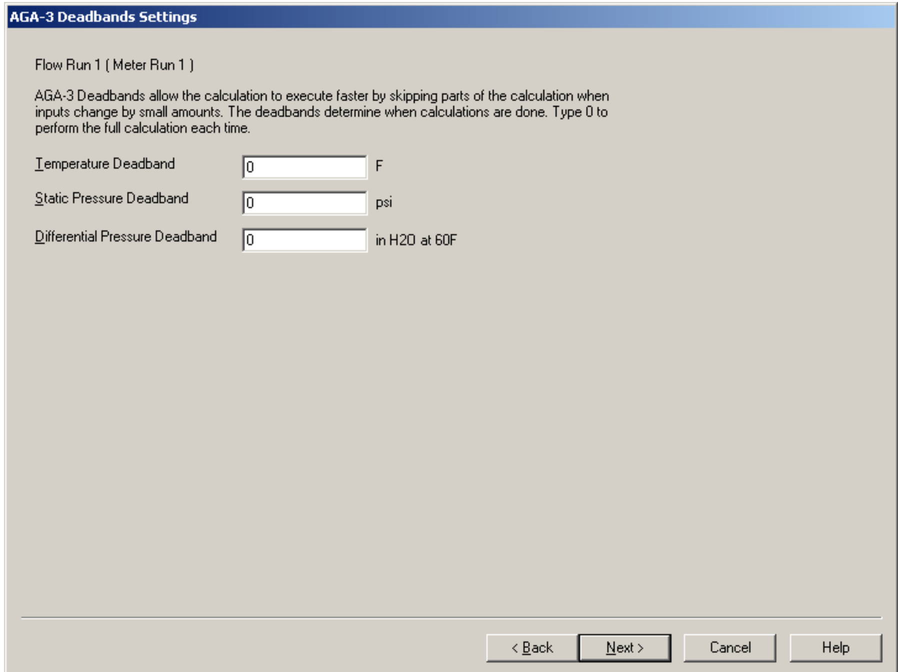
Realflo displays messages if the beta ratio is outside recommended limits.

Isentropic Exponent is a thermodynamic property of gas used to predict the relationships between pressure, temperature, volume and energy. If you are unsure of this value, a typical value of 1.3 is commonly used. The template selected determines the default value displayed.

Viscosity is a measure of the resistance of a measured gas to flow. Valid values are 0 to 1. The template selected determines the default value displayed.

AGA-3 Deadband Settings Step

This step sets AGA-3 calculation deadbands.



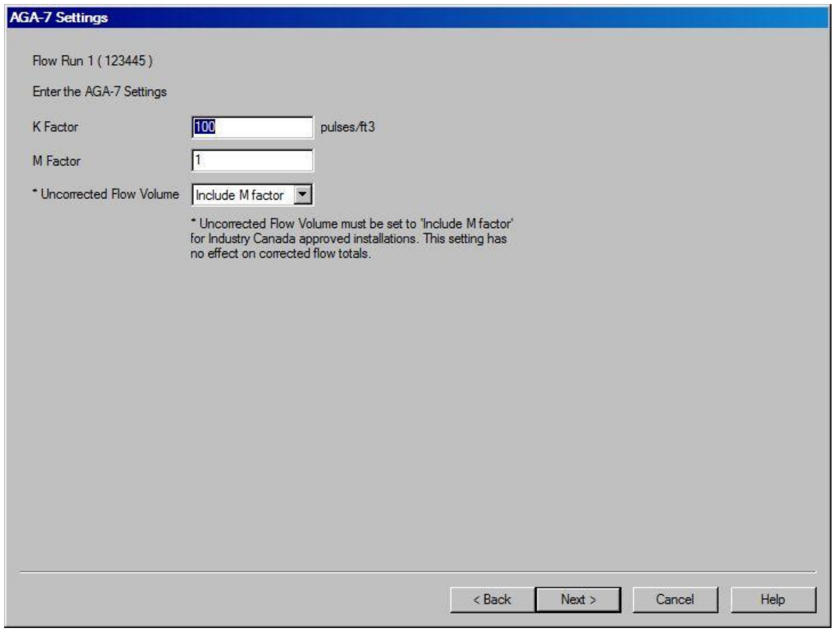
Temperature Deadband is the tolerated change in the flowing temperature before temperature dependent factors in the flow calculation are recalculated. Changes in the temperature smaller than the deadband will be ignored in determining the result. The template selected determines the default value displayed. The upper limit is 7°F or 4°C.

Static Pressure Deadband is the tolerated change in the static pressure before static pressure dependent factors in the flow calculation are recalculated. Changes in the static pressure smaller than the deadband will be ignored in determining the result. A static pressure deadband setting of up to four percent of the typical static pressure level should have a small effect on the accuracy of the AGA-3 calculation. The template selected determines the default value displayed. The upper limit is 800 psi or 5500 kPa or the equivalent in other units.

Differential Pressure Deadband is the tolerated change in the differential pressure before differential pressure dependent factors in the flow calculation are recalculated. Changes in the differential pressure smaller than the deadband will be ignored in determining the result. A change of N in the differential pressure input will cause a change of 0.5 N in the calculation volume at base conditions. It is recommended that the differential pressure deadband be set to zero. The template selected determines the default value displayed. The upper limit is 4.5 inWC or 1.1 kPa or the equivalent in other units.

AGA-7 Settings Step

This step lets you define the AGA-7 settings.



K Factor is the number of pulses per unit volume of the turbine meter. Valid values are 0.001 to 1000000. The template selected determines the default value displayed.

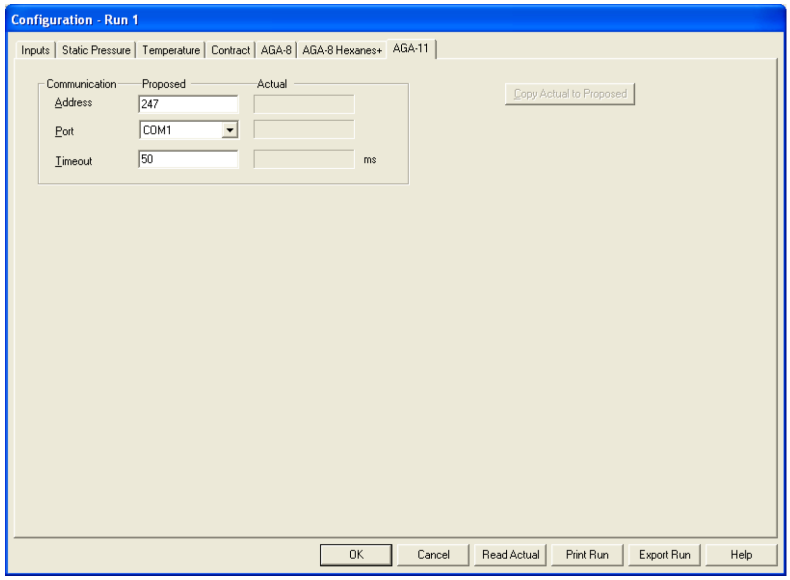
M Factor is the adjustment to the number of pulses per unit volume for the turbine meter compared to an ideal meter. Valid values are 0.001 to 1000. The template selected determines the default value displayed.

***Uncorrected Flow Volume** is the measurement of the volume of gas during the contract period.

The Uncorrected Flow Volume control is available in Realflo versions 6.20 and higher.

AGA -11 Configuration Step

AGA-11 configuration defines parameters unique to the AGA-11 calculation. The AGA-11 calculation communicates with a Coriolis meter for the calculation. The AGA-11 configuration sets the communication parameters for communication between the Coriolis meter and the flow computer.



Address

This is the Modbus address of the Coriolis Meter for serial communications. Multiple Coriolis meters using the same serial port on the flow computer need to each have a unique Modbus address. Valid Modbus addresses are between 1 and 247. The default address is 247.

Port

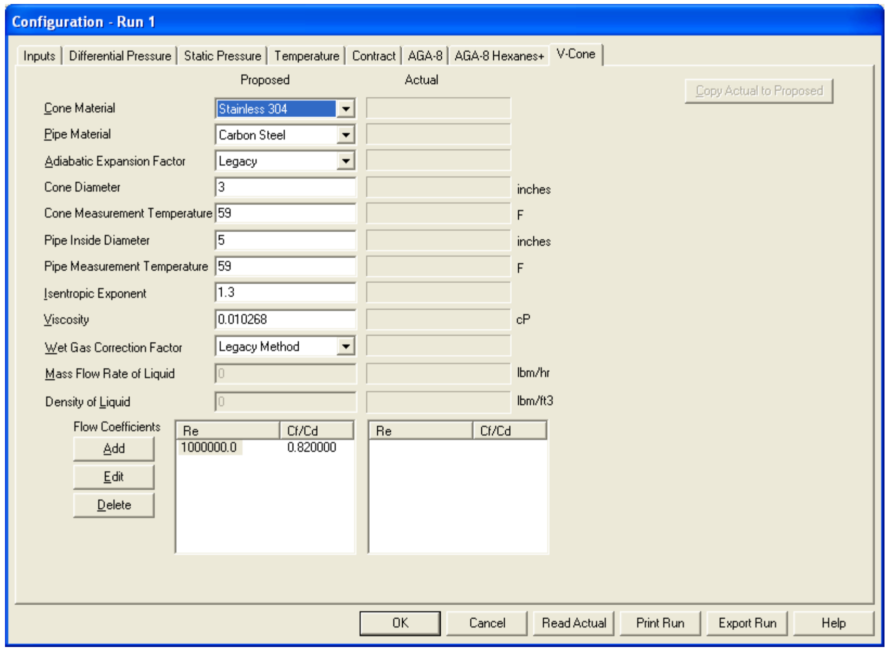
This is the communication port on the flow computer that will be used to communicate with the Coriolis meter. Valid port selections depend on the type of controller the flow computer running on. The default port is the first valid port available on the controller.

Timeout

This is the time the flow computer waits for a response for Modbus read commands send to the Coriolis meter. When the timeout time is exceeded the command is unsuccessful and an alarm is added to the flow computer alarm list. Valid timeout values are from 0 to 1000 ms. The default value is 50 ms.

V-Cone Settings Step

V-Cone Configuration defines parameters unique to the V-Cone calculation.



Cone Material

This is the material of the V-cone. Valid values are Carbon Steel, Stainless 304, and Stainless 316. The default value is determined by the template selected.

Pipe Material

This is the material from which the meter run pipe is made. Valid values are Carbon Steel, Stainless 304, and Stainless 316. The default value is determined by the template selected.

Adiabatic Expansion Factor

The **Adiabatic Expansion Factor** drop down list selects which calculation is used for the adiabatic expansion factor of the calculation.

- Select **Legacy Calculation** to use the older calculation method. This is the default selection. Flow computers prior to version 6.71 support only this selection.
- Select **V-Cone** to use the V-Cone specific calculation. This selection should be used with V-Cone devices.
- Select **Wafer-Cone** to use the Wafer-Cone specific calculation. This selection should be used with Wafer-Cone devices.

This control is disabled and forced to **Legacy Calculation** if the controller type is not one of SCADAPack 32, SCADAPack 32P, SCADAPack 314/330/334, SCADAPack 350 SCADAPack 4203 or SolarPack 410.

When **reading** from a flow computer that does not support the adiabatic expansion factor configuration, the method will be set to Legacy Calculation.

When **writing** to a flow computer that does not support the adiabatic expansion factor method, the configuration registers will be ignored and the expansion factor will not be written.

Cone Diameter

The diameter of the meter run cone used for the flow calculation. The measurement units are displayed depending on the input units selected. The default value is 3 inches.

Cone Measurement Temperature

This is the reference temperature at which the cone diameter for the meter run was measured. The measurement units are displayed depending on the input units selected. The default value is 59 degrees F.

Pipe Inside Diameter

This is the measurement of the meter run pipe inside diameter. The measurement units are displayed depending on the input units selected. The default value is 5 inches.

Pipe reference temperature

The temperature at which the meter run pipe diameter was measured. The measurement units are displayed depending on the input units selected. The default value is 59 degrees.

Isentropic Exponent

In general, this is a thermodynamic property of gas used to predict the relationships between pressure, temperature, volume and energy. If you are unsure of this value a typical value of 1.3 is commonly used. The default value is 1.3.

Viscosity

This is the viscosity of the measured gas. In general, this is the resistance of a gas or semi-fluid resistance to flow. The measurement units are displayed depending on the input units selected. Valid values are 0 to 1. The default value is 0.010268 centiPoise.

Wet Gas Correction Factor

- The Wet Gas Correction Factor Method drop down list selects which calculation is used for the wet gas correction factor of the calculation.
- Select **Legacy Method** to use the older correction method. This is the default selection. Flow computers prior to version 6.73 support only this selection.
- Select **V-Cone or Wafer Cone** to use the V-Cone and Wafer Cone specific calculation. This selection should be used with V-Cone or Wafer Cone devices.

This control is disabled and forced to **Legacy Calculation** if the controller type is not one of SCADAPack 32, SCADAPack 32P, SCADAPack 314/330/334, SCADAPack 350 SCADAPack 4203 or SolarPack 410.

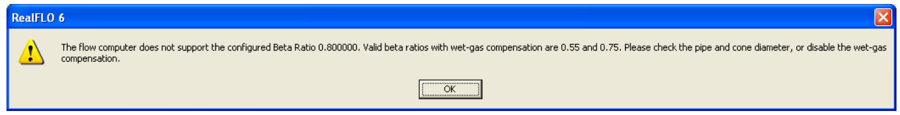
The V-Cone or Wafer Cone supported **Beta Ratios** are:

For Fr (Froude Number) < 5 supported Beta Ratio is 0.55.

For Fr (Froude Number) < 5 supported Beta Ratio is 0.75.

For Fr (Froude Number) > 5 supported Beta Ratio is 0.75.

When **V-Cone or Wafer Cone** is selected and if the current Beta ratio is not supported when executing verification, a message is displayed.



When **V-Cone or Wafer Cone** is selected, configuration of the fixed wet gas factor parameter, as set in the Contract tab, is disabled.

When **Legacy Method** is selected, configuration of the parameters used by the V-Cone or Wafer Cone method is disabled.

Mass Flow Rate of Liquid

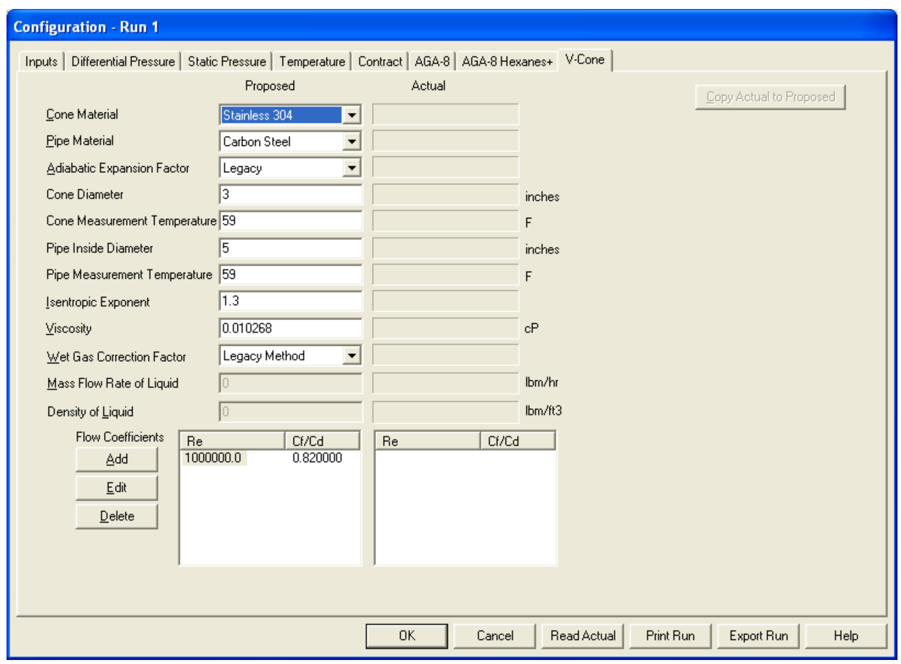
The Mass flow rate of liquid at flow conditions parameter is used by the V-Cone or Wafer Cone method and can be configured when **V-Cone or Wafer Cone** is selected. This information needs to be gathered using a sampling method or a tracer method. The default is 0.

Density of Liquid

The Density of liquid at flow conditions parameter is used by the V-Cone or Wafer Cone method and can be configured when **V-Cone or Wafer Cone** is selected. The default is 0.

V-Cone Coefficients

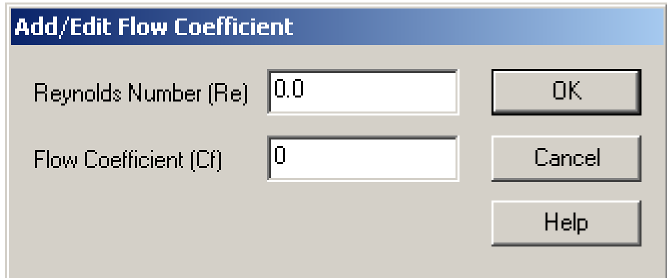
This step defines the V-Cone coefficients.



Enter the V-Cone coefficient pairs from the meter-sizing report. The default list contains one pair: Re = 1000000; Cf = 0.82.

Click **Add** to add a coefficient pair.

In the original McCrometer V-Cone Application Sizing sheet that is included with V-Cone meters uses the terminology **Cd** (discharge coefficient) rather than **Cf** (flow coefficient). You will need to use the **Re** and **Cd** values from the V-Cone Application Sizing sheet for the **Re** and **Cf** entries. If the **Re** value is the same for every entry in the table only the first pair is used. McCrometer now supplies one value of **Cd** in the sizing document. You need to enter one **Re/Cd** pair only. See the McCrometer Application Sizing sheet for the **Re/Cd** pair for your meter.



To edit a coefficient pair in the table:

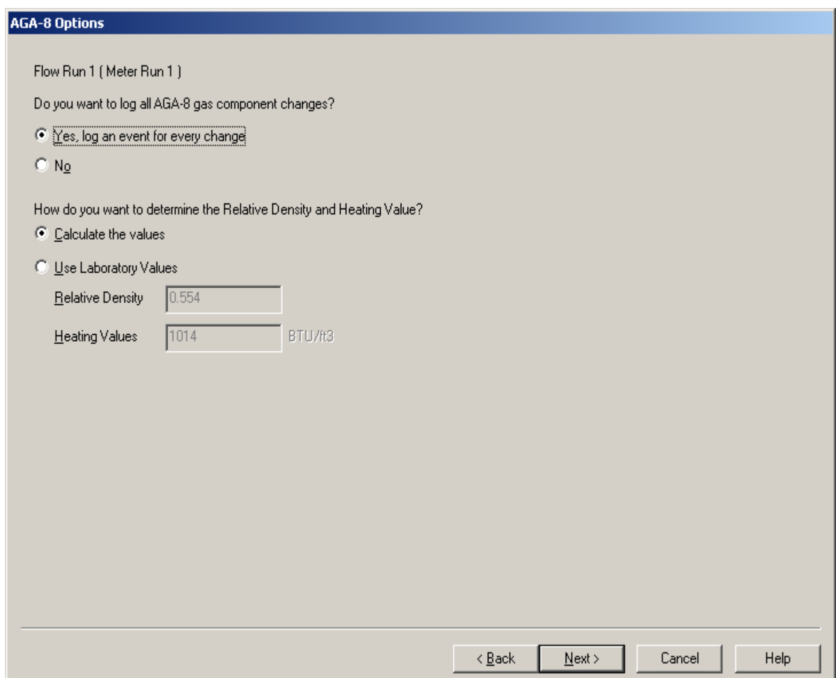
- Select a row in the list.
- Click **Edit** to open the Add/Edit Flow Coefficient dialog.

To delete a coefficient pair in the table:

- Select a row in the list.
- Click **Delete** to delete the pair form the list.

AGA-8 Options Step

This step sets AGA-8 calculation options.



Events can be logged each time an AGA-8 gas component changes.

- Select **Yes** to log each change to the gas composition. Use this option if the gas composition changes infrequently. This is the default selection.
- Select **No** to skip logging changes. Use this option if you are making frequent changes to the gas composition.

The Relative Density and Heating values can be calculated from the AGA-8 calculation or determined in a laboratory.

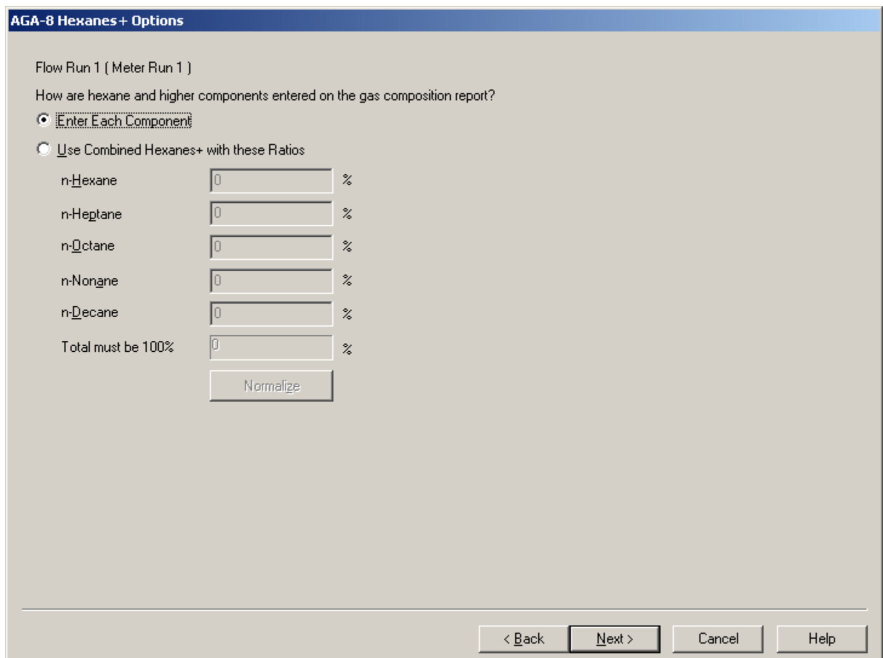
- Select **Calculate the Values** to have AGA-8 calculate the values.
- Select **Use Laboratory Values** to used fixed values.

Relative Density sets the real relative density of the gas. Valid values are 0.07 to 1.52. The template selected determines the default value displayed. This control is disabled if **Calculate the Values** is selected.

Heating Value sets the heating value of the gas. Valid values are 0 to 1800 BTU(60)/ ft^3 or the equivalent in the selected units. The template selected determines the default value displayed. This control is disabled if **Calculate the Values** is selected.

AGA-8 Hexanes+ Options

This step lets you choose to enter Hexane and higher components individually or as a single combined value.



Gas composition can be measured with individual values for hexane and higher components or use a combined value.

Select **Enter Each Component** to use individual values for the higher components. This is the default selection.

Select **Use Combined Hexanes+ with these Ratios** to use a combined value. Type the ratios of the higher components.

- **n-Hexane** defines the percentage of the Hexanes+ contributed by n-Hexane.
- **n-Heptane** defines the percentage of the Hexanes+ contributed by n-Heptane.
- **n-Octane** defines the percentage of the Hexanes+ contributed by n-Octane.
- **n-Nonane** defines the percentage of the Hexanes+ contributed by n-Nonane.

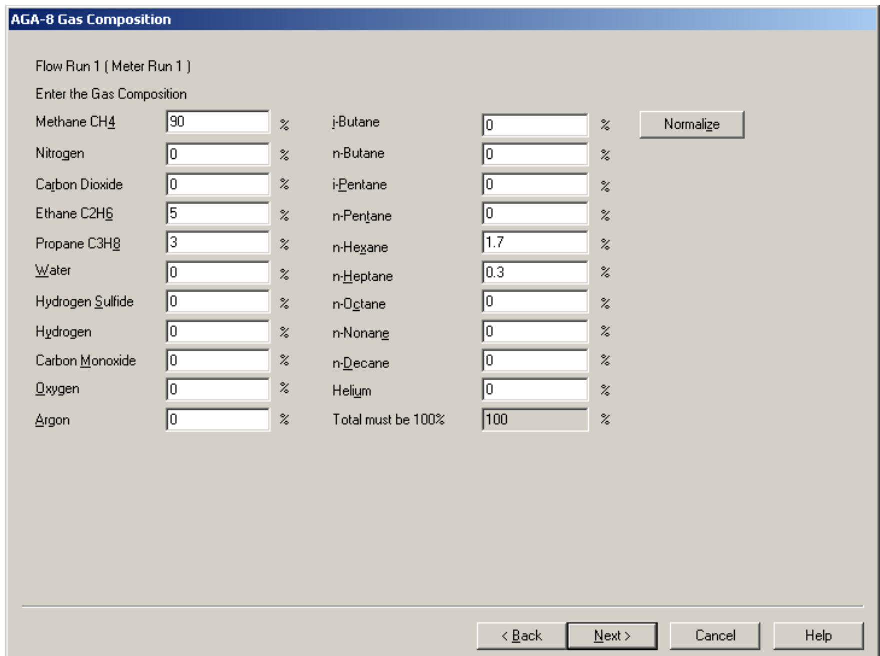
- **n-Decane** defines the percentage of the Hexanes+ contributed by n-Decane.
- The **Total** field displays the sum of all portions. This value cannot be edited. The total of portions needs to be 100 percent.

AGA-8 Gas Composition Step

This step lets you define the AGA-8 gas composition. One of two configuration dialogs opens based on how you elected to enter Hexane and higher components.

Individual Components

The dialog below lets you enter combined Hexanes+ composition.

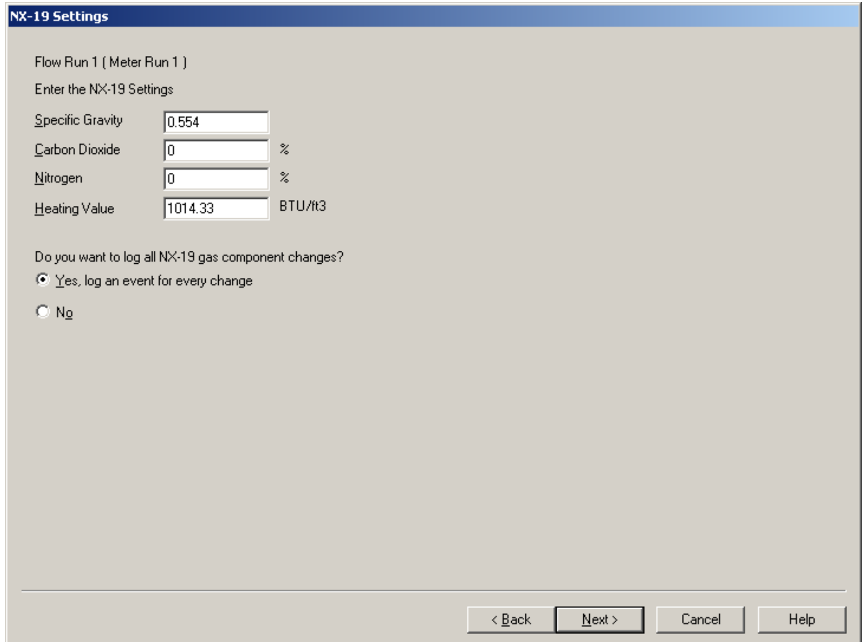


Type the gas composition according to the laboratory analysis. The total of components needs to be 100 percent.

Normalize adjusts non-zero components so that the total of components is 1.0000 (or 100.00 percent). The ratio to each other for the components remains the same.

NX-19 Settings

This step defines the NX-19 calculation. NX-19 is not supported for PEMEX flow computers.



Specific Gravity is the specific gravity of the gas being measured. Valid values are 0.554 to 1.000. The template selected determines the default value displayed.

Carbon Dioxide is the percent of carbon dioxide in the gas being measured. This value needs to be in the range 0 to 15. The template selected determines the default value displayed.

Nitrogen is the percent of nitrogen in the gas being measured. This value needs to be in the range 0 to 15.

Heating Value is the heating value of the gas being measured. Valid values are 0 to 1800 BTU(60)/ft^3 or the equivalent in the selected units. The template selected determines the default value displayed.

Events can be logged each time the NX-19 configuration changes.

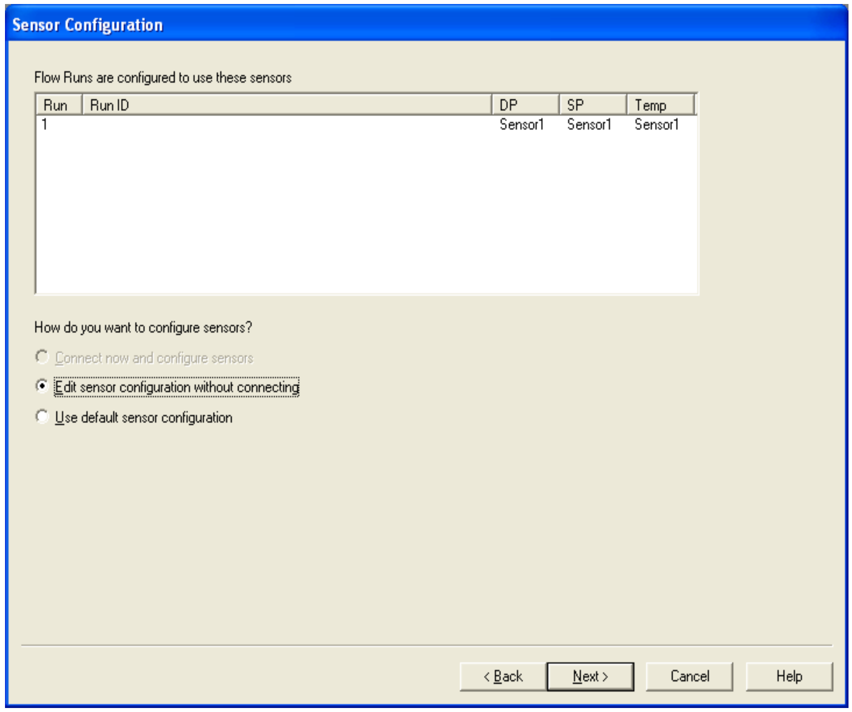
- Select **Yes** to log each change to the configuration. Use this option if the configuration changes infrequently. This is the default selection.
- Select **No** to skip logging changes. Use this option if you are making frequent changes to the configuration.

Sensor Configuration

The next step is Sensor Configuration if any transmitters were used in the input configuration. Otherwise the next step is **Flow Computer Configuration Summary**.

Sensor Configuration

This step lets you select how the transmitters are to be configured.



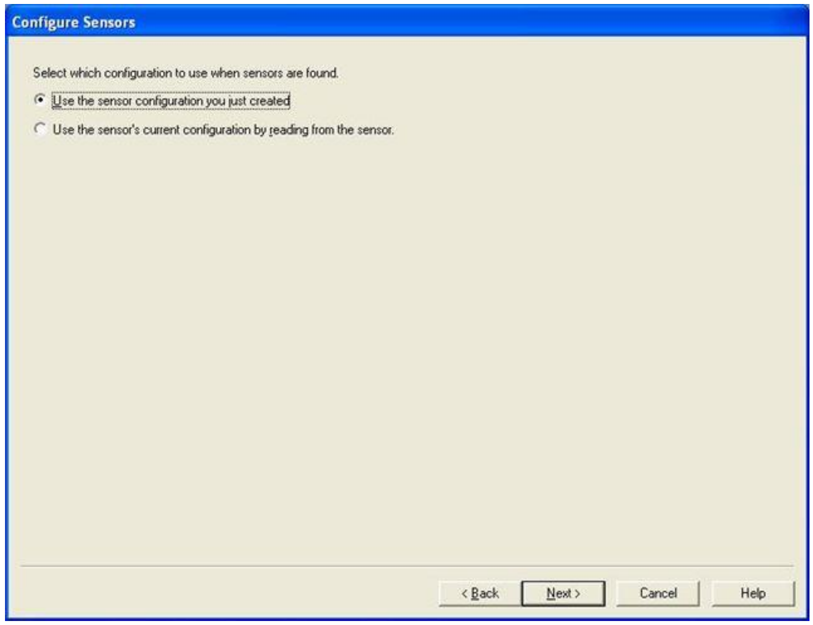
The **Flow Runs are configured to use these transmitters** dialog is a table that shows each of the configured flow run numbers, the Flow Run ID for each, and the transmitter that the run uses for the differential pressure (DP), static pressure (SP), and temperature sensors. If an analog input is used for the flow run, AIN will be displayed in the coresponding DP, SP, or Temp column.

The **How do you want to configure sensors?** option lets you select how to continue configuring the sensors. The three options are:

- **Connect now and configure transmitters** to connect to the flow computer and configure the attached transmitters. This selection is disabled if the flow computer configuration was selected to be completed offline in the Flow Computer Status step. If you choose this option, go to the **Configure Sensors** section to continue.
- **Edit sensor configuration without connecting** to proceed directly to the editing pages, without connecting to the flow computer. If you choose this option, go to the **Review Transmitters** section to continue.
- **Use default sensor configuration** to complete the configuration without changing the sensor configuration. Sensor configuration will be set to default values. If you choose this option, the next step is **Finish**.

Configure Sensors

This step lets you select to use the Realflo configuration or the sensor's configuration file.

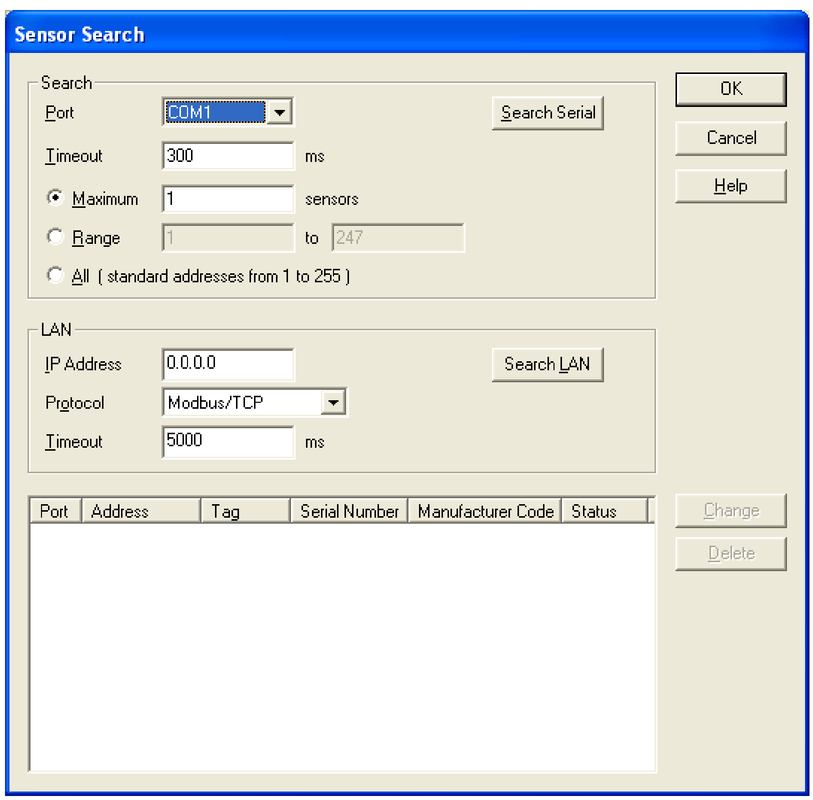


Select **Use the configuration from Realflo** to use the configuration data from the Realflo file. This is the default setting.

Select **Use the transmitter's current configuration by reading from the transmitter** to read configuration from a pre-configured transmitter.

Sensor Search

This step searches for sensors connected to the flow computer serial ports or LAN port.



Search Serial Option

Select **Search Serial** to search for transmitters connected to a serial port of the flow computer.

The **Port** parameter selects the flow computer serial port where the sensor is attached. Valid values are com1, com2, com3, and com4. The template selected determines the default value displayed.

The **Timeout** parameter specifies the length of time the flow computer will wait for a response from a sensor. Valid values are 100 ms to 10000 ms. The default is 300 ms.

Select **Maximum** to search for a number of MVT transmitters. The search operation will stop after finding the specified number of transmitters. The valid value is from 1 to 255. The default is 1.

Select **Range** to search the addresses in a specified range. The range to search for is typed in the edit boxes to the right of the radio button. The value in *To* edit control needs to be equal or great than the value in the first edit control. The maximum search range that can be typed is for 255 transmitters. The default range is 1 to 247.

- Range Search supports addresses 1 to 255 in standard Modbus mode, and 1 to 65534 in extended address mode. The address mode of the flow computer serial port needs to be set to extended in order to search for transmitters with extended addresses.

Select **All** to search the addresses of transmitters connected with the serial port selected in *Port*. Up to 255 addresses are searched.

Click **Next** to start the search for sensors or 4000 transmitters. A search process dialog is displayed so that the search operation can be cancelled at any time.

Search LAN Option

Select **Search LAN** to search for transmitters connected to a LAN port of the flow computer.

The **IP Address** parameter specifies the IP address of a 4000 transmitter. Valid entries are IP addresses in the format nnn.nnn.nnn.nnn where nnn are values between 0 and 255.

The **Protocol** parameter selects the type of IP protocol used to query the transmitter. Valid IP protocol selections are Modbus/TCP and Modbus RTU in UDP.

The IP port (for example port 502) for the selected protocol needs to be the same in the flow computer and the 4000 transmitter.

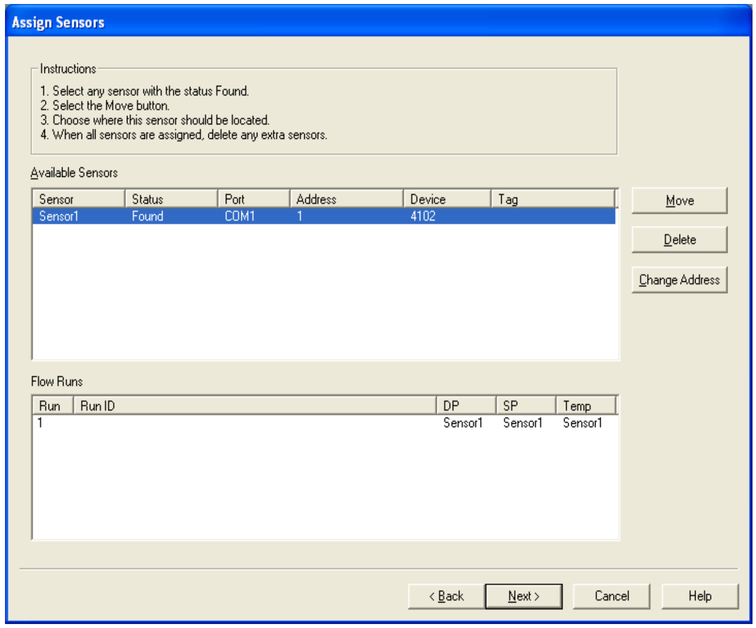
The **Timeout** parameter specifies the length of time the flow computer will wait for a response from a 4000 transmitter. Valid values are 100 to 10000 milliseconds. The default is 5000 ms.

Click **Next** to start the search for MVT transmitters or 4000 transmitters. A search process dialog is displayed so that the search operation can be cancelled at any time.

If no transmitters were found, then a message is displayed and the search step is displayed again.

Assign Sensors

This step assigns found transmitters to flow runs.



The **Available Sensors** window shows the transmitters that have been configured and the transmitters that were found by the search. There may be more transmitters in the list than there are runs.

The **Sensor** column shows the transmitter slots that have been configured. Transmitters that were found but not assigned are listed as *Not assigned*.

The **Status** column indicates if configuration data for the transmitter exists.

- ***Found*** indicates a transmitter has been configured and the search found one with the same port, address and device type.
- ***Missing*** means a transmitter has been configured but the search did not find one with the same port, address and device type.

The **Port** column displays the serial or LAN port the flow computer is using to communicate with the transmitter.

The **Address** column displays the Modbus station address or IP address of the transmitter.

The **Tag** column displays the Tag Name assigned to the transmitter. This column may be blank if a Tag Name has not been assigned to the transmitter.

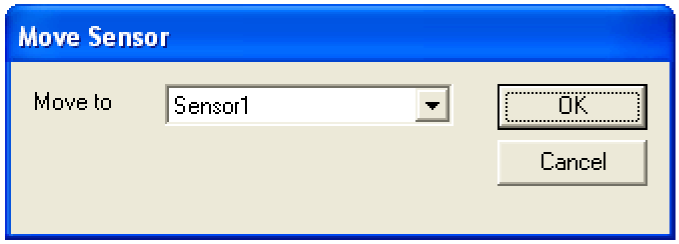
The **Device** type column displays type of transmitter. Valid values are 3095FB, 4101, 4102, 4202 DR, 4202 DS, 4203 DR, or 4203 DS.

The **Flow Runs** window shows which MVTs are assigned to the runs.

To Change the order of the sensors:

- Select a sensor in **Available Sensors** window.
- Click **Move**.

The Move Sensor dialog opens:



- In the Move Sensor dialog, use **Move To** selection to select the new location
- Click **OK**.

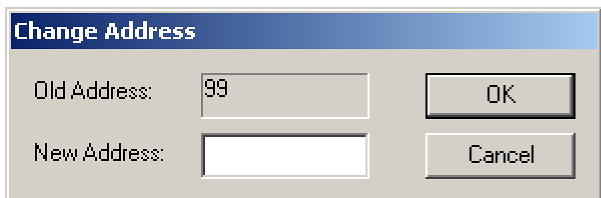
To delete a sensor:

- Select a transmitter in **Available Sensors**
- Click **Delete**.

To change the address of a Sensor:

- Select a transmitter in **Available Sensors**
- Click **Change Address**.

The Change Address dialog opens:



- Enter a new address for the transmitter in the **New Address:** window.
- Click **OK**.

Click **Next** when the transmitters have been moved to the correct location. **Next** is disabled if there are *Not Assigned* transmitters still in the list.

The next step is Search for More Transmitters.

Notes

The following actions may occur when moving a Sensor.

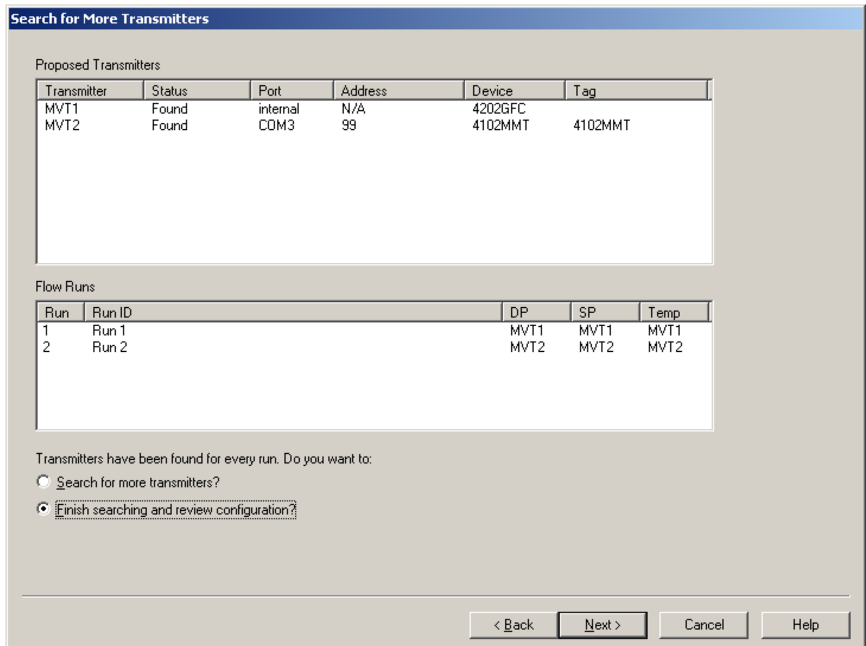
- Moving one sensor to another results in the both swapping positions.
- When *Use the configuration from Realflo* was selected, assigning a *Not assigned* transmitter to a Sensor with status ***Missing*** and device type matching will result in the sensor adopting the transmitter's port and address and retaining the rest of the sensor configuration. The sensor, being assigned, will disappear from the list.
- When *Read the configuration from the transmitter* was selected, assigning a *Not assigned* transmitter to a sensor with status ***Missing*** and device type matching will result in the sensor adopting the transmitter's configuration. The transmitter, being assigned, will disappear from the list.
- Assigning a *Not assigned* transmitter to a sensor with status ***Missing*** and device type not matching will result in the sensor adopting the

transmitter's configuration. The transmitter, being assigned, will disappear from the list.

- Other assignments are not permitted.

Search for More Sensors

This step displays the current sensor assignments and asks if more searches are needed.



Proposed Sensors shows the transmitters that have been configured and the transmitters that were found by the search.

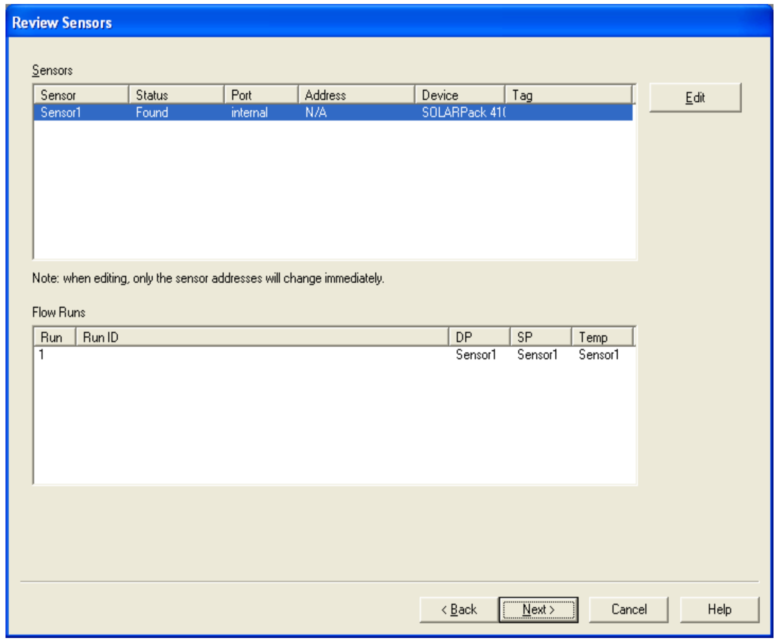
Flow Runs shows which sensors are assigned to the runs.

Select **Search for more transmitters** to search again. The next step is **Search for Transmitters**.

Select **Finish searching and review configuration** to use the current settings. This is the default button.

Review Transmitters

This step displays the transmitter assignments and allows editing the transmitter configuration.



The **Sensors** window shows the transmitters that have been configured.

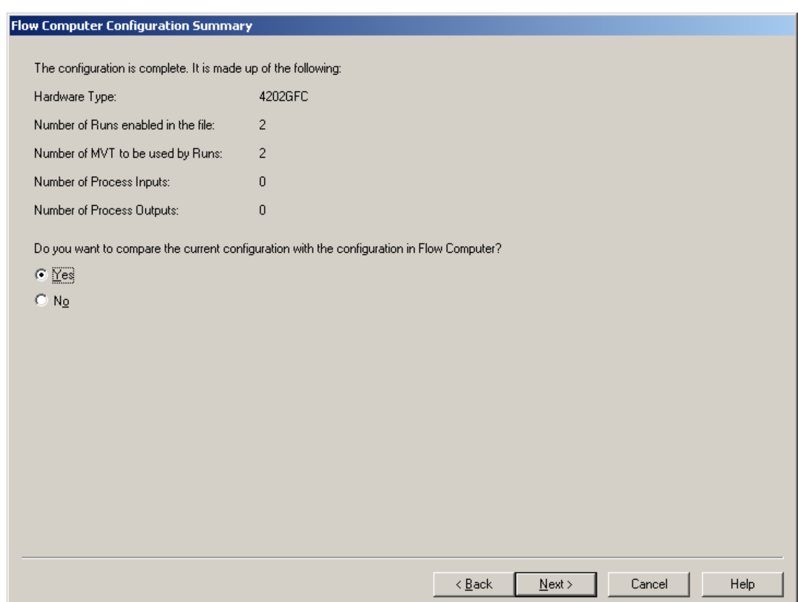
The **Flow Runs** window shows which sensors are assigned to the runs.

Click **Edit** to review and modify the settings for each transmitter. Edit opens the **Add/Edit Sensor Settings** dialog. Changes to a transmitter address will be written to the transmitter without affecting current flow computer configuration.

Once you have configured Run 1, the Flow Run ID dialog re-opens.

Flow Computer Configuration Summary

This step displays a summary of the flow computer settings.



A summary of the flow computer configuration is shown.

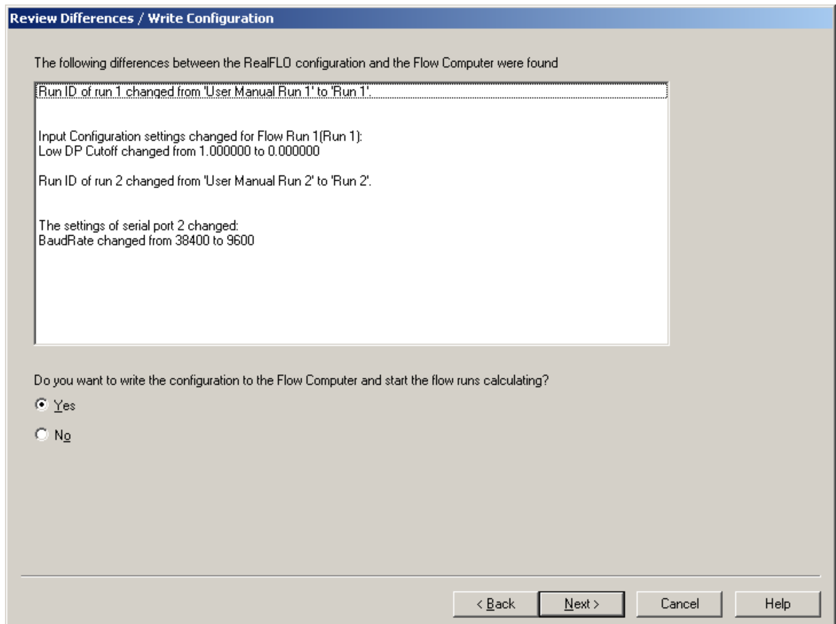
The current configuration can be compared with the configuration in the target flow computer.

Select **Yes** to compare the configurations. The next step is **Review Differences.**

Select **No** to not compare the configurations. The next step is **Save File**.

Review Differences

This step displays a summary of changes in the flow computer configuration. You can select to write to the flow computer or not.



A summary of the differences is the configuration is shown.

Select **Yes** to write the configuration to the flow computer. The configuration is written to the flow computer. The Start Executing command will be written for each flow run. The communication progress dialog shows the stages of writing.

Select **No** to write the configuration to the flow computer later.

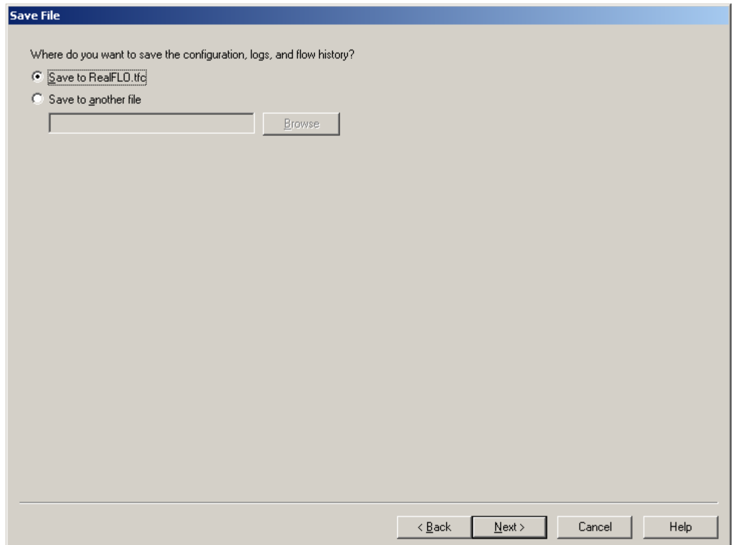
Click **Next** to perform the selected action.

In Flow Computer versions 6.73 and older, when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers. The Actual registers are not updated until a new Density calculation is started with the new values. The new values are not available to SCADA host software reading the Actual registers until a until a new Density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers and in the Actual registers. This allows a SCADA host to immediately confirm the new values were written to the flow computer. The new gas values are not used by the flow computer until a new density calculation is started.

Save File

This step selects where to save the configuration file.

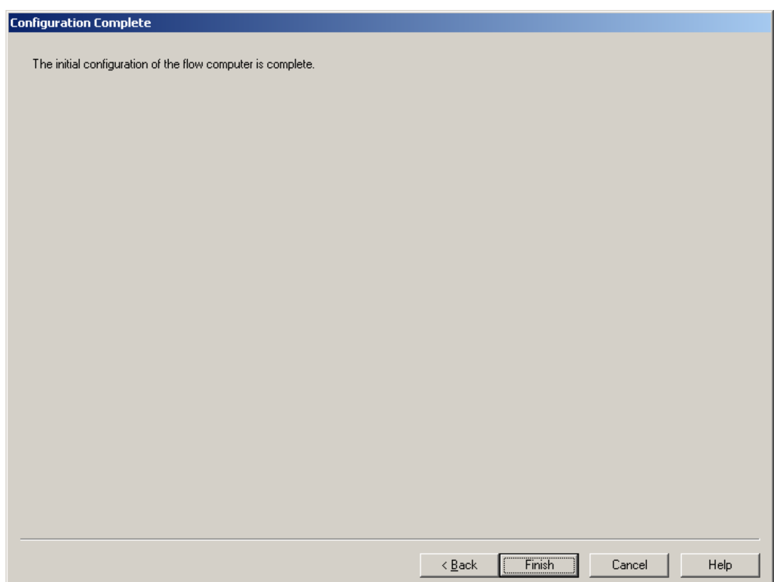


Select the **Save to Realflo.tfc** to save the configuration file to the default file location.

Select the **Save to another file** to either enter a file name or use the Browse option to open the **Save As** dialog.

Finish

This step is displayed at the end of the wizard.



Click **Finish** to close the wizard.

Notes

1. Views for extra runs are closed but new ones may be opened.
2. The history and event logs contain no information.

3. The configuration data for supported runs in the file is set to usable values, so when the number of runs is changed there is useful data in the configuration.

Create Configuration Step-by-Step

When you choose to configure the flow computer step-by-step, the Create New File Wizard prompts you through the steps needed. The dialogs displayed are dependent upon the calculations you select.

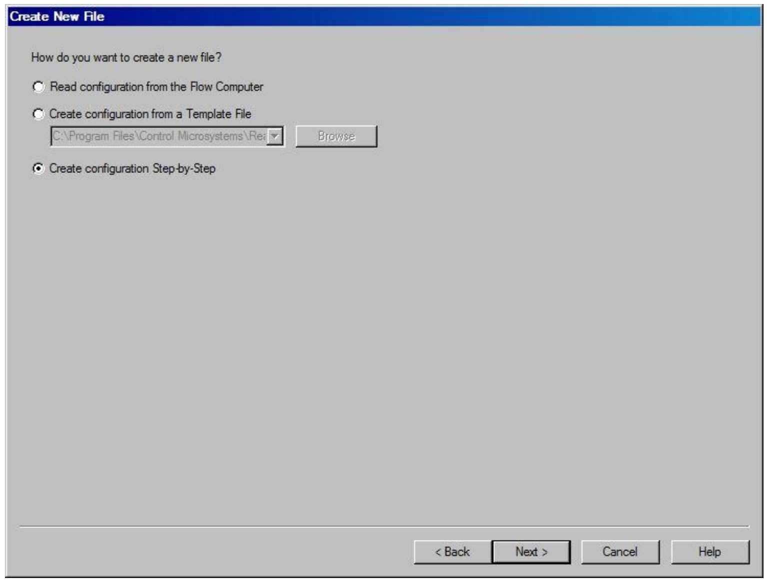
Step-by-Step Configuration Sequence for a Flow Computer

The main steps in the configuration sequence to configure flow computer step-by-step are:

- Use Create New File Dialog to select how to create a new file.
- Use Hardware and Firmware Type Dialog to configure the hardware and firmware you are using.
- Use the I/O Module Dialog to configure your I/O module (Telepace only).
- Use the Flow Computer ID Dialog to assign an ID to the flow computer.
- Use the Flow Runs Dialog to configure the number of flow runs
- Use the ***Flow Run ID*** Dialog to assign an ID to the flow run.
- Use the ***Flow and Compressibility Calculations*** to select the flow and compressibility calculations for the meter run.
- Select the ***Flow Run Inputs*** to configure the type of inputs for the flow run.
- Select the ***Differential Pressure Limits*** to configure the differential pressure calibration to use for the run.
- Configure the ***Static Pressure*** for the run.
- Configure the ***Static Pressure Input Limits*** for the run.
- Use the ***Static Pressure*** Dialog to configure your sensors to compensate for the gravitation pull of the Earth according to altitude and latitude variations.
- Define the ***Temperature Limits*** for the run.
- Define the ***Contract Settings*** for the run.
- Select the **** Flow Calculation*** for the run.
- Configure the ***Sensor Configuration*** for the run.
- Review the ***Flow Computer Configuration Summary*** to confirm the configuration settings.
- Use ***Save File*** to save the new configuration.

Select the **Create a new file?** radio button from the Select File dialog to configure the flow computer step-by-step.

Create New File Dialog



(1) Select the **Create Configuration Step-by-Step** radio button.

(2) Click **Next >** to continue.

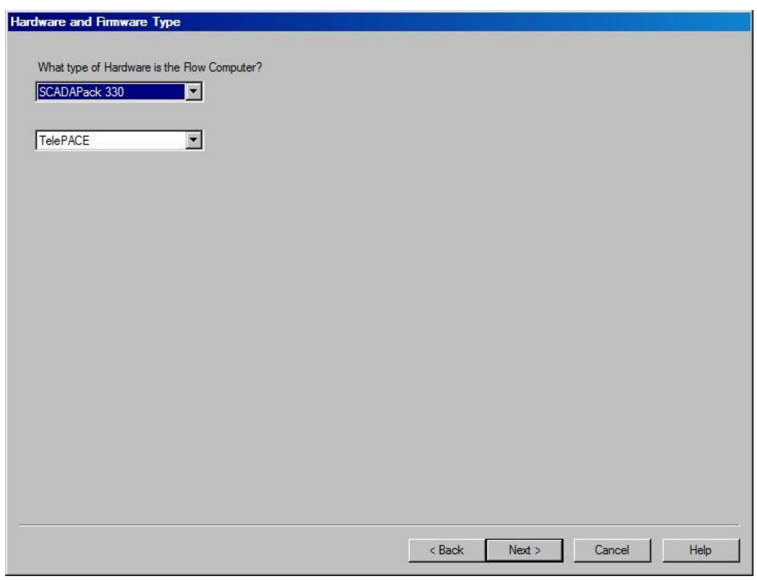
Follow the wizard steps described in the following sections to configure the flow computer.

Flow Computer Status Dialog

When configuring the flow computer step-by-step, select **No** when the Flow Computer Status dialog opens. This lets you choose the hardware type and firmware type manually see **Select Flow Computer Wizard.**

Hardware and Firmware Type Dialog

The Hardware and Firmware Type Dialog opens when you select **No** in the Flow Computer Status dialog.



First, select the **Hardware Type** from the dropdown list. The default value is SCADAPack 4202 DR. The options from which you can select are:

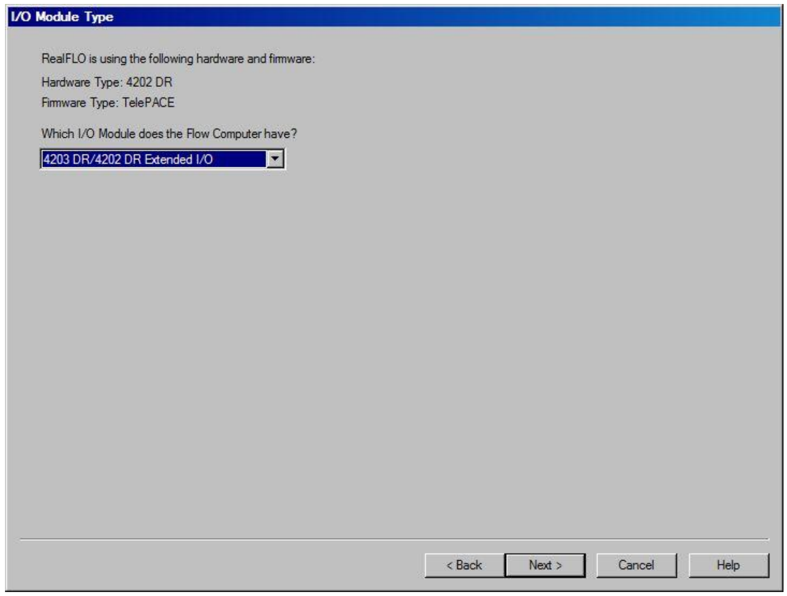
- Micro16
- SCADAPack
- SCADAPack Plus
- SCADAPack Light
- SCADAPack LP
- SCADAPack 32
- SCADAPack 32P
- 4202 DR
- SCADAPack 100: 1024K
- 4202 DS
- SCADAPack 314
- SCADAPack 330
- SCADAPack 334
- SCADAPack 350
- 4203 DR
- 4203 DS
- SolarPack 410

Second, select the **Firmware Type** from the dropdown list. The default value is Telepace. You can select ISaGRAF from the dropdown list for the firmware type.

If the firmware selected is Telepace, the I?O Module Dialog opens, followed by the **Flow Computer ID** dialog. If the firmware type selected is ISaGRAF, the Flow Computer ID dialog opens.

I/O Module Type Dialog

This step lets you select the I/O module to use for the selected Hardware type. The register assignment in the new file is set to the default register assignment for the selected hardware type.



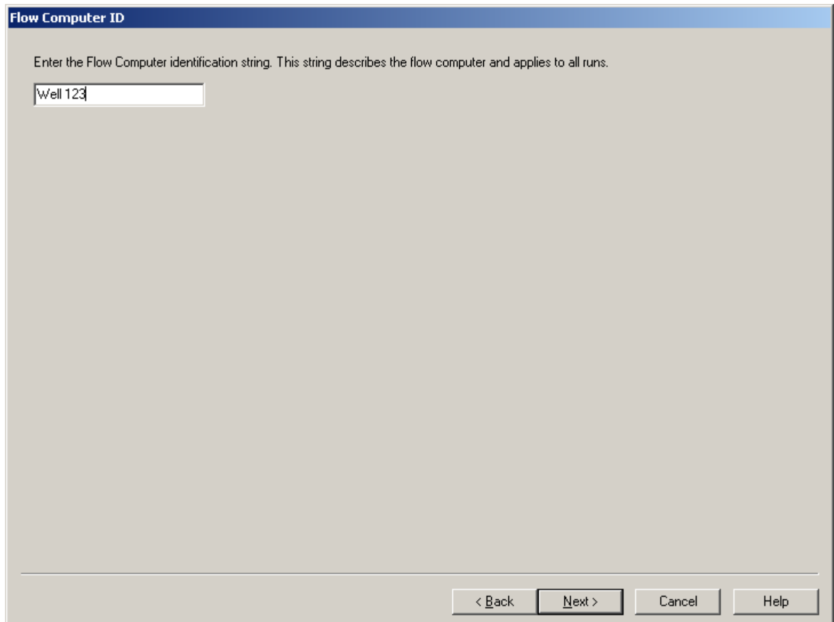
Select the I/O module for the flow computer from the dropdown list. The choices displayed depend on the flow computer hardware type.

Hardware Type	I/O Modules Available
Micro16	Controller I/O only or Backwards compatible modules.
SCADAPack	5601 I/O Module, 5604 I/O Module, or 5606 I/O Module
SCADAPack Plus	5601 I/O Module, 5604 I/O Module, or 5606 I/O Module
SCADAPack Light	5602 I/O Module
SCADAPack LP	SCADAPack LP I./O
SCADAPack 32	5601 I/O Module, 5604 I/O 10V/40mA Module 5604 I/O 5V/20mA Module 5606 I/O Module
SCADAPack 32P	SCADAPack 32P I/O
4202 DR	4202 DR or 4202 DR Extended/4203 DR I/O
SCADAPack 100: 1024K	SCADAPack 100: 1024K I/O
4202 DS	4202/4203 DS I/O
SCADAPack 314	SCADAPack 314/33x I/O
SCADAPack 330	SCADAPack 330 Controller.
SCADAPack 334	SCADAPack 33x I/O
SCADAPack 350	SCADAPack 350 10V/40mA Module SCADAPack 350 5V/20mA Module SCADAPack 357 Module

Hardware Type	I/O Modules Available
4203 DR	4202 DR Extended/4203 DR I/O
4203 DS	4202/4203 DS I/O
SolarPack 410	N/A

Flow Computer ID Dialog

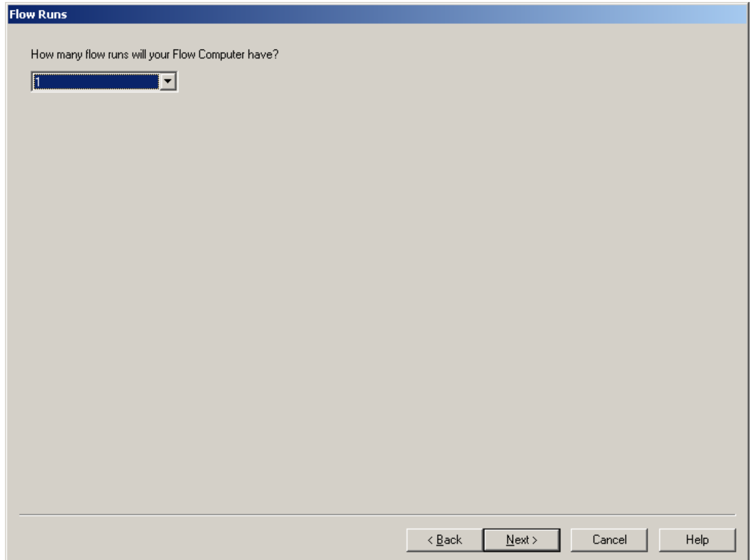
This step sets the Flow Computer ID.



Type the Flow Computer ID string in the edit box. This unique ID stops accidental mixing of data from different flow computers. The maximum length of the Flow Computer ID is eight characters. Any character is valid. You can leave the Flow Computer ID edit box blank. The default value is blank.

Flow Runs Dialog

This step selects the number of flow runs in the flow computer. The wizard will step through the configuration of the first run and then each subsequent run if more than one run is selected.

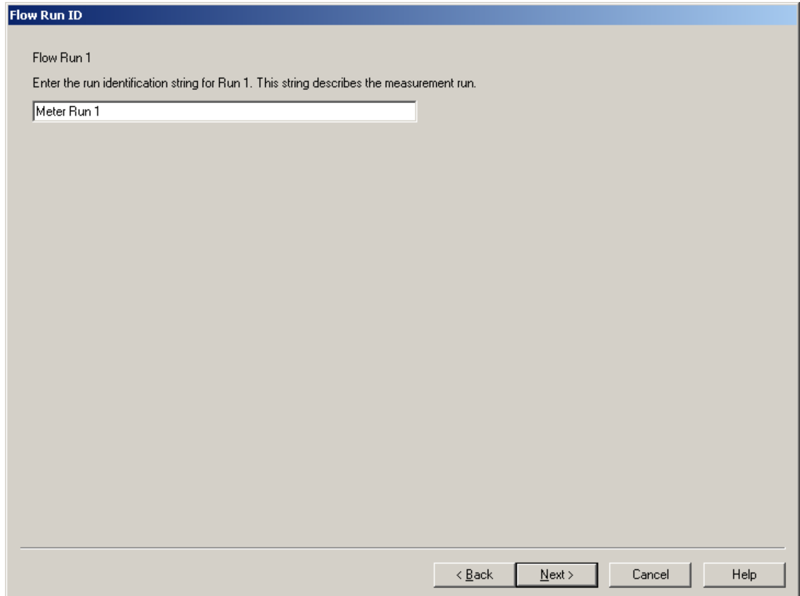


Select the number of flow runs with the dropdown list. Valid values depend on the hardware type and the number of flow runs enabled for the flow computer. The default value is one.

- For Micro16, SCADAPack, SCADAPack Light and SCADAPack Plus Flow Computers, the maximum number of meter runs is three.
- The selection of three meter runs is available for older flow computers that could be enabled for three meter runs.
- For SCADAPack LP and SCADAPack (4202 and 4203) Flow Computers, the maximum number of meter runs is two.
- For SCADAPack 100: 1024K and SolarPack 410 Flow Computers, the maximum number of meter runs is one.
- For SCADAPack 314/330/334 and SCADAPack 350 Flow Computers the maximum number of meter runs is four.
- For SCADAPack 32 and SCADAPack 32P Flow computers the maximum number of runs you can select is ten.

Flow Run ID

This step sets the Flow Run ID for the meter run. This is the first step of a flow run configuration. The wizard will step you through the configuration of the first run and then each subsequent run if you select more than one run.



The **Flow Run ID** helps to identify the flow run. Type a string up to 32 characters long. Any character is valid. You can leave the Flow Run ID edit box blank.

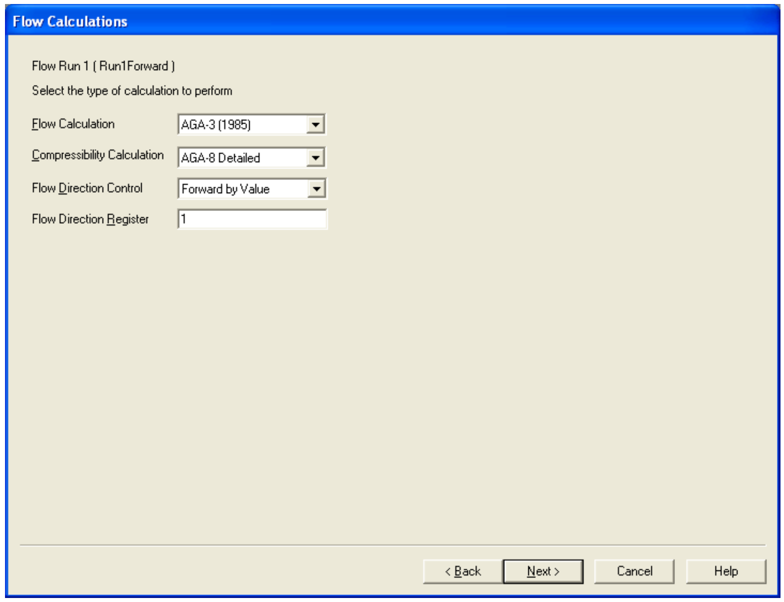
Older flow computers allow a string up to 16 characters. See the TeleBUS Protocol Interface section.

For run 1 the next step is

Flow Calculations Dialog.

Flow Calculations Dialog

This step selects the flow and compressibility calculations for the first run.



Flow Calculation selects the type of flow calculation for the meter run. Valid values are:

- AGA-3 (1985 version)
- AGA-3 (1992 version)
- AGA-7
- AGA-11 (not available for 16-bit controllers)
- V-cone calculations

The template selected determines the default value.

Compressibility Calculation selects the type of compressibility calculation for the meter run. Valid compressibility calculation values are:

- AGA-8 Detailed
- NX-19 (Not supported for PEMEX flow computers)

AGA-8 Detailed is the recommended calculation for new systems as it has superior performance compared to NX-19. NX-19 is provided for legacy systems. The template selected determines the default value.

Flow Direction Control selects the direction of flow indication, forward or reverse, for a meter run.

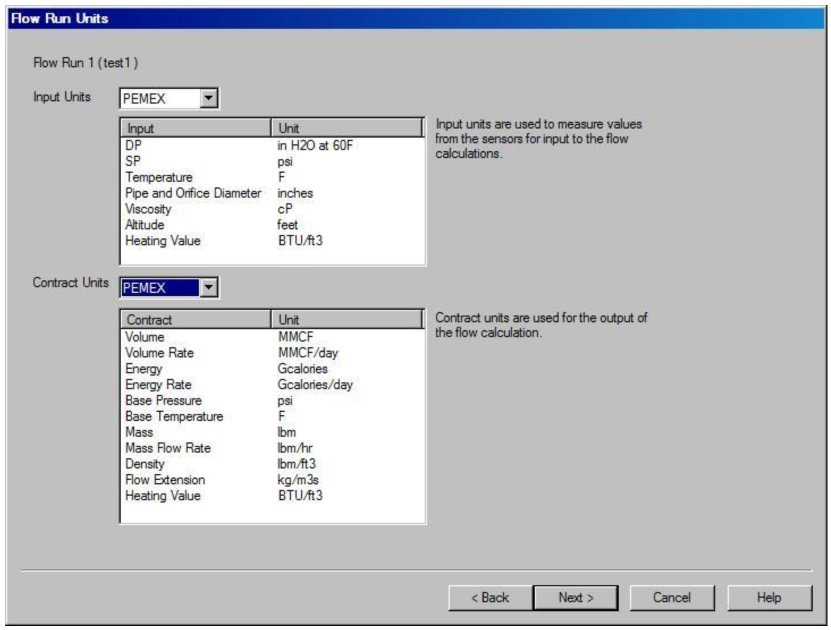
- **Forward by Value** selection indicates the flow direction is forward when the value from a differential pressure (DP) sensor is positive or the mass flow rate value from a Coriolis meter is positive.
- **Reverse by Value** selection indicates the flow direction is reverse when the value from a differential pressure (DP) sensor is negative or the mass flow rate value from a Coriolis meter is negative.
- **Forward by Status** selection indicates the flow direction is forward when the Flow Direction Register has a value of 0 (OFF).

- **Reverse by Status** selection indicates the flow direction is reverse when the Flow Direction Register has a value of 1 (ON).

Flow Direction Register specifies which register indicates the forward or reverse flow direction status. Any valid register for the flow computer controller can be used for this setting. The default register is 1. This edit control is disabled if **Flow Direction Control** selection is Value. This control is hidden in GOST mode flow computers.

Flow Run Units Dialog

This step selects the units that are used for input measurements and contracts.



Input Units selects the units of measurement of input values for the meter run. Inputs may be measured in different units than the calculated results. This allows you to use units that are convenient to you for measuring inputs. A dropdown box allows the selection of the following unit types. US2 is the default value.

- US1
- US2
- US3
- IP
- Metric1
- Metric2
- Metric3
- SI
- US4
- US5
- US6

- US7
- US8
- PEMEX

The reference list for the Input Units displays the parameters and units for these parameters:

- DP (Differential pressure)
- SP (Static pressure)
- Temperature
- Pipe and Orifice Diameter
- Viscosity
- Altitude
- Heating value

Contract Units selects the units of measurement of contract values. These units are used for the calculated results. A dropdown box allows the selection of the following unit types. The default value is US2.

- US1
- US2
- US3
- IP
- Metric1
- Metric2
- Metric3
- SI
- US4
- US5
- US6
- US7
- US8
- PEMEX

The reference list for the Contract Units displays the parameters and units for these parameters when used for the contract. The parameters displayed depend on the contract units selected. The parameters are:

- Volume
- Volume Rate
- Energy
- Energy Rate
- Base Pressure

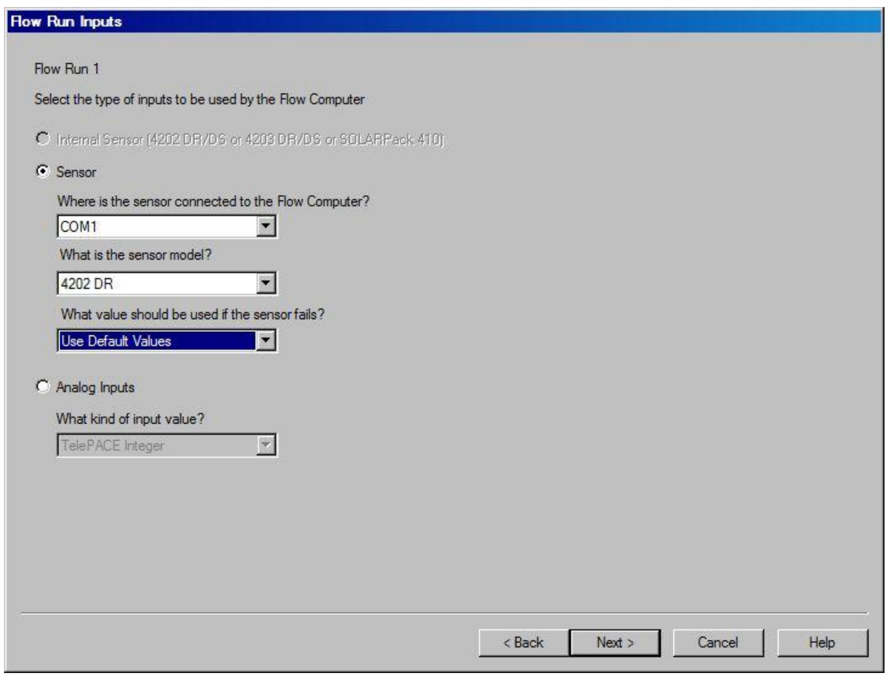
- Base Temperature
- Mass
- Mass Flow Rate
- Density
- Flow Extension
- Heating Value

Flow Run Inputs

This step lets you configure the flow run inputs. One of two configuration dialogs is presented based on the input type you configure.

- Sensor Inputs.
- Analog Inputs.

Sensor Inputs



- **Select Internal Sensor (4202 DR/DS or 4203DR/DS or SolarPack 410)** to use a SCADAPack internal transmitter as the input device. The transmitter is the input for pressure, differential pressure, and temperature. This is the only valid selection for run 1of a SCADAPack flow computer. Other options are disabled.
- Select **Sensor** to use a multivariable transmitter as the input device. The transmitter is the input for pressure, differential pressure, and temperature. This is the default selection, except for run 1 of a SCADAPack controller.
- The **Where is sensor connected to the Flow Computer** parameter enables the ability to select the serial or LAN port where the sensor is

connected to the flow computer. Selections vary according to the flow-computer type. The default value is com1. Valid selections can include:

- com1
- com2
- com3
- com4
- LAN

- The **What is the sensor model** parameter selects the multivariable transmitter (MVT) type. The selections available are:
  - 3095FB
  - 4101
  - 4102
  - 4202 DR
  - 4202 DS
  - 4203 DR
  - 4203 DS
- The **What value should be used if the sensor fails** parameter selects the specified value in this field as the live input value when communicating with a sensor. The dropdown list lets you select:
  - Use Last Known Good Value
  - Use Default Value

When you open a file using an older file format, Realflo sets the default value of the **Values on Sensor Fail** field to **Use Last Known Good.**

When the status to a sensor changes and you select the **Use Default Value** option, this is added to the Event Log.

- For flow computers 6.70 and later, when communication to a sensor fails and the configuration option "Use Last Known Good Value" is set to "Use Default Value," the flow computer needs to use the specified default value in the configuration in place of a live input value.
- When communication to a sensor is restored and the configuration option for the **Value on Sensor Fail** field is set to use the default value, the flow computer uses the input value from the sensor as the live input value.
- For flow computers prior to 6.70, the value on sensor fail is ``Use Last Known Good Value."

Analog Inputs

Select **Analog Inputs** to use analog inputs to measure pressure, differential pressure, and temperature.

Valid values are:

- Telepace Integer
- ISaGRAF Integer

- Float
- Raw Float

The default value is Telepace integer if Telepace firmware is running and ISaGRAF integer if ISaGRAF firmware is running.

For AGA-7 calculations, the value is fixed and set automatically. The value is Telepace Long if Telepace firmware is running and ISaGRAF integer if ISaGRAF firmware is running.

The next step is ***Differential Pressure Input Limits*** if AGA-3 or V-Cone is configured.

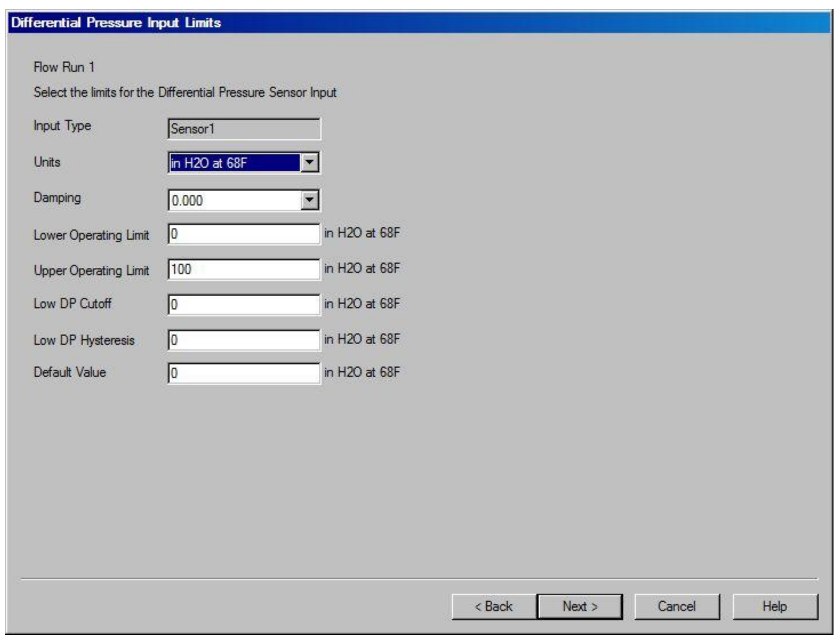
If AGA-7 is configured, the next step is ***Turbine Settings*****.**

Differential Pressure Input Limits

This step lets you configure the differential pressure input limits. One of two configuration dialogs is presented based on the input type you configure.

- Sensor Inputs
- Analog Inputs

Sensor Inputs



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

Units are the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display, the transmitter uses these units. Valid values depend on the MVT type:

- For SCADAPack transmtters, valid units are: inches H2O at 68°F, Pascal (Pa) and kiloPascal (kPa). The default is inches H2O at 68°F.
- For the 3095 MVT valid units are: inches H2O at 60°F, Pascal (Pa), kiloPascal (kPa) and inches H2O at 68°F. The default is inches H2O at 60°F.

Damping is the response time of the transmitter. It is used to smooth the process variable reading when there are rapid input variations.

- For SCADAPack transmitters the valid values are 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 seconds. The default value is 0 (damping off).
- For the 3095 MVT the valid values are 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824 and 27.648. The default is 0.864.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The default value is 0. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The default value is the upper range limit of the transmitter. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Low DP Cutoff is the differential pressure where flow accumulation will stop and needs to be less than the UOL. The default value is 0. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Low DP Hysteresis is the amount by which the differential pressure needs to rise above the Low DP Cutoff for flow accumulation to start. It may be a value using the DP units or may be a percentage of the operating span. The operating span is the difference between the Upper Operating Limit and the Lower Operating limit. Values depend on the transmitter. The flow accumulation level needs to be less than the Upper Operating Limit. The default value is 0.

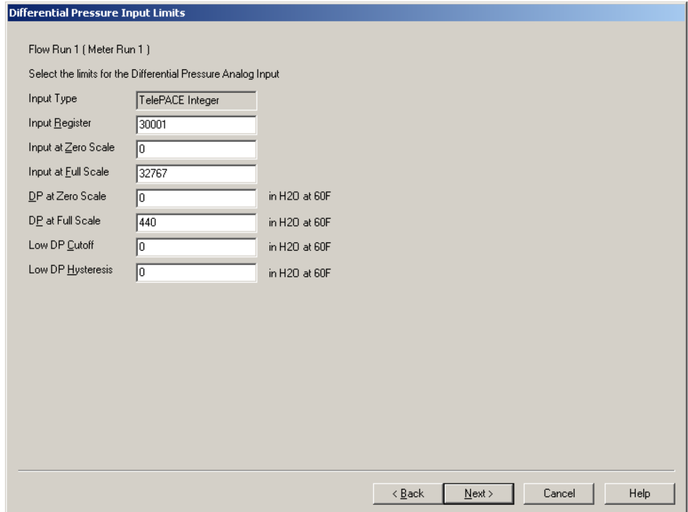
Default Value is enabled if you configured the field using the Flow Run Inputs dialog. Type the live input value to use when communicating with a sensor. The default value is 0.

If you configured sensor inputs, go to the

Static Pressure Options Dialog section.

Analog Inputs

The dialog below opens when analog inputs are selected.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The default value is 0. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The default value is 32767. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

DP at Zero Scale is the pressure that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The default value is 0.

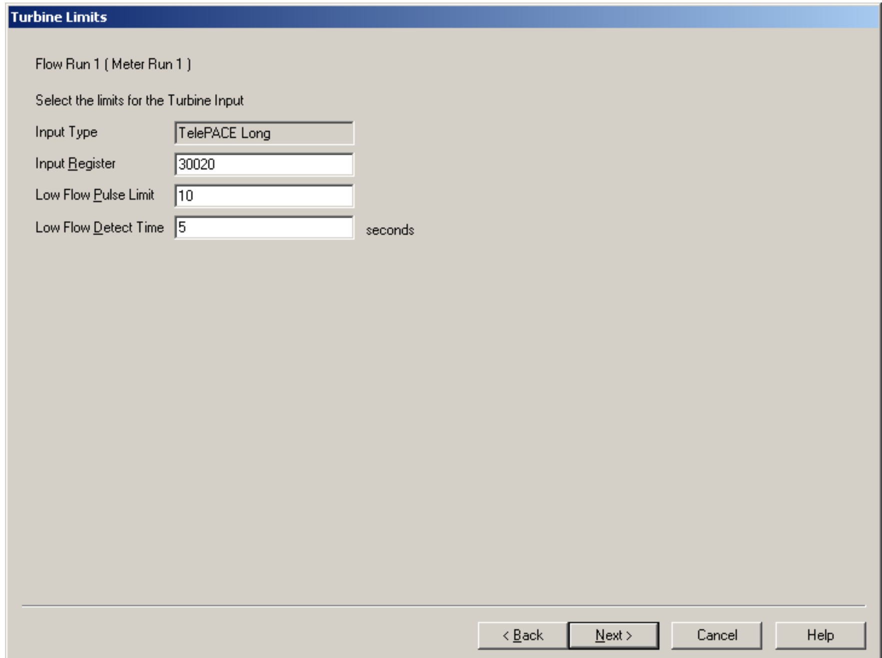
DP at Full Scale is the pressure that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The default value is 16.

Low DP Cutoff is the differential pressure where flow accumulation will stop and needs to be less than the UOL. The default value is 0. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Low DP Hysteresis is the amount by which the differential pressure needs to rise above the Low DP Cutoff for flow accumulation to start. It may be a value using the DP units or may be a percentage of the operating span. The operating span is the difference between the Upper Operating Limit and the Lower Operating limit. Values depend on the transmitter. The flow accumulation level needs to be less than the Upper Operating Limit. The default value is 0.

Turbine Settings

This step configures the turbine input for AGA-7 calculations.



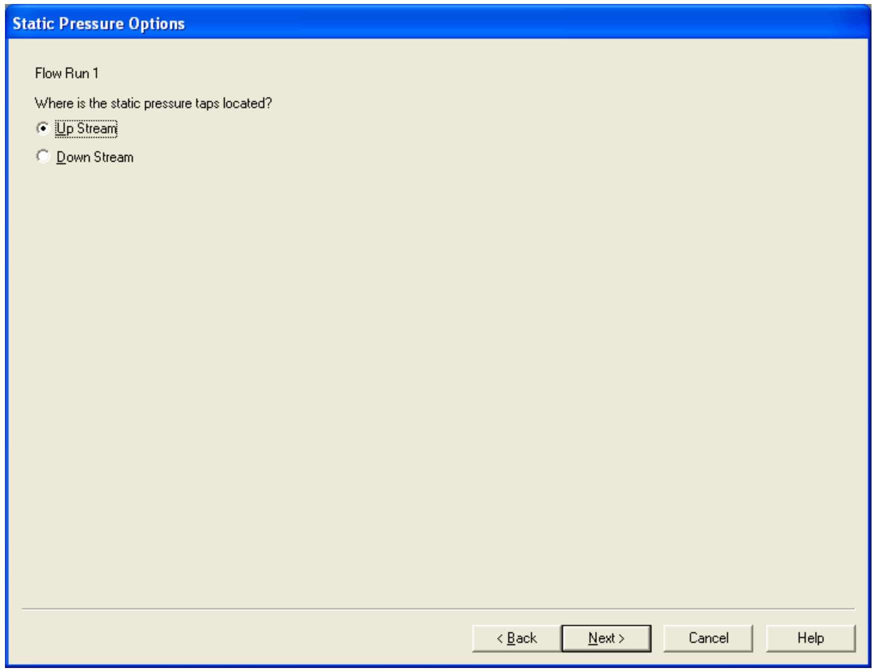
Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Low Flow Pulse Limit is the number of pulses below which a low flow alarm will occur. The default value is 10.

Low Flow Detect Time is the length of time the number of pulses needs to remain below the Low Flow Pulse Limit for a low flow alarm to occur. Valid values are 1 to 5 seconds. The default value is 5.

Static Pressure Options Dialog

This step lets you select how the static pressure is measured.



The pressure tap may be upstream or downstream of the orifice plate for AGA-3.

- Select **Up Stream** for an upstream static pressure tap. This is the default value. The control is disabled for AGA-7 and V-Cone calculations.
- Select **Down Stream** for a downstream static pressure tap. The control is disabled for AGA-7 and V-Cone calculations.

Static Pressure Input Limits

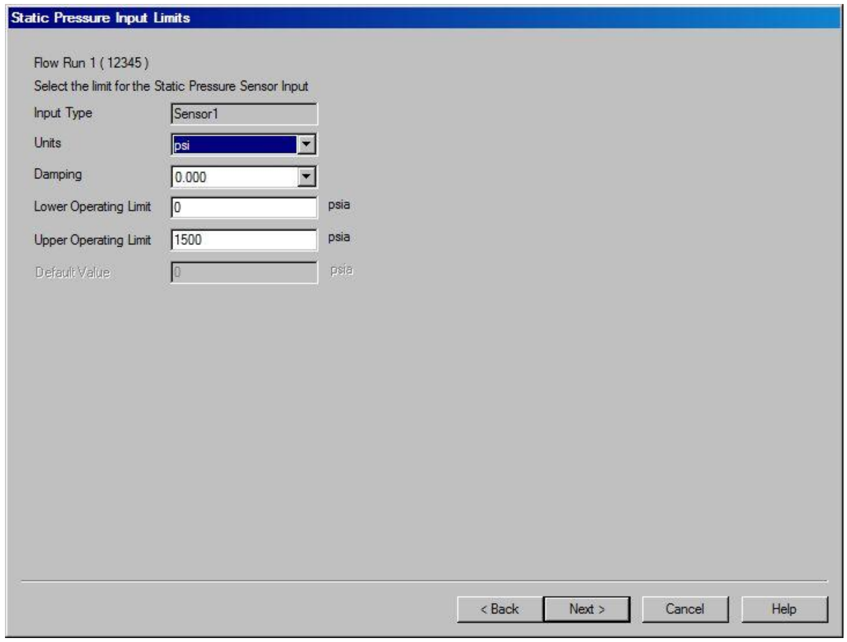
This step defines the limits for the temperature input. One of two configuration dialogs is presented based on the Input Type configured for static pressure limits:

-

- Sensor Inputs.
- Analog Inputs.

Sensor Inputs

The dialog below is presented when sensor inputs are used.



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

Units is the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display it uses these units. Valid values are kiloPascal, MegaPascal, and psi (pounds per square inch). The default is psi.

Damping is the response time of the transmitter. It is used to smooth the process variable reading when there are rapid input variations.

- For SCADAPack transmitters the valid values are 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 seconds. The default value is 0 (damping off).
- For the 3095 MVT the valid values are 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824 and 27.648. The default is 0.864.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The default value is 0. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The default value is the upper range limit of the transmitter. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Default Value is enabled if you gage pressure using the Static Pressure Options. Type the live input value to use when communicating with a sensor. The template selected determines the default value displayed.

The pressure sensor may measure absolute or gage pressure.

- Select **Absolute Pressure** to measure absolute static pressure. This is the default value unless the Compressibility Calculation type is set to NX-19. The Static Pressure is set to Gage and the Atmospheric pressure is 14.7psi when NX-19 is selected.
- Select **Gage Pressure** to measure gage static pressure.
- Type the **Atmospheric Pressure** measured at the site. This control is disabled and set to zero if absolute pressure is selected.

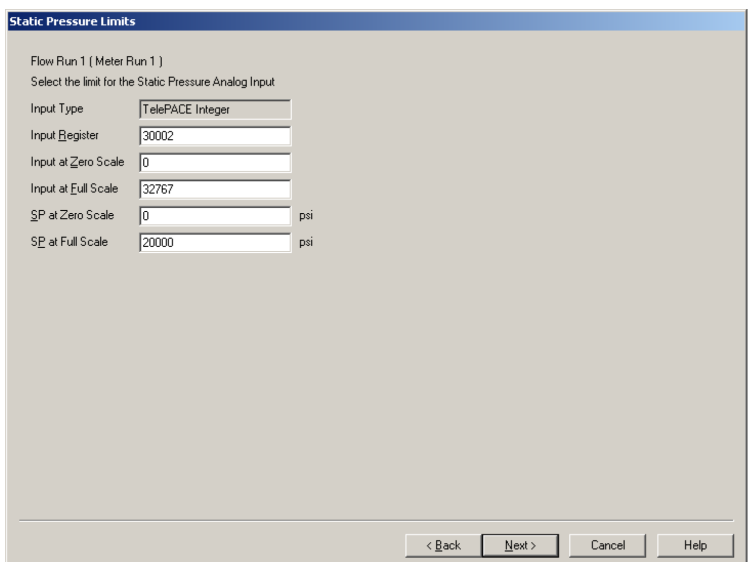
The atmospheric pressure entered needs to be greater than zero. The maximum upper limits for atmospheric pressure are:

30	psi	for US1, US2, US3, US4, US5, US6, US7, US8, and PEMEX units
4320	lbf/ft2	for IP units
207	kPa	for Metric1 units
2.07	bar	for Metric2 units
0.207	MPa	for Metric3 units
207000	Pa	for SI units

If you configured sensor inputs, see the ***Static Pressure Compensation*** section.

Analog Inputs

The dialog below is presented when analog inputs are used.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The default value is 0. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

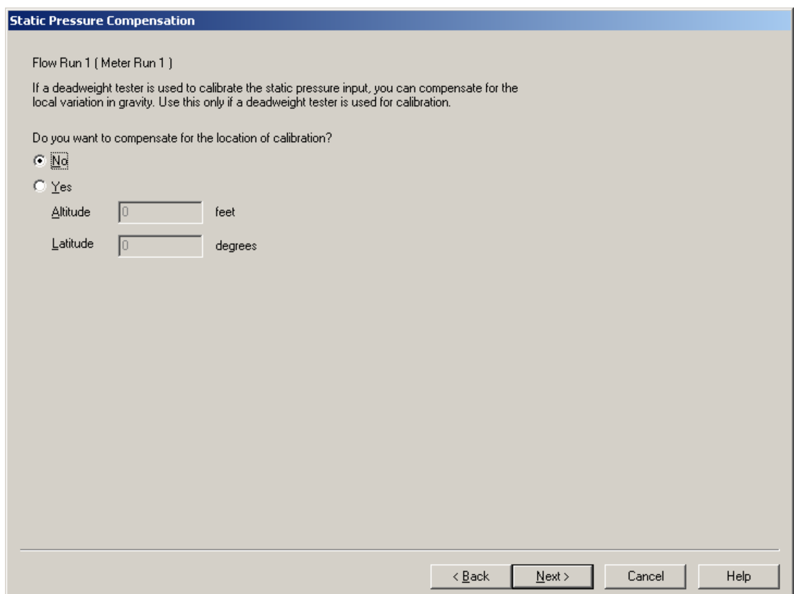
Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The default value is 32767. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

SP at Zero Scale is the pressure that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The default value is 0.

SP at Full Scale is the pressure that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The default value is 20000.

Static Pressure Compensation

This step selects if compensation is applied for the location where calibration was performed. If you configured sensors or analog inputs from the Static Pressure Limits dialog, this is the next step in the configuration sequence.



Select **No** if compensation is not required. This is the default value.

Select **Yes** to compensate for the altitude and latitude.

- Type the **Altitude** of the location. Valid values are -30000 to 30000. The default value is 0. This control is disabled if No is selected.
- Type the **Latitude** of the location. Valid values are -90 to 90. The default value is 0. This control is disabled if No is selected.

Temperature Limits

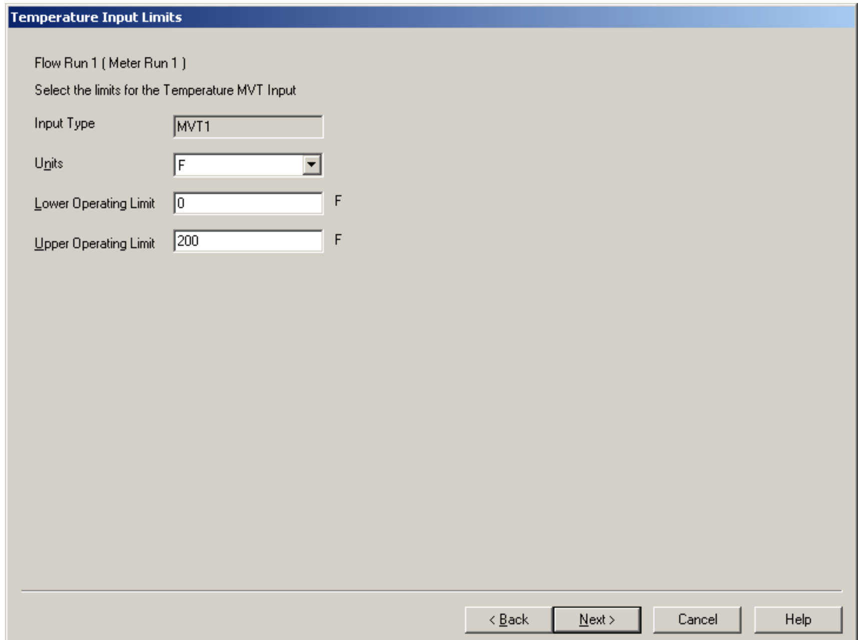
This step lets you define the limits for the temperature input. One of two configuration dialogs is presented based on the Input Type configured for static pressure limits:

- Sensor Inputs
-

- Analog Inputs

Sensor Inputs

The following dialog is presented when sensor (MVT) inputs are used.



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

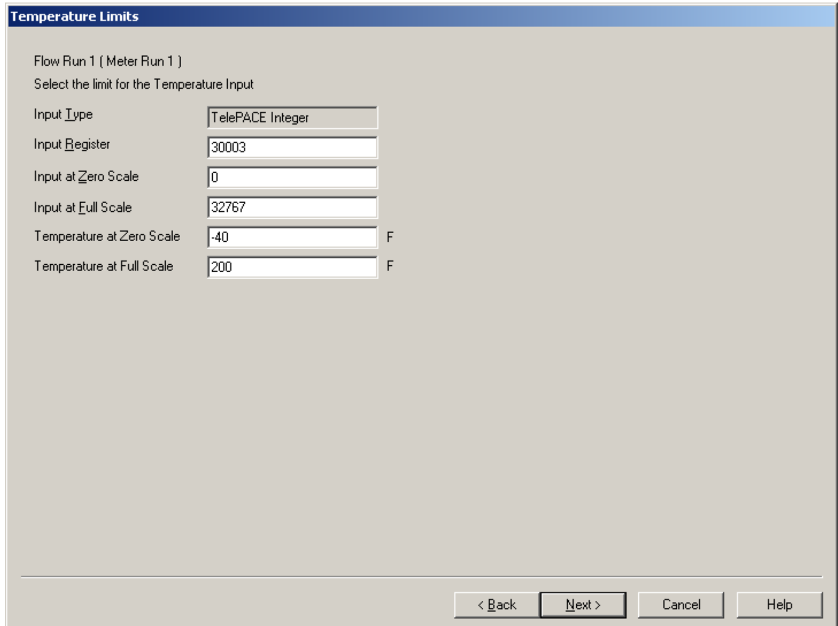
Units is the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display it uses these units. Valid values are kiloPascal, MegaPascal, and psi (pounds per square inch). The default is psi.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The default value is 0. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The default value is the upper range limit of the transmitter. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Analog Inputs

The following dialog is presented when analog inputs are used.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The default value is 0. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

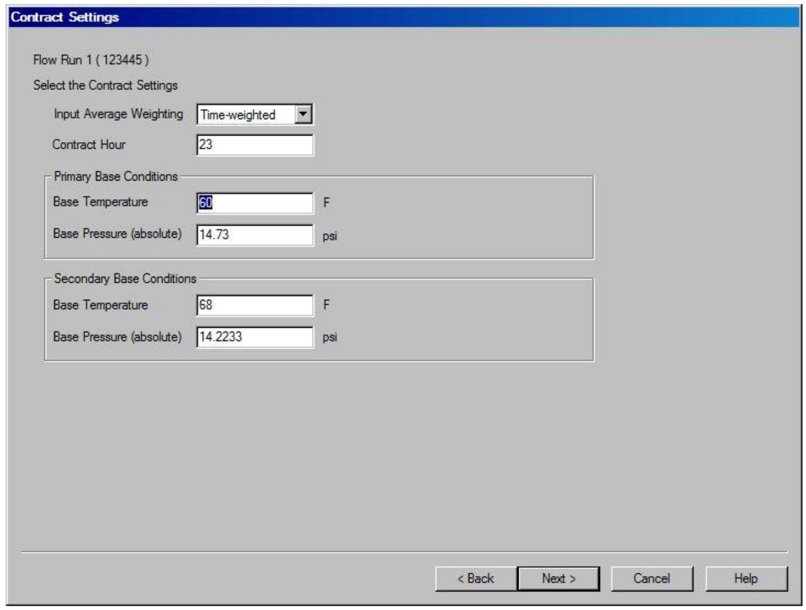
Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The default value is 32767. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

Temperature at Zero Scale is the temperature that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The default value is –40.

Temperature at Full Scale is the temperature that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The default value is 200.

Contract Settings

This step sets the contract settings for the run.



Input Average Weighting is the weighting method of the linear inputs. This applies to the differential pressure, static pressure, and temperature. Valid values are time-weighted or flow-weighted (see Input Averaging on page 948 for more information). The default is time-weighted.

Contract Hour is the hour of the day that starts a new contract day specified using a 24-hour clock. The contract day begins at 00 minutes and 00 seconds of the specified hour. Valid values are 0 to 23. The default value is 0 (midnight).

Standard Base Conditions are the default **Base Temperature** and **Base Pressure (absolute)** values.

- **Base Temperature** is the reference temperature to which contract flow values are corrected. Valid values are -40 to 200. The default value is given in the table below.
- **Base Pressure** is the reference pressure to which contract flow values are corrected. The base pressure is measured as absolute pressure (not a gauge pressure). Valid values are 0 to 32000. The default value is given in the table below.

Contract Units	Standard Base Temperature	Standard Base Pressure
US1	60 F	14.73 psi
US2	60 F	14.73 psi
US3	60 F	14.73 psi
IP	60 F	2116.2281 lbf/ft^2
Metric1	15 C	101.325 kPa
Metric2	15 C	1.01325 bar
Metric3	15 C	0.101325 MPa
SI	288.15 K	101325 Pa

Contract Units	Standard Base Temperature	Standard Base Pressure
US4	60 F	14.73 psi
US5	60 F	14.73 psi
US6	60 F	14.73 psi
US7	60 F	14.73 psi
US8	60 F	14.73 psi
PEMEX	60 F	14.73 psi

Realflo for PEMEX flow computers provide a second set of base conditions. **PEMEX Base Conditions** are the default **Base Temperature** and **Base Pressure (absolute)** values when Realflo is operating in PEMEX mode.

- **Base Temperature** is the reference temperature to which contract flow values are corrected. The default is listed in the table below for each type of contract unit.
- **Base Pressure** is the reference pressure to which contract flow values are corrected. The base pressure is measured as absolute pressure (not a gauge pressure). Valid values are 0 to 32000. The default values are listed in the table below for each contract unit.

Contract Units	Standard Base Temperature	Standard Base Pressure
US1	60 F	14.73 psi
US2	60 F	14.73 psi
US3	60 F	14.73 psi
IP	60 F	2116.2281 lbf/ft^2
Metric1	15 C	101.325 kPa
Metric2	15 C	1.01325 bar
Metric3	15 C	0.101325 MPa
SI	288.15 K	101325 Pa
US4	60 F	14.73 psi
US5	60 F	14.73 psi
US6	60 F	14.73 psi
US7	60 F	14.73 psi
US8	60 F	14.73 psi
PEMEX	68 F	14.73 psi

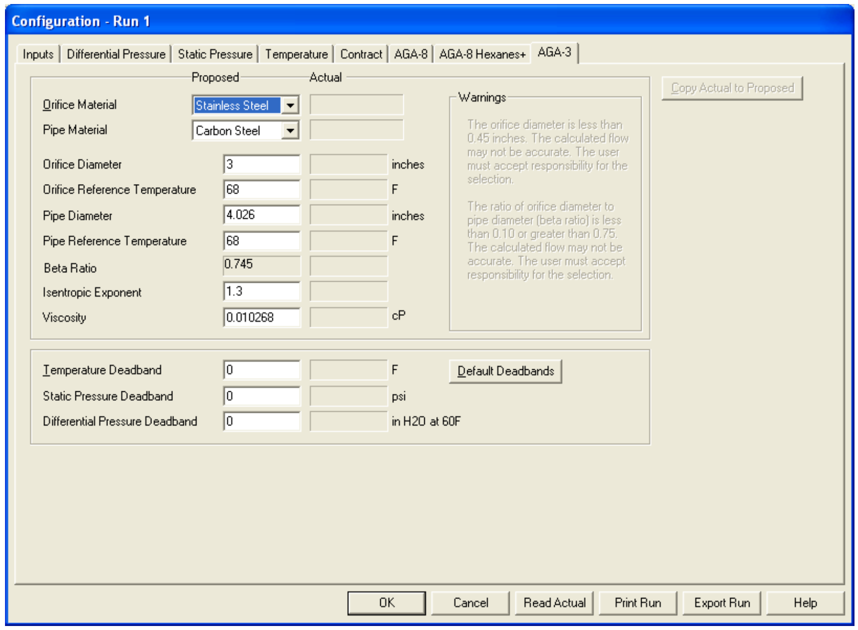
Flow Calculations

When configuring a flow computer, you can configure it to use the following calculations:

- AGA-Settings
- AGA-3 Deadband Settings
- AGA-7 Settings
- AGA-11 Settings

AGA-3 Settings

This step lets you set the AGA-3 calculation parameters.



Orifice Material is the material the orifice plate for the meter run is made of. Valid values are Stainless Steel, Monel, and Carbon Steel. The default value is Stainless Steel.

Pipe Material is the material the meter run pipe is made of. Valid values are Stainless Steel, Monel, and Carbon Steel. The default value is Carbon Steel.

Orifice Diameter is the diameter of the meter run orifice. The default value is 3 inches.

Orifice reference temperature is the temperature at which the diameter of the meter run orifice was measured. The default value is 68°F.

Pipe Diameter is the measurement of the meter run pipe inside diameter. The default value is 4.026 inches.

Pipe reference temperature is temperature at which the meter run pipe diameter was measured. The default value is 68°F.

Beta Ratio is the ratio of orifice diameter to pipe diameter. It is displayed for information purposes only and cannot be edited.

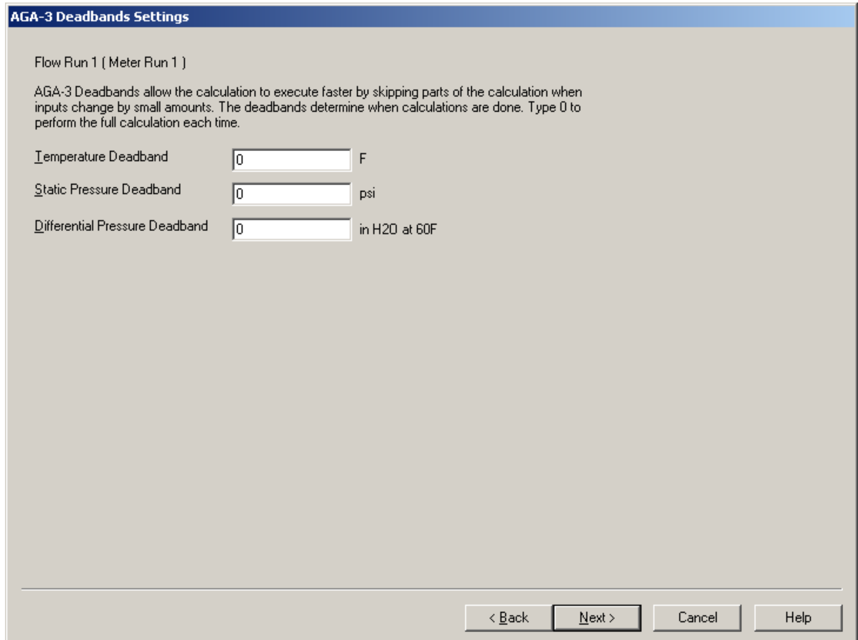
Realflo displays a message if the beta ratio is outside recommended limits.

Isentropic Exponent is a thermodynamic property of gas used to predict the relationships between pressure, temperature, volume and energy. If you are unsure of this value, a typical value of 1.3 is commonly used. The default value is 1.3.

Viscosity is a measure of the resistance of a measured gas to flow. Valid values are 0 to 1. The default value is 0.010268 centipoise.

AGA-3 Deadband Settings

This step lets you set AGA-3 calculation deadbands.



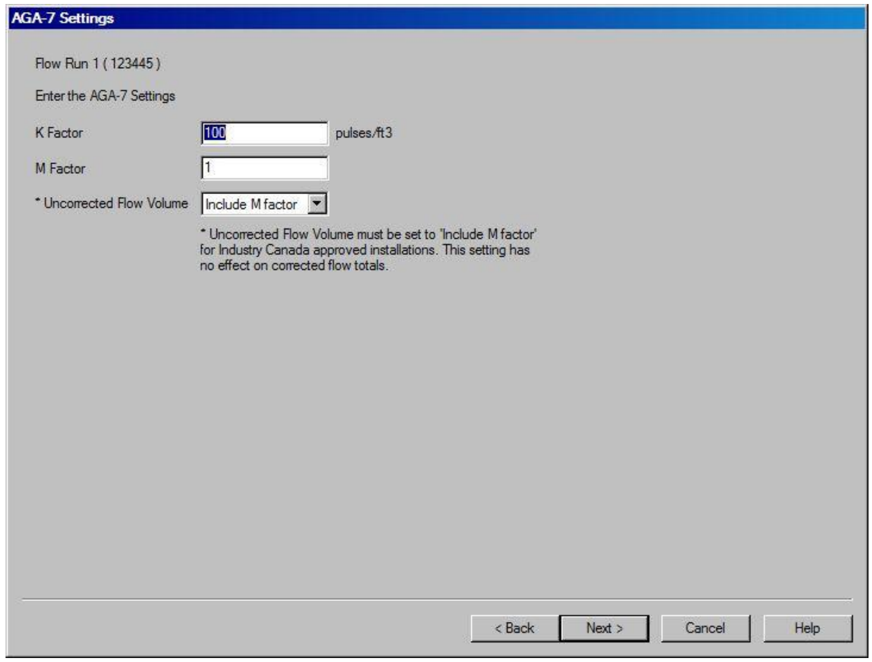
Temperature Deadband is the tolerated change in the flowing temperature before temperature dependent factors in the flow calculation are recalculated. Changes in the temperature smaller than the deadband will be ignored in determining the result. The default value is 0. The upper limit is 7°F or 4°C.

Static Pressure Deadband is the tolerated change in the static pressure before static pressure dependent factors in the flow calculation are recalculated. Changes in the static pressure smaller than the deadband will be ignored in determining the result. A static pressure deadband setting of up to four percent of the typical static pressure level should have a small effect on the accuracy of the AGA-3 calculation. The default value is 0. The upper limit is 800 psi or 5500 kPa or the equivalent in other units.

Differential Pressure Deadband is the tolerated change in the differential pressure before differential pressure dependent factors in the flow calculation are recalculated. Changes in the differential pressure smaller than the deadband will be ignored in determining the result. A change of N in the differential pressure input will cause a change of 0.5 N in the calculation volume at base conditions. It is recommended that the differential pressure deadband be set to zero. The default value is 0. The upper limit is 4.5 inWC or 1.1 kPa or the equivalent in other units.

AGA-7 Settings

This step lets you define AGA-7 settings.



K Factor is the number of pulses per unit volume of the turbine meter. Valid values are 0.001 to 1000000. The default value is 100.

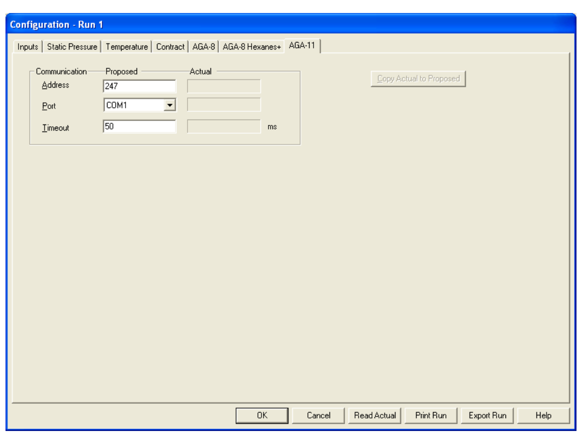
M Factor is the adjustment to the number of pulses per unit volume for the turbine meter compared to an ideal meter. Valid values are 0.001 to 1000. The default value is 1.

Uncorrected Flow Volume is the accumulated uncorrected flow volume at base conditions.

The Uncorrected Flow Volume control is available in Realflo versions 6.20 and higher.

AGA -11 Settings

AGA-11 configuration defines parameters unique to the AGA-11 calculation. The AGA-11 calculation communicates with a Coriolis meter for the calculation. The AGA-11 configuration sets the communication parameters for communication between the Coriolis meter and the flow computer.



Address

This is the Modbus address of the Coriolis Meter for serial communications. Multiple Coriolis meters using the same serial port on the flow computer need to each have a unique Modbus address. Valid Modbus addresses are between 1 and 247. The default address is 247.

Port

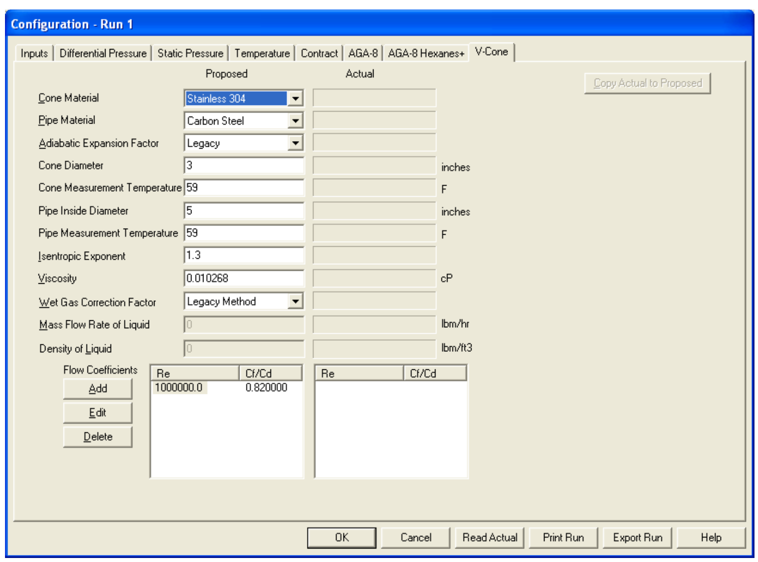
This is the communication port on the flow computer that will be used to communicate with the Coriolis meter. Valid port selections depend on the type of controller the flow computer running on. The default port is the first valid port available on the controller.

Timeout

This is the time the flow computer will wait for a response for Modbus read commands send to the Coriolis meter. When the timeout time is exceeded the command is unsuccessful and an alarm is added to the flow computer alarm list. Valid timeout values are from 0 to 1000 ms. The default value is 50 ms.

V-Cone Settings

V-Cone Configuration defines parameters unique to the V-Cone calculation.



Cone Material

This is the material of the V-cone. Valid values are Carbon Steel, Stainless 304, and Stainless 316. The default value is determined by the template selected.

Pipe Material

This is the material from which the meter run pipe is made. Valid values are Carbon Steel, Stainless 304, and Stainless 316. The default value is determined by the template selected.

Adiabatic Expansion Factor

The **Adiabatic Expansion Factor** drop down list selects which calculation is used for the adiabatic expansion factor of the calculation.

- Select **Legacy Calculation** to use the older calculation method. This is the default selection. Flow computers prior to version 6.71 support only this selection.
- Select **V-Cone** to use the V-Cone specific calculation. This selection should be used with V-Cone devices.
- Select **Wafer-Cone** to use the Wafer-Cone specific calculation. This selection should be used with Wafer-Cone devices.

This control is disabled and forced to **Legacy Calculation** if the controller type is not one of SCADAPack 32, SCADAPack 32P, SCADAPack 314/330/334, SCADAPack 350 SCADAPack 4203 or SolarPack 410.

When **reading** from a flow computer that does not support the adiabatic expansion factor configuration, the method will be set to Legacy Calculation.

When **writing** to a flow computer that does not support the adiabatic expansion factor method, the configuration registers will be ignored and the expansion factor will not be written.

Cone Diameter

The diameter of the meter run cone used for the flow calculation. The measurement units are displayed depending on the input units selected. The default value is 3 inches.

Cone Measurement Temperature

This is the reference temperature at which the cone diameter for the meter run was measured. The measurement units are displayed depending on the input units selected. The default value is 59 degrees F.

Pipe Inside Diameter

This is the measurement of the meter run pipe inside diameter. The measurement units are displayed depending on the input units selected. The default value is 5 inches.

Pipe reference temperature

The temperature at which the meter run pipe diameter was measured. The measurement units are displayed depending on the input units selected. The default value is 59 degrees.

Isentropic Exponent

In general, this is a thermodynamic property of gas used to predict the relationships between pressure, temperature, volume and energy. If you are unsure of this value a typical value of 1.3 is commonly used. The default value is 1.3.

Viscosity

This is the viscosity of the measured gas. In general, this is the resistance of a gas or semi-fluid resistance to flow. The measurement units are displayed depending on the input units selected. Valid values are 0 to 1. The default value is 0.010268 centiPoise.

Wet Gas Correction Factor

The Wet Gas Correction Factor Method drop down list selects which calculation is used for the wet gas correction factor of the calculation.

- Select **Legacy Method** to use the older correction method. This is the default selection. Flow computers prior to version 6.73 support only this selection.
- Select **V-Cone or Wafer Cone** to use the V-Cone and Wafer Cone specific calculation. This selection should be used with V-Cone or Wafer Cone devices.

This control is disabled and forced to **Legacy Calculation** if the controller type is not one of SCADAPack 32, SCADAPack 32P, SCADAPack 314/330/334, SCADAPack 350 SCADAPack 4203 or SolarPack 410.

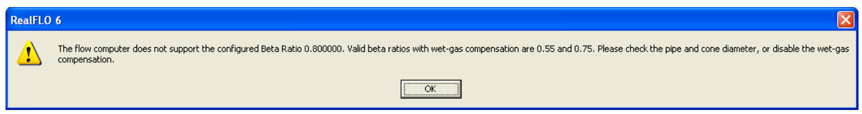
The V-Cone or Wafer Cone supported **Beta Ratios** are:

For Fr (Froude Number) < 5 supported Beta Ratio is 0.55.

For Fr (Froude Number) < 5 supported Beta Ratio is 0.75.

For Fr (Froude Number) > 5 supported Beta Ratio is 0.75.

When **V-Cone or Wafer Cone** is selected and if the current Beta ratio is not supported when executing verification, a message is displayed.



When **V-Cone or Wafer Cone** is selected, configuration of the fixed wet gas factor parameter, as set in the Contract tab, is disabled.

When **Legacy Method** is selected, configuration of the parameters used by the V-Cone or Wafer Cone method is disabled.

Mass Flow Rate of Liquid

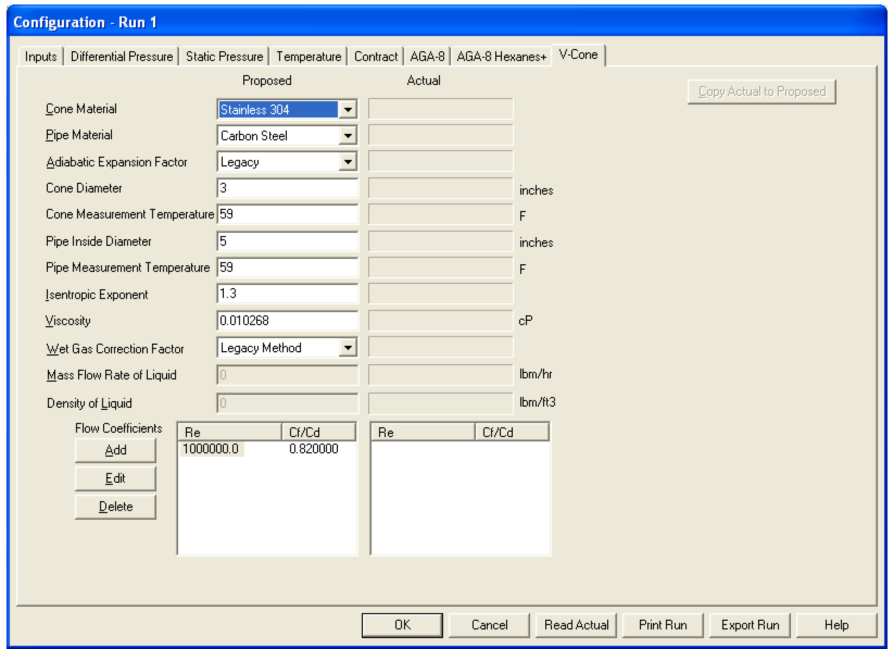
The Mass flow rate of liquid at flow conditions parameter is used by the V-Cone or Wafer Cone method and can be configured when **V-Cone or Wafer Cone** is selected. This information needs to be gathered using a sampling method or a tracer method. The default is 0.

Density of Liquid

The Density of liquid at flow conditions parameter is used by the V-Cone or Wafer Cone method and can be configured when **V-Cone or Wafer Cone** is selected. The default is 0.

V-Cone Coefficients

This step lets you define the V-Cone coefficients.

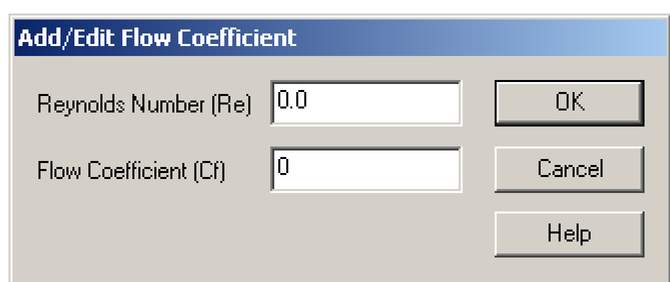


Enter the V-Cone coefficient pairs from the meter sizing report. The default list contains one pair: Re = 1000000; Cf = 0.82.

Click **Add** to add a coefficient pair.

In the original McCrometer V-Cone Application Sizing sheet that is included with V-Cone meters uses the terminology Cd (discharge coefficient) rather than Cf (flow coefficient). You will need to use the Re and Cd values from the V-Cone Application Sizing sheet for the Re and Cf entries. If the Re value is the same for every entry in the table only the first pair is used.

McCrometer now supplies one value of Cd in the sizing document. You need to enter one Re/Cd pair only. See the McCrometer Application Sizing sheet for the Re/Cd pair for your meter.



To edit a coefficient pair in the table:

- Select a row in the list.
- Click **Edit** to open the Add/Edit Flow Coefficient dialog.

To delete a coefficient pair in the table:

- Select a row in the list.
- Click **Delete** to delete the pair form the list.

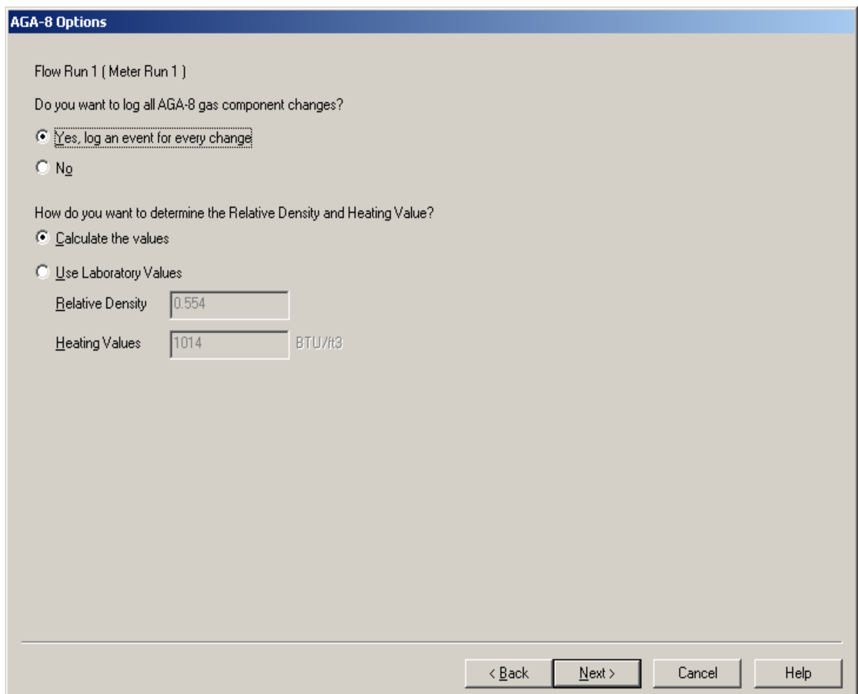
Compressibility Calculations

When configuring a flow computer, you can configure it to use the following compressibility calculations:

- *AGA-8 Settings*
- *AGA-8 Hexanes+ Settings*
- *AGA-8 Gas Composition*
- *NX-19 Settings*

AGA-8 Settings

This step sets AGA-8 calculation options.



Events can be logged each time an AGA-8 gas component changes.

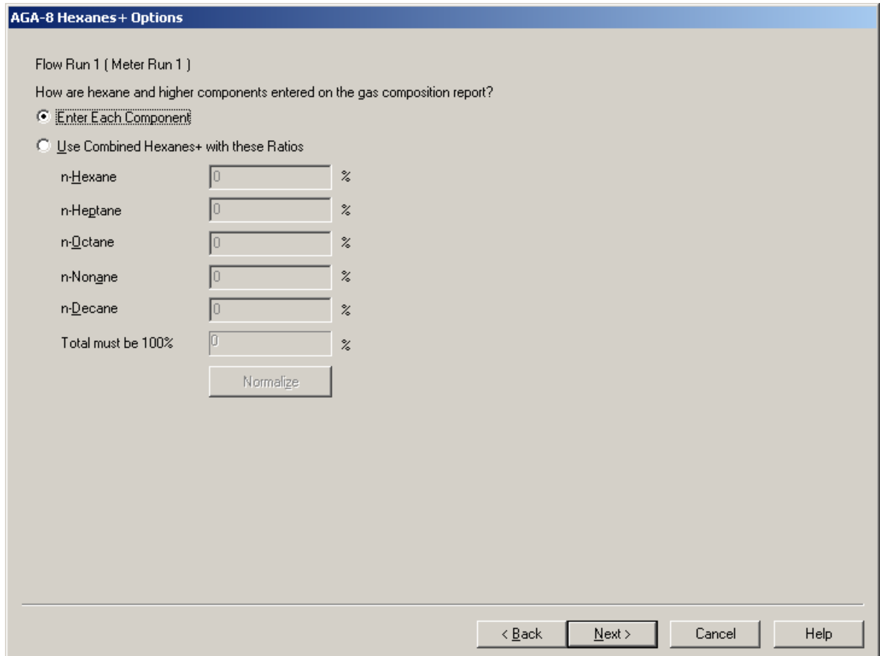
- Select **Yes** to log each change to the gas composition. Use this option if the gas composition changes infrequently. This is the default selection.
- Select **No** to skip logging changes. Use this option if you are making frequent changes to the gas composition.

The Relative Density and Heating values can be calculated from the AGA-8 calculation or determined in a laboratory.

- Select **Calculate the Values** to have AGA-8 calculate the values.
- Select **Use Laboratory Values** to used fixed values.
- **Relative Density** sets the real relative density of the gas. Valid values are 0.07 to 1.52. The default value is 0.554. This control is disabled if **Calculate the Values** is selected.
- **Heating Value** sets the heating value of the gas. Valid values are 0 to 1800 BTU(60)/ ft^3 or the equivalent in the selected units. The default value is 1014 BTU(60)/ft^3 or the equivalent in the selected units. This control is disabled if **Calculate the Values** is selected.

AGA-8 Hexanes+ Settings

This step chooses if Hexane and higher components are entered individually or as a single combined value.



Gas composition can be measured with individual values for hexane and higher components or use a combined value.

Select **Enter Each Component** to use individual values for the higher components. This is the default selection.

Select **Use Combined Hexanes+ with these Ratios** to use a combined value. Type the ratios of the higher components.

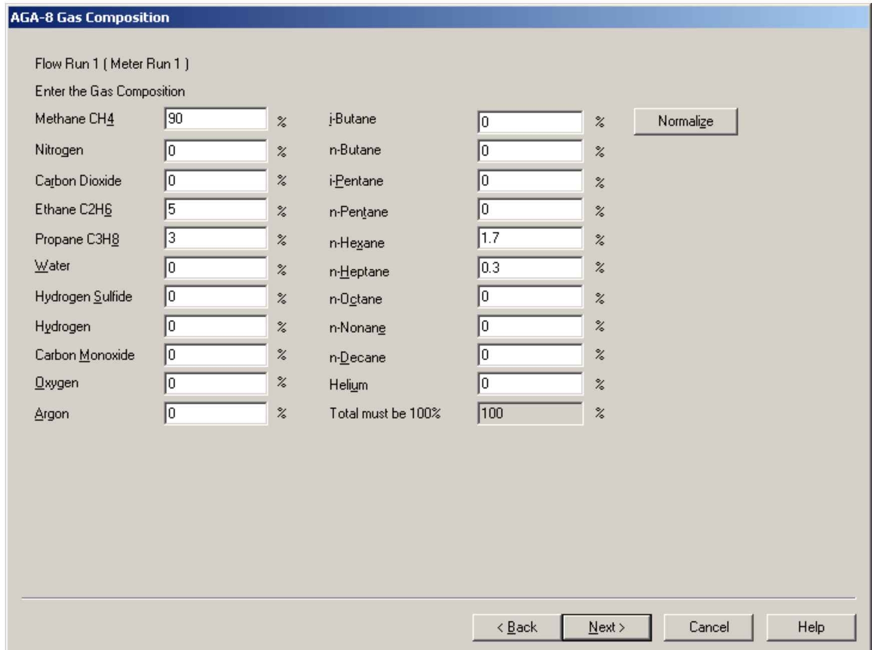
- **n-Hexane** defines the percentage of the Hexanes+ contributed by n-Hexane.
- **n-Heptane** defines the percentage of the Hexanes+ contributed by n-Heptane.
- **n-Octane** defines the percentage of the Hexanes+ contributed by n-Octane.
- **n-Nonane** defines the percentage of the Hexanes+ contributed by n-Nonane.
- **n-Decane** defines the percentage of the Hexanes+ contributed by n-Decane.
- The **Total** field displays the sum of each portion. This value cannot be edited. The total of portions needs to be 100 percent.

AGA-8 Gas Composition

This step defines the AGA-8 gas composition. One of two configuration dialogs opens based on whether Hexane and higher components are entered individually or as a single combined value.

Individual Components

The dialog below lets you enter combined Hexanes+ composition.

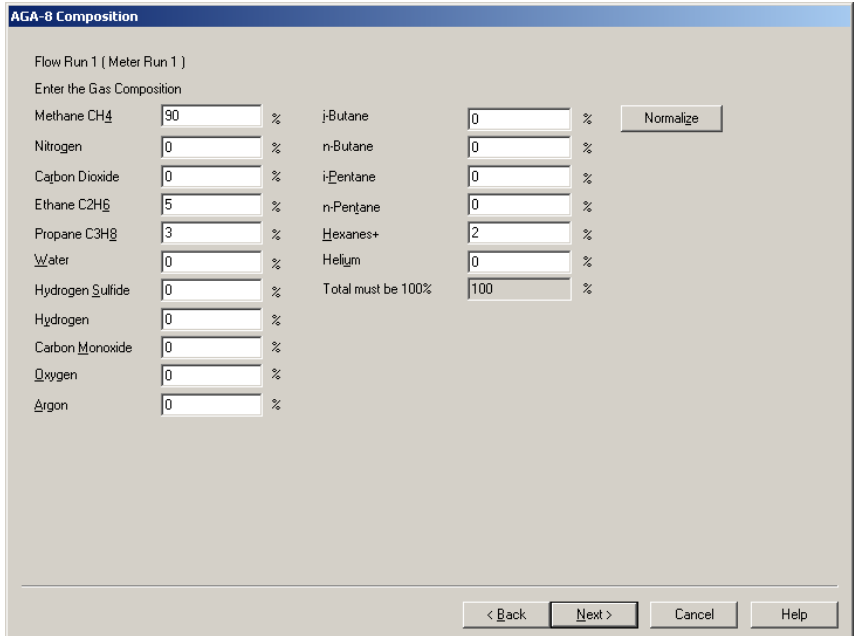


Type the gas composition according to the laboratory analysis. The total of components needs to be 100 percent.

Normalize adjusts non-zero components so that the total of components is 1.0000 (or 100.00 percent). The ratio to each other for the components remains the same.

Combined Hexanes+

The dialog below lets you enter combined Hexanes+ composition.

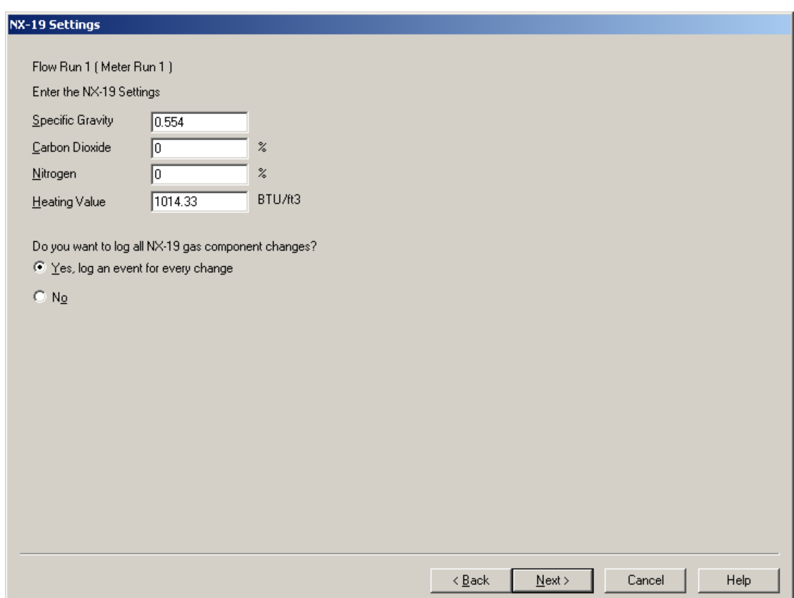


Type the gas composition according to the laboratory analysis. The total of components needs to be 100 percent.

Normalize adjusts non-zero components so that the total of components is 1.0000 (or 100.00 percent). The components remain in their current ratio to each other.

NX-19 Settings

This step lets you define the NX-19 calculation. NX-19 is not supported for PEMEX flow computers.



Specific Gravity is the specific gravity of the gas being measured. Valid values are 0.554 to 1.000. The default value is 0.554.

Carbon Dioxide is the percent of carbon dioxide in the gas being measured. This value needs to be in the range 0 to 15. The default value is 0.

Nitrogen is the percent of nitrogen in the gas being measured. This value needs to be in the range 0 to 15.

Heating Value is the heating value of the gas being measured. Valid values are 0 to 1800 BTU(60)/ft^3 or the equivalent in the selected units. The default value is 1014.33 BTU(60)/ft3.

Events can be logged each time the NX-19 configuration changes.

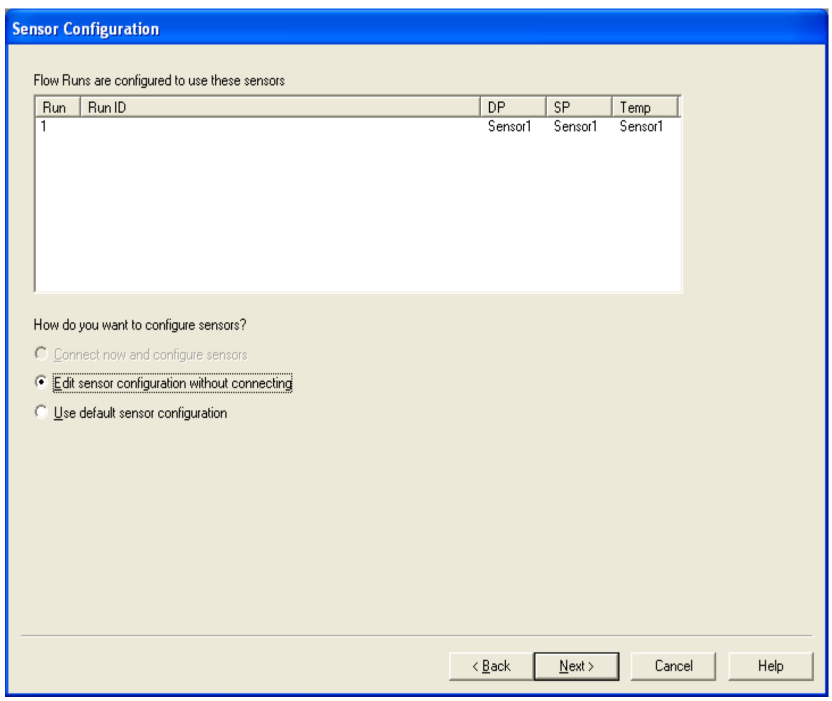
- Select **Yes** to log each change to the configuration. Use this option if the configuration changes infrequently. This is the default selection.
- Select **No** to skip logging changes. Use this option if you are making frequent changes to the configuration.

Sensor Configuration Parameters

The next step is MVT Configuration if any transmitters were used in the input configuration. Otherwise the next step is ***Flow Computer Configuration Summary***.

Sensor Configuration

This step selects how the transmitters are to be configured.



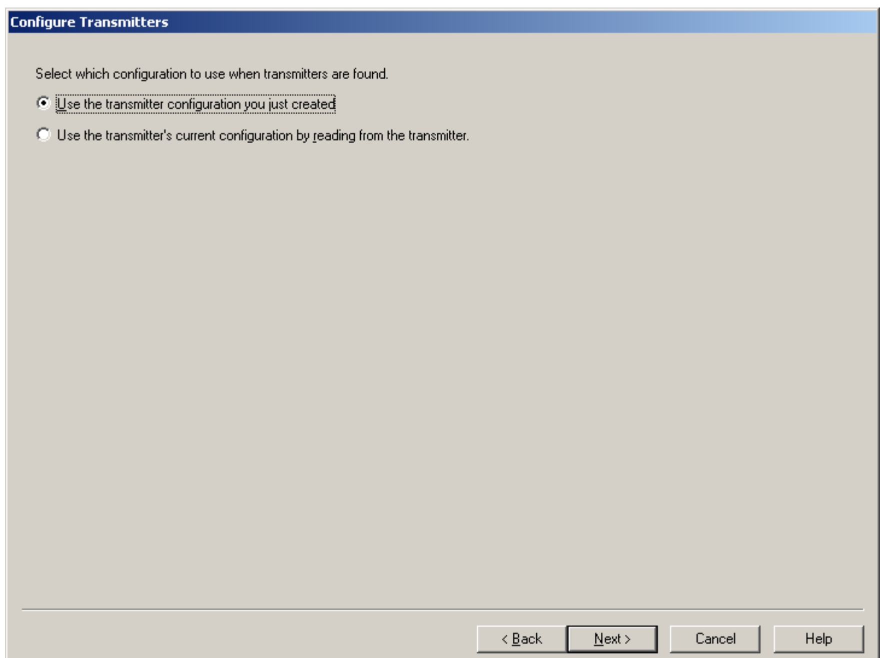
The **Flow Runs are configured to use these transmitters** window is a table that shows each of the configured flow run numbers, its Flow Run ID and the transmitter that it uses for the differential pressure (DP), static pressure (SP) and temperature sensors. If an analog input is used for the flow run AIN will be displayed in the coresponding DP, SP, or Temp column.

The **How do you want to configure sensors?** option lets you select how to continue configuring the sensors. The three options are:

- **Connect now and configure transmitters** to connect to the flow computer and configure the attached transmitters. This selection is disabled if the flow computer configuration was selected to be completed offline in the Flow Computer Status step. If you choose this option, go to the ***Configure Connected Transmitters*** section to continue.
- **Edit sensor configuration without connecting** to proceed directly to the editing pages, without connecting to the flow computer. If you choose this option, go to the ***Review Sensors Dialog*** section to continue.
- **Use default sensor configuration** to complete the configuration without changing the sensor configuration. Sensor configuration will be set to default values. If you choose this option, the next step is ***Finish***.

Configure Connected Transmitters

This step lets you select to either use the Realflo configuration data or the configuration from a pre-configured transmitter.

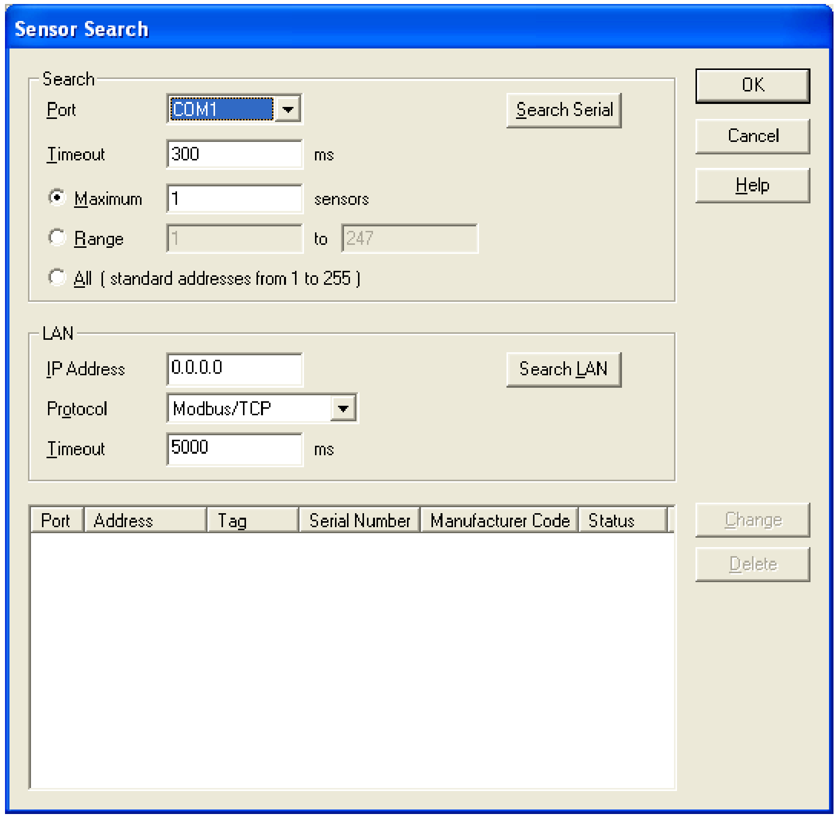


Select **Use the configuration from Realflo** to use the configuration data from the Realflo file. This is the default setting.

Select **Read the configuration from the transmitter** to read configuration from a pre-configured transmitter.

Sensor Search

This step searches for sensors connected to the flow computer serial ports or LAN port.



Search Serial Option

Select **Search Serial** to search for transmitters connected to a serial port of the flow computer.

The **Port** parameter selects the flow computer serial port where the sensor is attached. Valid values are com1, com2, com3, and com4. The default value is com2 for a SCADAPack controller and com1 for other controllers.

The **Timeout** parameter specifies the length of time the flow computer will wait for a response from a sensor. Valid values are 100 ms to 10000 ms. The default is 300 ms.

Select **Maximum** to search for a number of MVT transmitters. The search operation will stop after finding the specified number of transmitters. The valid value is from 1 to 255. The default is 1.

Select **Range** to search the addresses in a specified range. The range to search for is typed in the edit boxes to the right of the radio button. The value in *To* edit control needs to be equal or great than the value in the first edit control. The maximum search range that can be typed is for 255 transmitters. The default range is 1 to 247.

- Range Search supports addresses 1 to 255 in standard Modbus mode, and 1 to 65534 in extended address mode. The address mode of the flow computer serial port needs to be set to extended to search for transmitters with extended addresses.

Select **All** to search the addresses of transmitters connected with the serial port selected in *Port*. Up to 255 addresses are searched.

Click **Next** to start the search for sensors or 4000 transmitters. A search process dialog is displayed so that the search operation can be cancelled at any time.

Search LAN Option

Select **Search LAN** to search for transmitters connected to a LAN port of the flow computer.

The **IP Address** parameter specifies the IP address of a 4000 transmitter. Valid entries are IP addresses in the format nnn.nnn.nnn.nnn where nnn are values between 0 and 255.

The **Protocol** parameter selects the type of IP protocol that will be used to query the transmitter. Valid IP protocol selections are Modbus/TCP and Modbus RTU in UDP.

The IP port (for example port 502) for the selected protocol needs to be the same in the flow computer and the 4000 transmitter.

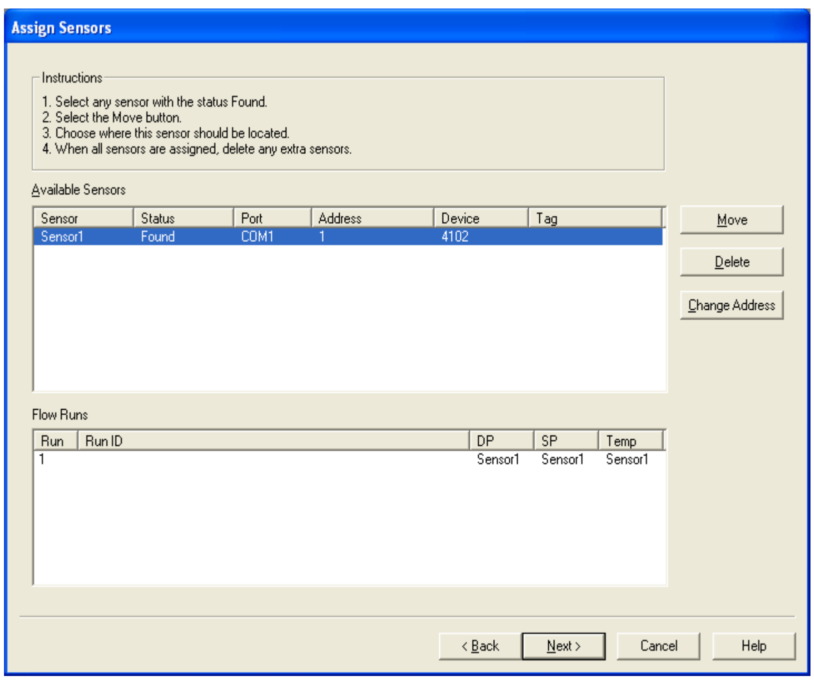
The **Timeout** parameter specifies the length of time the flow computer will wait for a response from a 4000 transmitter. Valid values are 100 to 10000 milliseconds. The default is 5000 ms.

Click **Next** to start the search for MVT transmitters or 4000 transmitters. A search process dialog is displayed so that the search operation can be cancelled at any time.

If no transmitters were found, a message is displayed and the search step is displayed again.

Assign Sensors

This step lets you assign found transmitters to flow runs.



The **Available Sensors** pane shows the transmitters that have been configured and the transmitters that were found by the search. There may be more transmitters in the list than there are runs.

The **Sensor** column indicates the transmitter slots that have been configured. Transmitters that were found but not assigned are listed as *Not assigned*.

The **Status** column indicates if configuration data for the transmitter exists.

- ***Found*** indicates a transmitter has been configured and the search found one with the same port, address and device type.
- ***Missing*** indicates a transmitter has been configured but the search did not find one with the same port, address, and device type.

The **Port** column displays the serial or LAN port the flow computer is using to communicate with the transmitter.

The **Address** column displays the Modbus station address or IP address of the transmitter.

The **Tag** column displays the Tag Name assigned to the transmitter. You can leave this column blank if a Tag Name has not been assigned to the transmitter.

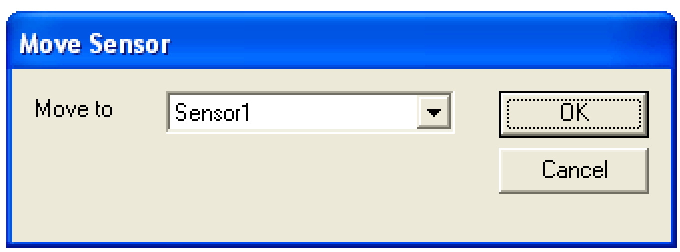
The **Device** type column displays the transmitter type. Valid values are 3095FB, 4101, 4102, 4202 DR, 4202 DS, 4203 DR, or 4203 DS.

The **Flow Runs** window shows which MVTs are assigned to the runs.

To Change the order of the sensors:

- Select a sensor in Available Sensors window.
- Click Move.

The Move Sensor dialog opens:



- In the Move Sensor dialog, use **Move To** selection to select the new location
- Click **OK**.

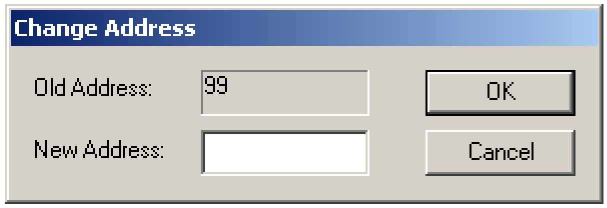
To delete a sensor:

- Select a transmitter in **Available Sensors.**
- Click **Delete**.

To change the address of a Sensor:

- Select a transmitter in Available Sensors.
- Click Change Address.

The Change Address dialog opens:



- Enter a new address for the transmitter in the **New Address:** edit box.
- Click **OK**.

Click **Next** when the transmitters have been moved to the correct location.

- Next is disabled if there are *Not Assigned* transmitters still in the list.

The next step is ***Search for More Transmitters Dialog***.

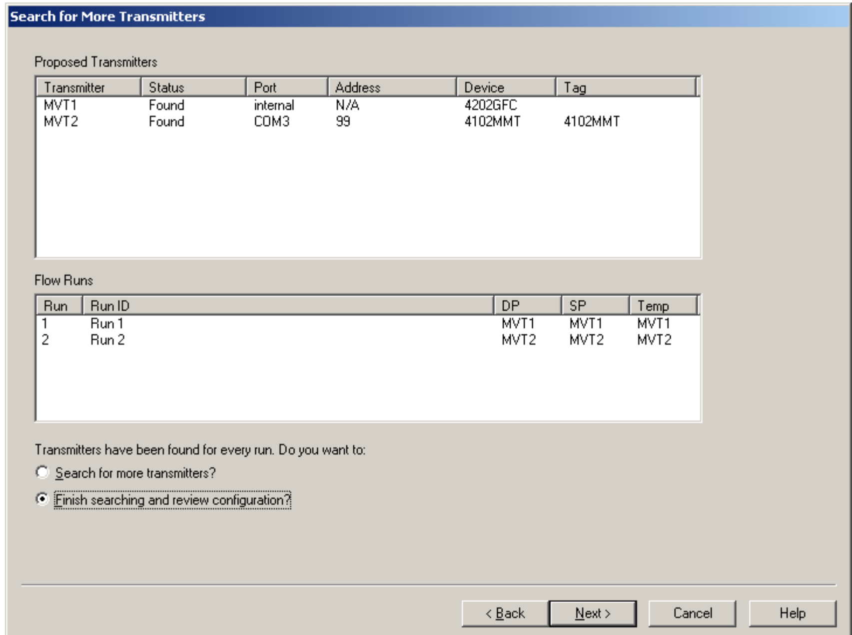
Notes

The following actions may occur when moving a sensor.

- Moving one sensor to another results in the both swapping positions.
- When Use the configuration from Realflo is selected, assigning a Not assigned transmitter to a Sensor with status Missing and device type matching result in the sensor adopting the transmitter's port and address and retaining the rest of the sensor configuration. The sensor, being assigned, will disappear from the list.
- When Read the configuration from the transmitter is selected, assigning a Not assigned transmitter to a sensor with status Missing and device type matching results in the sensor adopting the transmitter's configuration. The transmitter, being assigned, will disappear from the list.
- Assigning a Not assigned transmitter to a sensor with status Missing and device type not matching will result in the sensor adopting the transmitter's configuration. The transmitter, being assigned, will disappear from the list.
- Other assignments are not permitted.

Search for More Transmitters Dialog

This step displays the current sensor assignments and asks if more searches are needed.



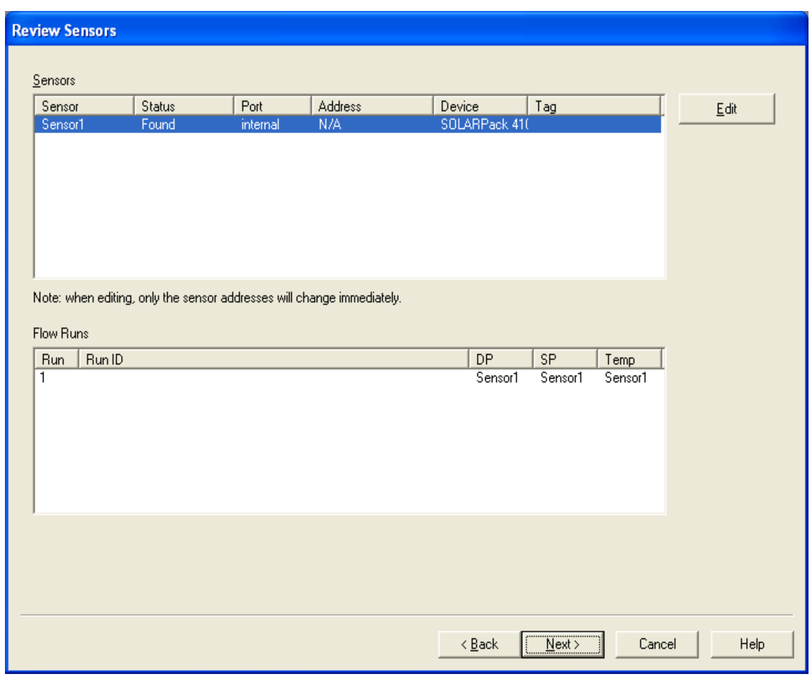
Proposed Sensors shows the transmitters that have been configured and the transmitters that were found by the search.

Flow Runs shows which sensors are assigned to which runs.

- Select Search for more transmitters to search again.
- Select Finish searching and review configuration to use the current settings. This is the default radio button.

Review Sensors Dialog

This step displays the transmitter assignments and allows you to edit the transmitter configuration.



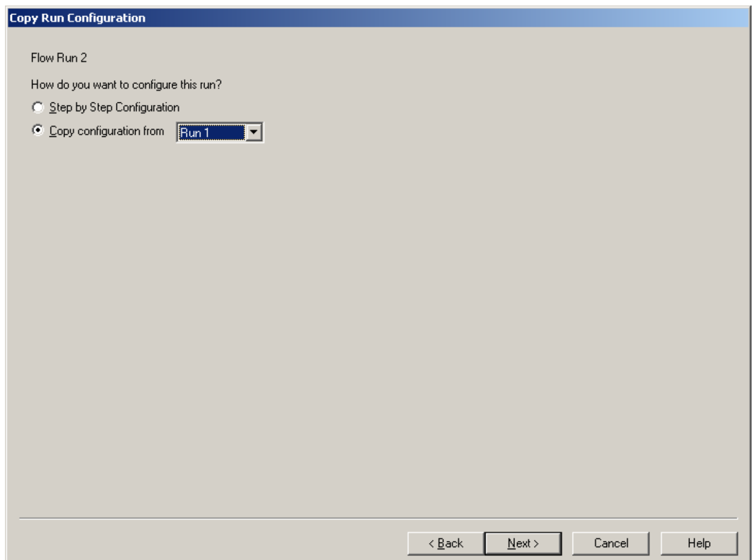
The **Sensors** pane shows the transmitters that have been configured.

The **Flow Runs** pane shows which sensors are assigned to the runs.

Click **Edit** to review and modify the settings for each transmitter. Edit opens the **Add/Edit Sensor Settings** dialog. Changes to a transmitter address will be written to the transmitter without affecting current flow computer configuration.

Copy Run Configuration Dialog

The Copy Run step is displayed only if you selected more than one run is selected in the Number of Flow Runs step and you have configured the first run.

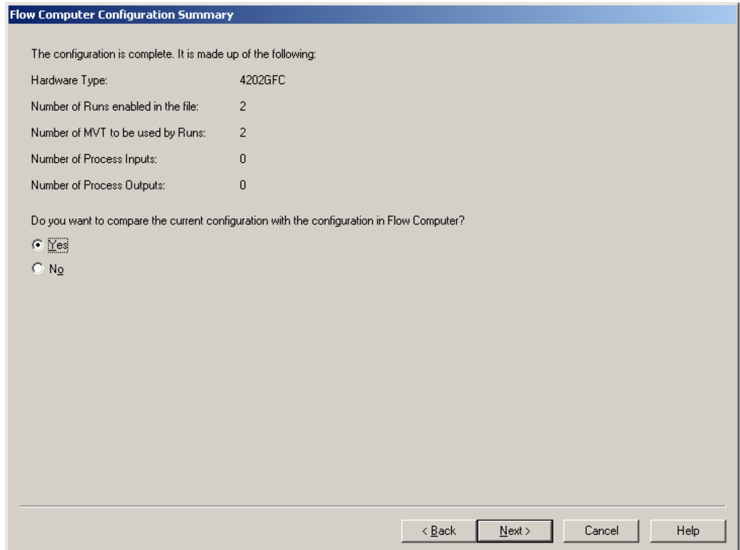


The second flow run, and subsequent runs, may be configured step-by-step or by copying the configuration of a previous run.

- Select ***Create Configuration Step-by-Step*** to configure another run using the wizard without copying Run 1.

Flow Computer Configuration Summary

This step displays a summary of the flow computer settings.



A summary of the flow computer configuration is shown.

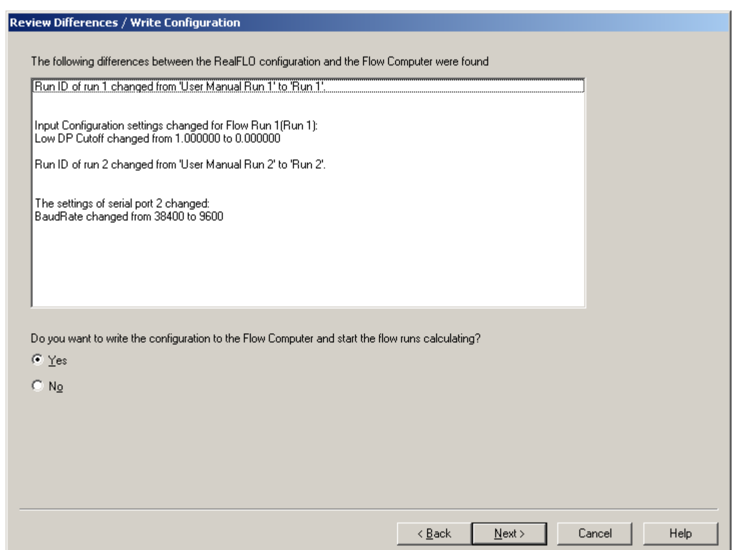
The current configuration can be compared with the configuration in the target flow computer.

Select **Yes** to compare the configurations.

Select **No** to not compare the configurations.

Review Differences

This step displays a summary of changes in the flow computer configuration. You can select to write to the flow computer or not.



The summary shows the differences in the configuration.

Select **Yes** to write the configuration to the flow computer. The configuration is written to the flow computer. The Start Executing command will be written for each flow run. The communication progress dialog shows the stages of writing.

Select **No** to write the configuration to the flow computer later.

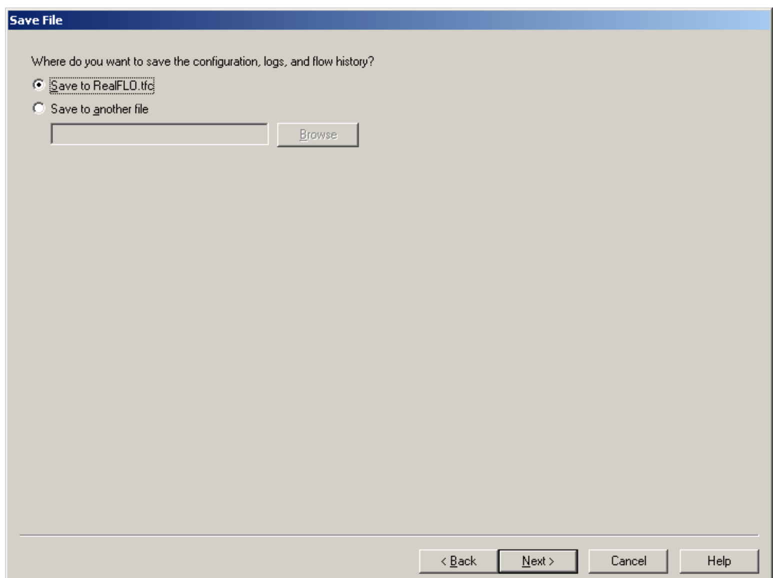
Click **Next** to perform the selected action.

In Flow Computer versions 6.73 and older, when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers. The Actual registers are not updated until a new Density calculation is started with the new values. The new values are not available to SCADA host software reading the Actual registers until a until a new Density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers and in the Actual registers. This allows a SCADA host to immediately confirm the new values were written to the flow computer. The new gas values are not used by the flow computer until a new density calculation is started.

Save File

This step lets you select where to save the configuration file.

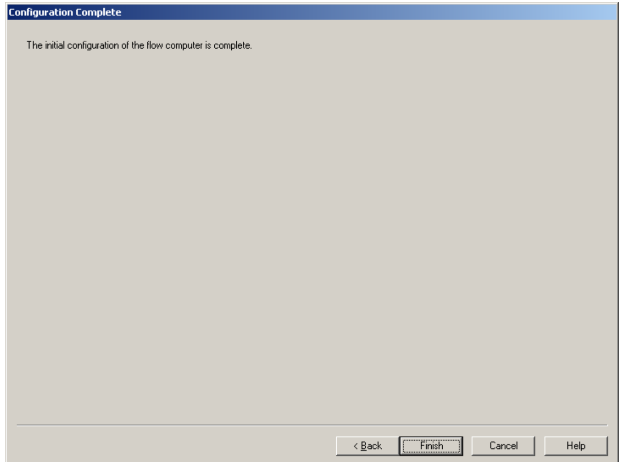


Select **Save to Realflo.tfc** to save the configuration file to the default file location.

Select the **Save to another file** to either enter a file name or use the Browse option to open the **Save As** dialog.

Finish

This step is displayed at the end of the wizard.



Click **Finish** to close the wizard.

View Data

The View Data section contains a ***View Current Readings*** button and a ***Read Logs and Flow History*** button.

Click the ***View Current Readings*** button to start the View Current Readings wizard, which will lead you through the steps to connect to a flow computer and view the current readings.

Click the ***Read Logs and Flow History*** button to start the Read Logs and Flow History wizard, which will lead you through the steps to connect to a flow computer and read the alarm and event logs and the flow history.

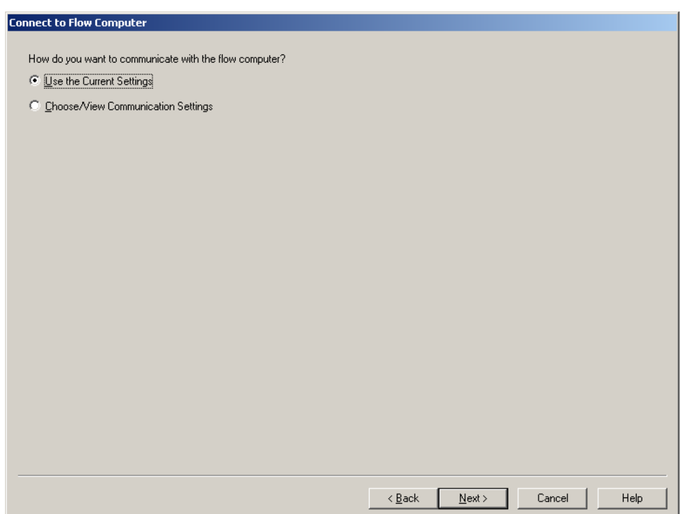
View Current Readings

The View Current Readings wizard will lead you through the steps to connect to a flow computer and view the current readings.

- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.
- **Cancel** cancels the operation and closes the wizard. Steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.
- **Help** opens the user manual.

Connect to Flow Computer

The connect to flow computer step defines the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two selections.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo.

(The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are:

- COM 1 (serial port on the PC)
- 9600 baud, no parity
- 8 Data bits
- 1 Stop bit

The default Modbus address Realflo will connect to is station 1.

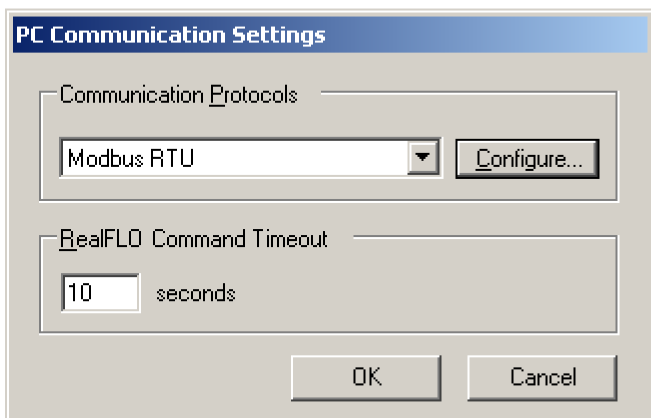
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click the **Next>** button to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

See the section **Communication** >> **PC Communication Settings Command** in the **Realflo Expert Mode Reference** section of this manual for complete details on the parameter settings in this dialog.

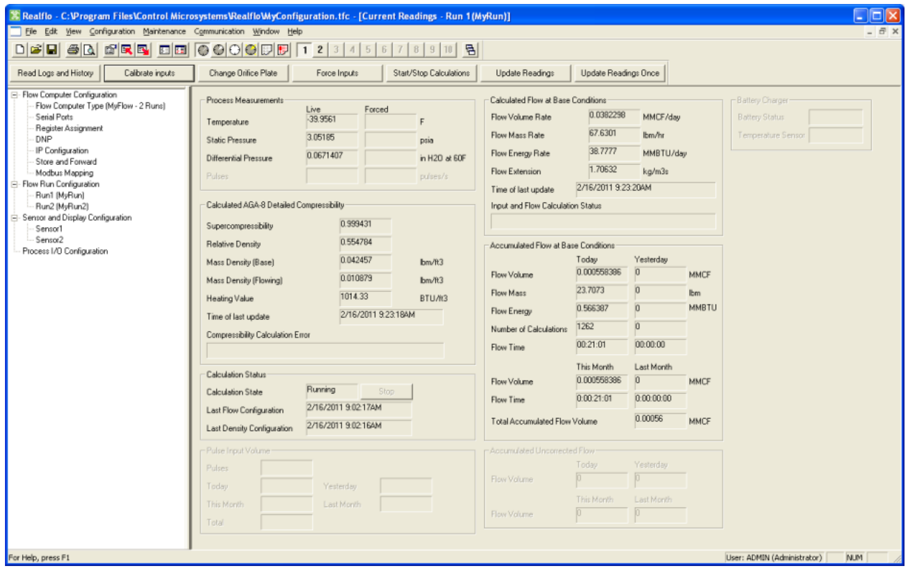
You need to know the communication settings for the connection to the flow computer to use this step.



- Once the communication settings have been selected click the **OK>** button to close the dialog and begin communication with the flow computer.

Current Readings View

The Current Readings view displays current measured and calculated values from the flow computer. The Current Readings view will appear differently depending on the run configuration.



The view is divided into eight sections. These sections are:

Process Measurements

This section displays the live and forced values for the flow calculation process inputs. The live values show the value read from the sensor. The forced values show the inputs to the flow calculation when they are forced. The Forced values are disabled when the input is live. The forced values are shown in red when the value is forced.

The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types. Process measurements not used by the flow calculation are disabled.

Forced values are not displayed for flow computers older than 6.0.

Calculated Compressibility

This section displays the results of the compressibility calculation selected in the ***Input Configuration*** property page. The time of the last compressibility calculation update and any compressibility calculation errors are also displayed in this section. The units of measurement displayed are those in effect when the readings were made. See Measurement Units for a description of the unit types.

Calculation Status

The **Calculation Status** section displays the Calculation State of the flow computer calculations for the run. Refer to the Calculation Control command in the Flow Computer menu for further information on flow calculation control.

The Calculation State Start and Stop button is disabled for users who have a **read and view** privileges account.

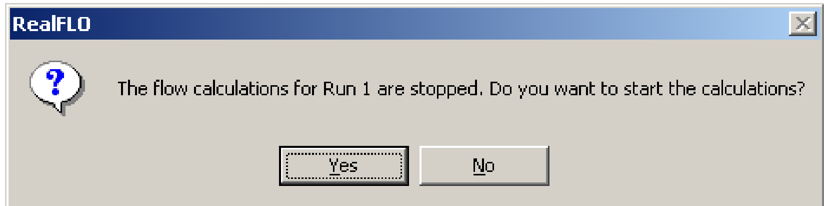
The Calculation State can be changed using the start or stop button beside the Calculation State display.

- When the Current Readings are being updated and the calculation is **stopped** or **not set** then the button is labeled **Start**.
- When the Current Readings are being updated and the calculation is **running** then the button is labeled **Stop**.

- When the Current Readings are not being updated the button is disabled and no text is displayed on it.

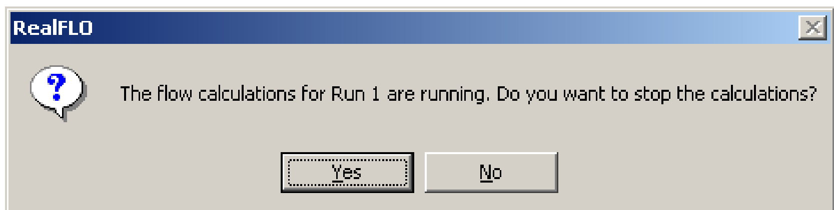
Click on the button to change the Calculation State.

If the calculations are stopped the following message box is displayed.



- If **Yes** is selected the flow calculations for the run are started.
- If **No** is selected the message box is closed and no further action is taken.

If the calculations are running the following message box is displayed.



- If **Yes** is selected the flow calculations for the run are stopped.
- If **No** is selected the message box is closed and no further action is taken.

The **Last Flow Configuration** displays the time stamp of the last time the flow configuration was changed.

The **Last Density Configuration** displays the time stamp of the last time the compressibility configuration was changed.

The Last Flow Configuration and Last Density Configuration values are not displayed for flow computers older than 6.0.

Pulse Input Volume

The **Pulse Input Volume** section is enabled when you configure a SolarPack 410, see section **SolarPack 410**.

Calculated Flow at Base Conditions

The **Calculated Flow** displays the instantaneous Flow Mas Rate, Standard Flow Volume Rate, Flow Energy Rate, Flow Product, Time of last update, and Input and Flow Calculation Status. The Flow Extension is displayed when the run is configured for AGA-3 (1990) calculations. The Flow Product is displayed when the run is configured for AGA-3 (1990) calculations. The time of the last flow calculation and input and flow calculation status are also displayed. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

Calculated Flow (PEMEX)

The **Calculated Flow** displays the instantaneous Flow Volume Rate, Standard Flow Volume Rate, Flow Energy Rate, Flow Product, Time of last update, and Input and Flow Calculation Status. The Flow Extension is displayed when the run is configured for AGA-3 (1990) calculations. The Flow Product is displayed when the run is configured for AGA-3 (1990) calculations. The time of the last flow calculation and input and flow calculation status are also displayed. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

Accumulated Flow

The **Accumulated Flow** section displays the flow volume for the current contract day (Today) and the previous contract day (Yesterday). Data is copied from the current contract day (Today) to the previous contract day (Yesterday) at the end of the contract day, as measured by the real time clock. Data is not copied when a new day is started for other reasons. It also displays the standard flow volume, flow energy, the number of flow calculations. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

This section also displays the accumulated flow volume and flow time for the current month and the previous month. Data is copied from the current month (This Month) to the previous month (Last Month) at the end of the contract day at the end of the month, as measured by the real time clock.

Accumulated Flow (PEMEX)

The **Accumulated Flow** section displays the PEMEX flow volume for the current contract day (Today) and the previous contract day (Yesterday). Data is copied from the current contract day (Today) to the previous contract day (Yesterday) at the end of the contract day, as measured by the real time clock. Data is not copied when a new day is started for other reasons. It also displays the standard flow volume, flow energy, the number of flow calculations. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

This section also displays the accumulated flow volume and flow time for the current month and the previous month. Data is copied from the current month (This Month) to the previous month (Last Month) at the end of the contract day at the end of the month, as measured by the real time clock.

AGA-7 Calculations Only

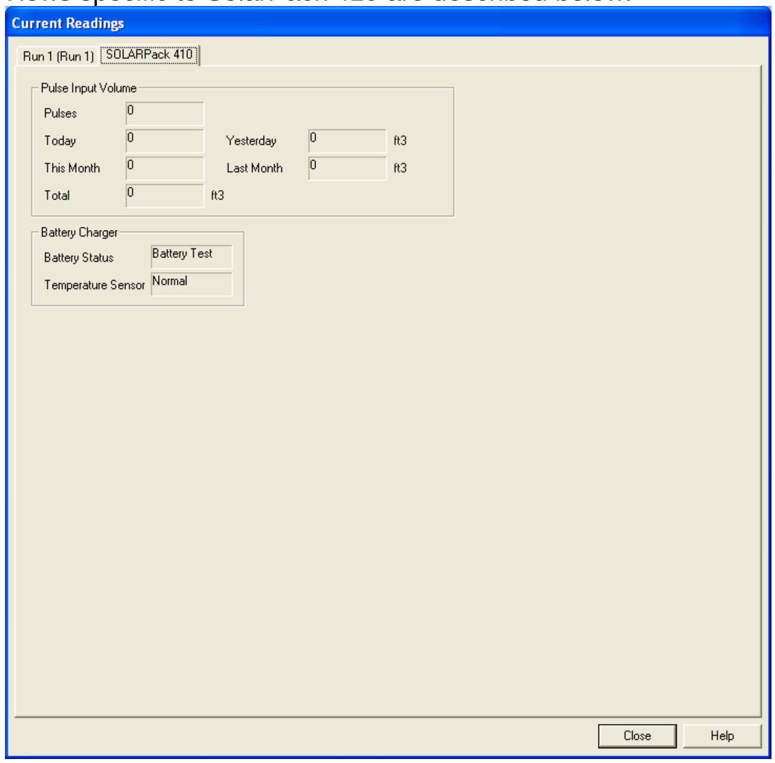
Accumulated Uncorrected Flow

The **Accumulated Uncorrected Flow** section displays the total calculated uncorrected flow volume (for the current contract day, the previous contract day, the current month and the last month. The accumulator holds a number between 0 and 999,999,999,999. It rolls over when the accumulated value is equal or greater than 1,000,000,000,000.

The view is updated according to the status of the **Update Readings** selection in the **Maintenance** menu.

SolarPack 410

Views specific to SolarPack 410 are described below.



The view has two additional sections. These sections are described below:

Pulse Input Volume

This section displays pulse and accumulated flow volumes for the onboard counter of a SolarPack 410. This section applies only to the SolarPack 410 system.

Data displayed is as follows:

- Pulses: Raw instantaneous pulse count
- Today: An accumulation of today’s total.
- Yesterday: An accumulation of yesterday’s total.
- This Month: An accumulation of the totals for this month.
- Last Month: An accumulation of the totals for last month.
- Total: A running total volume since the beginning of this operation.

Volumes are listed in the unit selected when configuring the Pulse Input.

Battery Charger

This section applies only to the SolarPack 410.

The **Battery Status** indicates the current state of the battery charger.

The **Temperature Sensor** indicates the current status of the battery charger temperature sensor.

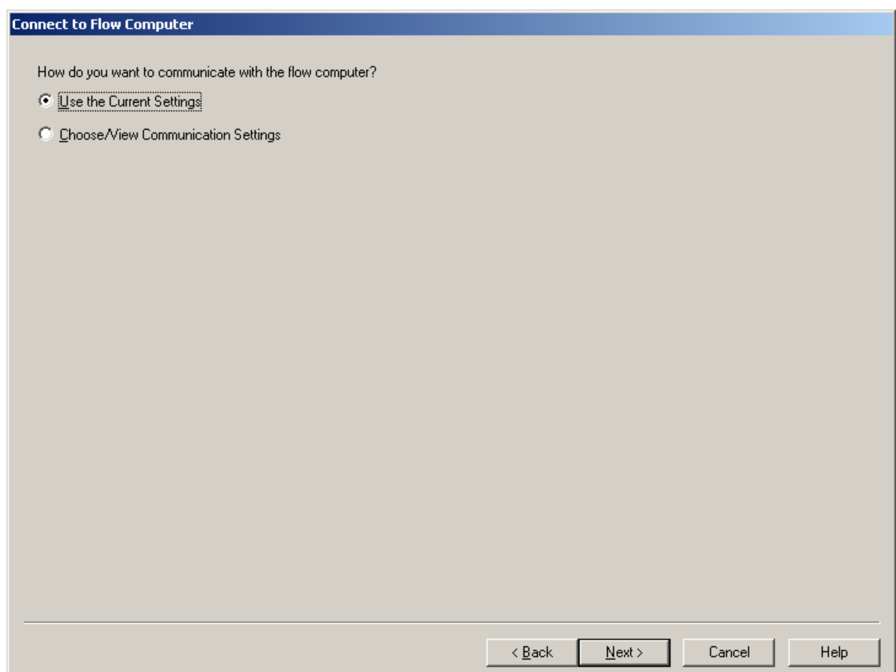
Read Logs and Flow History

The Read Logs and Flow History wizard will lead you through the steps to connect to a flow computer and read the alarm and event logs and the flow history.

- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.
- **Cancel** cancels the operation and closes the wizard. Steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.
- **Help** opens the user manual.

Connect to Flow Computer

The connect to flow computer step defines the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two selections.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo. (The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are:

- COM 1 (serial port on the PC)

- 9600 baud
- no parity
- 8 Data bits
- 1 Stop bit

The default Modbus address Realflo will connect to is station 1.

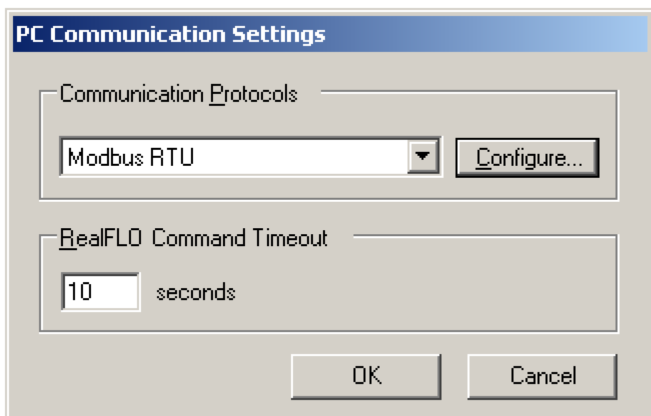
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click the **Next>** button to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

See the section **Communication** >> **PC Communication Settings Command** in the **Realflo Expert Mode Reference** section of this manual for complete details on the parameter settings in this dialog.

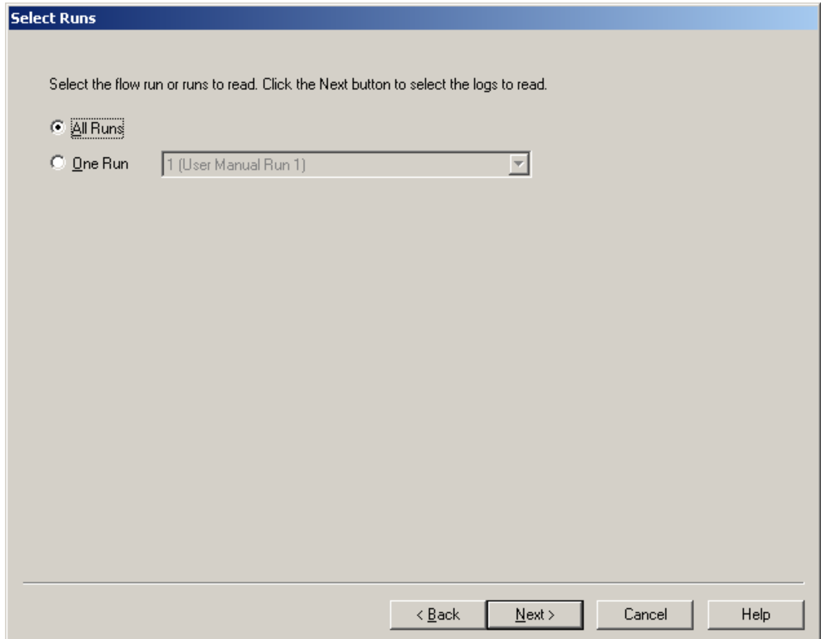
You need to know the communication settings for the connection to the flow computer to use this step.



- Once the communication settings have been selected click the **OK>** button to close the dialog and begin communication with the flow computer.

Select Runs to Read

This step selects the flow run or runs to read.

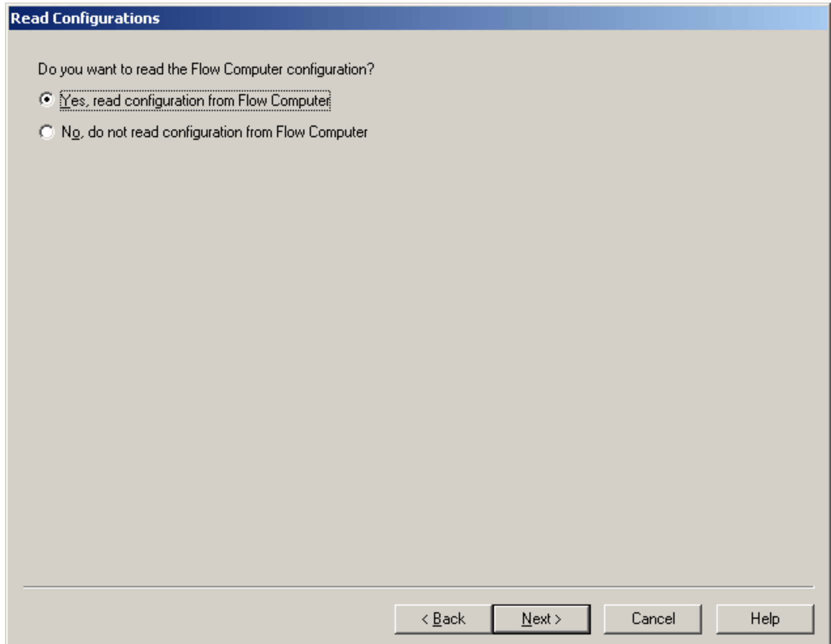


The **Select the Flow Run or Runs to Read selection** determines if data for all runs or for a single run is read.

- The **All Runs** radio button selects reading data for all runs.
- The **Selected Run** radio button selects reading from a single run. The drop-down list selects the run to be read.
- Click the **Next>** button to move to the next step in the wizard.

Select Flow Computer Configuration

This step selects whether to read the flow run configuration.

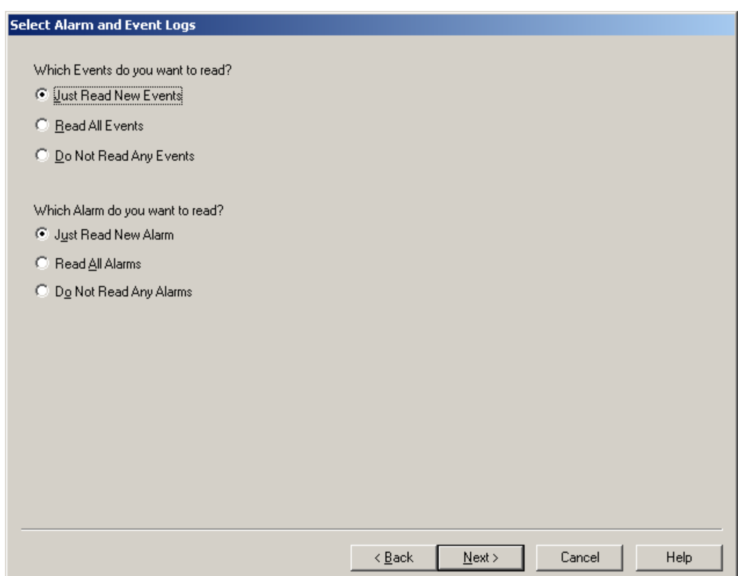


Select **Yes** to read the flow run configuration.

Select **No** to not read the flow run configuration.

Select Alarm and Event Logs to Read

This step selects which alarm and event logs to read.



The **Which Events do you want to read?** selection determines which events to read from the flow computer.

- Select **Just Read New Events** to read unacknowledged events in the flow computer. If the operator has **View, Read and Write Data** or **Administrator** authorization then the events will be acknowledged after reading the new events. If the events in the log are not acknowledged, the event log will fill with 700 events. Operator activity will be prevented until the events are read and acknowledged. The control is grayed under the following conditions:

  - The event log is not selected.
  - The user has **Read and View** account privileges.
  - The **Restrict Realflo users to reading all alarms and events** option is selected in the Expert Mode Options menu.

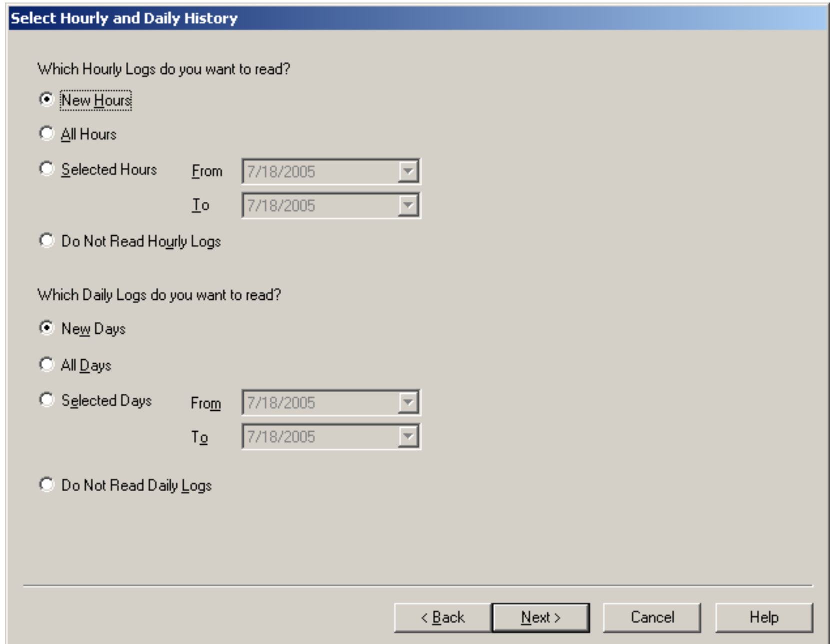
- Select **Read All Events** to read all events in the flow computer. This control is grayed if the Event Log control is not selected.
- Select **Do Not Read Any Events** to skip reading of events from the flow computer.

The **Which Alarms to you want to read?** selection determines which alarm logs to read from the flow computer.

- Select **Just Read New Alarms** to read unacknowledged alarms in the flow computer. If the operator has **View, Read and Write Data** or **Administrator** authorization then the alarms will be acknowledged after reading the new events. If the events in the log are not acknowledged, the alarm log will fill with 300 events. Operator activity will be prevented until the alarms are read and acknowledged. The control is grayed under the following conditions:
  - The alarm log is not selected.
  - The user has **Read and View** account privileges.
  - The **Restrict Realflo users to reading all alarms and events** option is selected in the Expert Mode Options menu.
- The **Read All Alarms** radio button selects the reading of all alarms in the controller. The control is grayed if the Alarm control is not selected.
- The **Do Not Read Any Alarms** button selects not to read alarms from the flow computer.
- Click the **Next>** button to move to the next step in the wizard.

Select Hourly and Daily History to Read

This step selects which hourly and daily logs to read.



The **Which Hourly Logs do you want to read?** selection determines which hourly history is read.

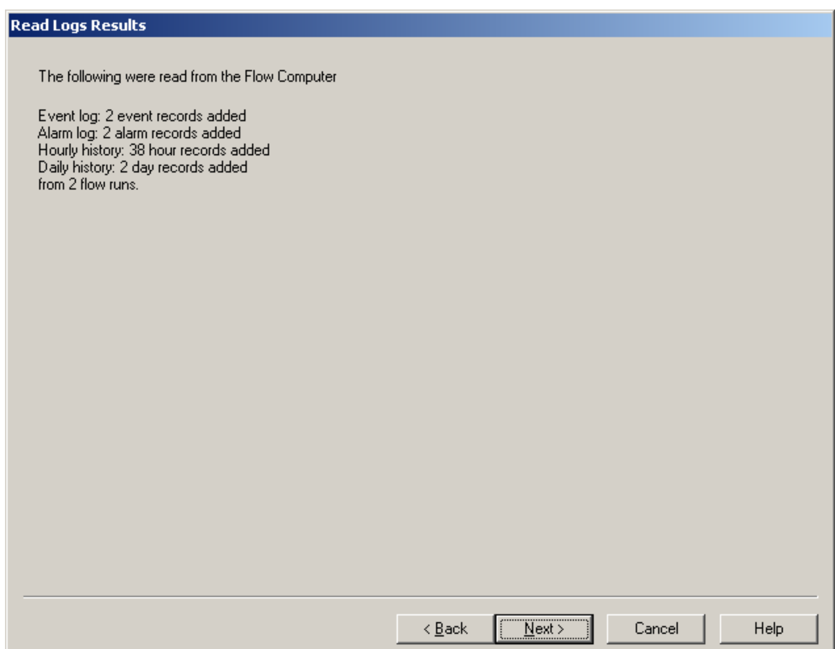
- Select **New Hours** to read hourly history for hours after the current time in the file. If the file is empty then Realflo will read hourly history stored in the flow computer. This is the default selection.
- Select **All Days** to read hourly history for days stored in the flow computer.
- Select **Selected Hours** to read hourly history for the range of days selected with the From and to drop-down lists. Records are read for the contract days whose first hour is within the date range. Records for the contract day are read, regardless of their calendar date. This may result in records with calendar days outside the range being added to the log. For example, if the contract day is configured to start at 7:00 AM. Reading hourly history for September 23 would return the records where the first record in a day was between 7:00 on the 23rd to 6:59:59 AM on the 24th.
- The **From** control contains the oldest previous day for which the hourly history is to be read. The initial value is the current day. Change this date to avoid reading data that has previously been read into the log.
- The **to** control contains the recent previous day for which the hourly history is to be read. The initial value is the current day. The allowed range is the same or greater than the value in the **From** control. Change this date when wanting to read older data only. Leaving this date at its default will result in the recent data being read.
- Select the **Do Not Read Hourly Logs** to skip the reading of hourly logs.

The **Which Daily Logs do you want to read?** selection determines which hourly history is read.

- Select **New Days** to read daily history for days after those in the current file. If the file is empty then Realflo will read all hourly history stored in the flow computer. This is the default selection.

- Select **All Days** to read daily history for all days stored in the flow computer.
- Select **Selected Days** to read daily history for the range of days selected with the From and to drop-down lists. Records are read for the contract days whose first record is within the date range. Records for the contract day are read, regardless of their calendar date. This may result in records with calendar days outside the range being added to the log. For example, if the contract day is configured to start at 7:00 AM. Reading daily history for September 23 would return the daily records whose end time is in the range 7:00 on the 23rd to 6:59:59 AM on the 24th.
- The **From** control contains the oldest previous day for which the daily history is to be read. The initial value is the current day. Change this date to avoid reading data that has previously been read into the log.
- The **to** control contains the recent previous day for which the daily history is to be read. The initial value is the current day. The allowed range is the same or greater than the value in the **From** control. Change this date when wanting to read older data only. Leaving this date at its default will result in the recent data being read.
- Select the **Do Not Read Hourly Logs** to skip the reading of hourly logs.
- Click the **Next>** button to read the selected logs and history from the runs selected and move to the next step in the wizard.

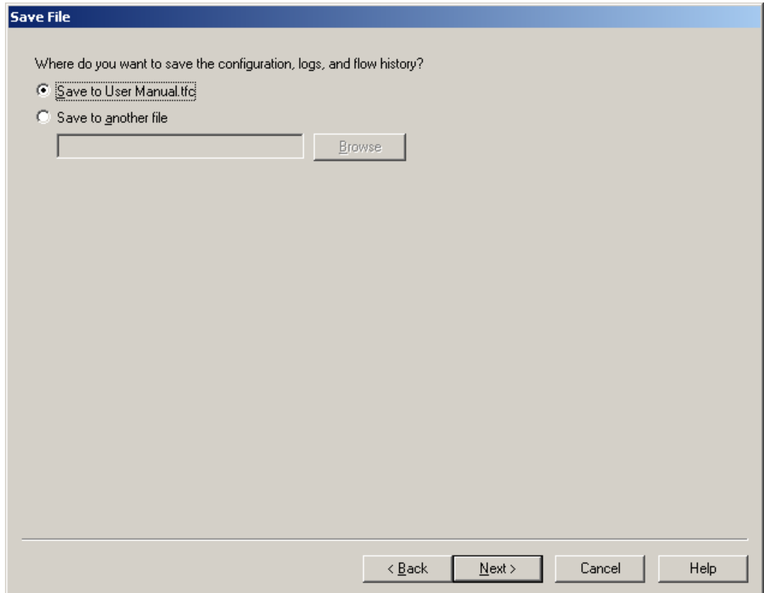
The Read Logs Results page displays the results of the Read Logs and History.



- Click the **Next>** button to move to the next step in the wizard.

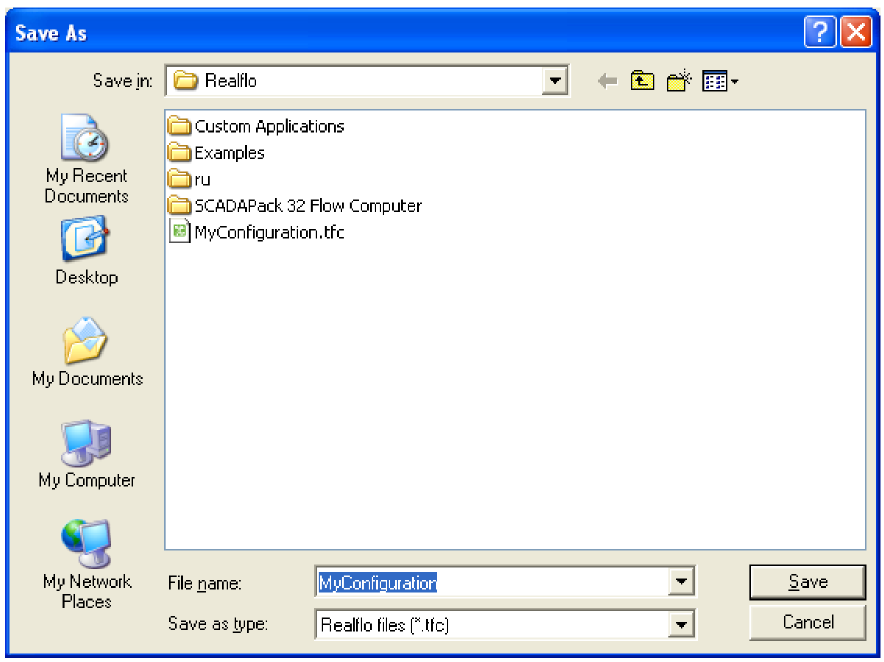
Save Data

This step selects where to save the flow run configuration, logs and flow history.



Select **Save to *File name.tfc*** to save the data read to the currently opened file. The name of the current file is shown in place of *file name.tfc.*

Select **Save to another file** and enter a file name or click the Browse button to open the Save As dialog.



The following options allow you to specify the name and location of the file you're about to save:

The **Save in:** box lists the available folders and files.

The **File name:** box allows entry of a new file name to save a file with a different name. Realflo adds the extension you specify in the *Save As type* box.

The **Save as type:** box lists the types of files Realflo can save. Realflo can open flow computer (TFC) files and flow computer Template files (RTC).

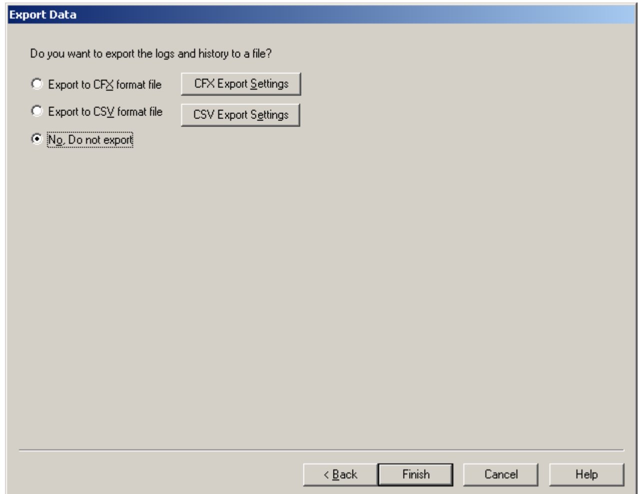
If the open file is a flow computer file and the Save as Type is a template file, Realflo will ask if the flow computer file should be saved before converting it to a template. This stops the missing of flow computer data when the file is converted.

The **Save** button saves the file to the specified location.

The **Cancel** button closes the dialog without saving.

Export Data

This step selects whether to export the logs and history.



Select **Export to CFX format file** to export the logs and history to a Flow-Cal CFX format file. This format is designed for importing into Flow-Cal. Data is exported to the CFX file from one flow run. The file includes data from the configuration, current readings, alarm log, event log and hourly history log.

- When this option is selected the **Export Data to CFX** dialog is opened when the **Finish** button is clicked.
- The **CFX Export Setting** button opens the CFX Export Settings dialog. The parameters for this dialog are described in the CFX Export Settings section below.

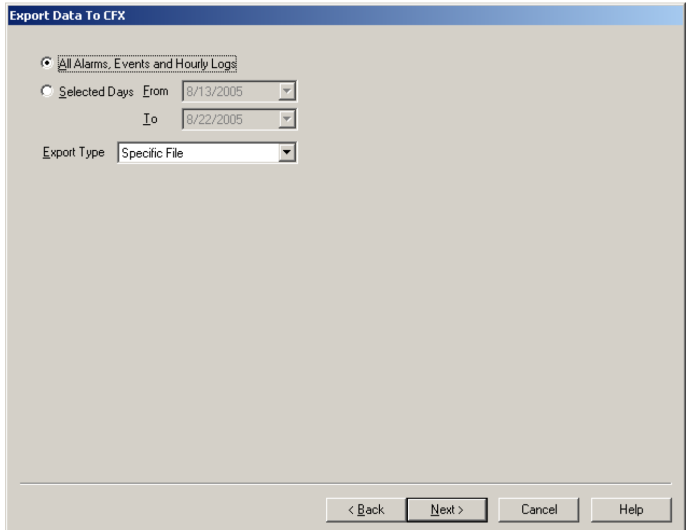
Select **Export to CSV format file** to export the logs and history to a CSV (comma-separated values) format file. This format can be read by spreadsheet and database software.

- When this option is selected the **Export Data to CSV** dialog is opened when the **Finish** button is clicked.
- The **CSV Export Setting** button opens the CSV Export Settings dialog. The parameters for this dialog are described in the CSV Export Settings section below.

Select **No, Do not export** to skip the Export Data step.

- When this option is selected the dialog is closed and the Read Logs Flow History wizard is ended when the **Finish** button is clicked.

Export Data to CFX



Select **All Alarms, Events and Hourly Logs** to select all of the data in the flow run. This is the default button.

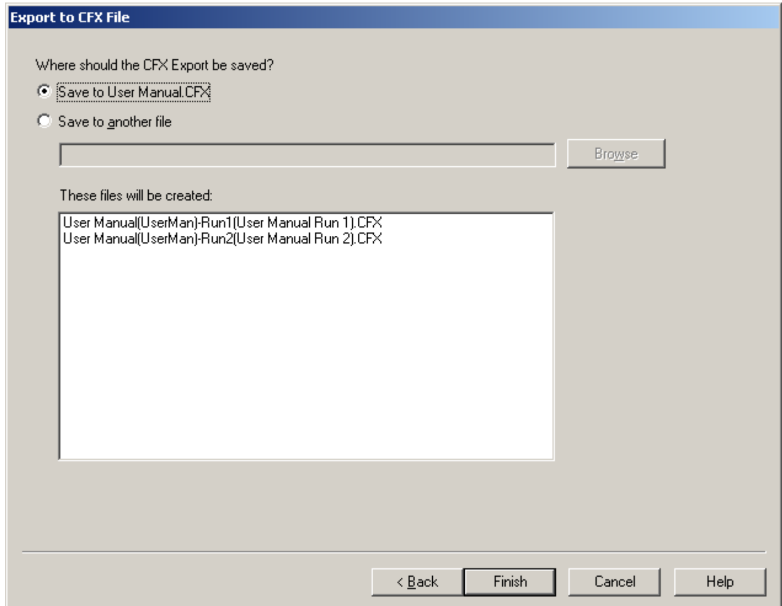
Select **Selected Days** to select the data from the contract days in the **From** and **To** dropdown lists.

- The **From** dropdown list selects the oldest contract day. This control is enabled when the **Selected Days** radio button is selected.
- The **To** dropdown list selects the recent contract day. This control is enabled when the **Selected Days** radio button is selected.

The **Export Type** dropdown list selects how export files are stored.

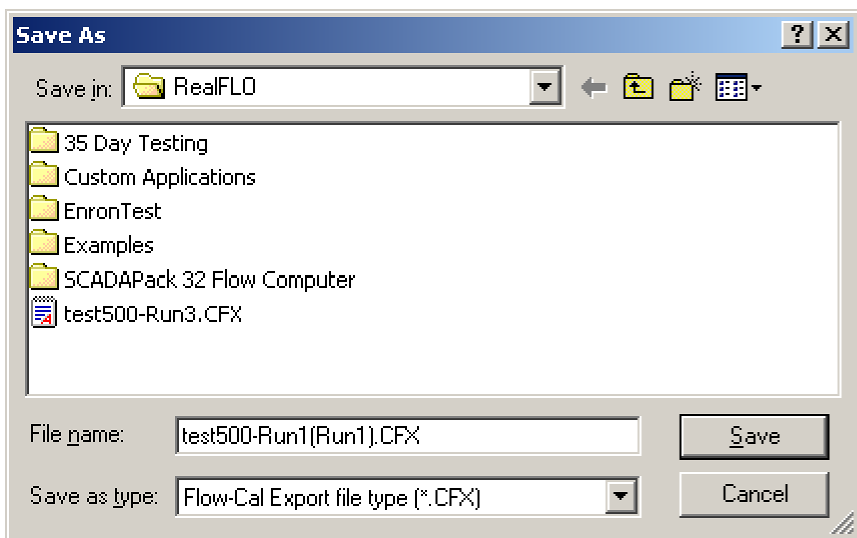
- Select **Specific File** to export to a single file. A standard file save dialog opens to allow you to select the file name. The default file name is **<Realflo file name>(<FC ID>) - <Run Number> (<Run ID>).CFX.**
- Select **Dated CFX** to export one file per day to a single folder per run. Realflo exports one file for each day. The file name is based on the time and date according to the CFX standard (YYYYMMDD.CFX).

Save CFX Export



Select **Save to *File name.CFX*** to save the CFX Export data to the currently opened file. The name of the current file is shown in place of *file name.CFX.* The files that that will be created are shown in the display window.

Select **Save to another file** to save the CFX Export data to a different file name and location. Enter the name in the window or select **Browse** to open the Save As dialog and select a name and location.



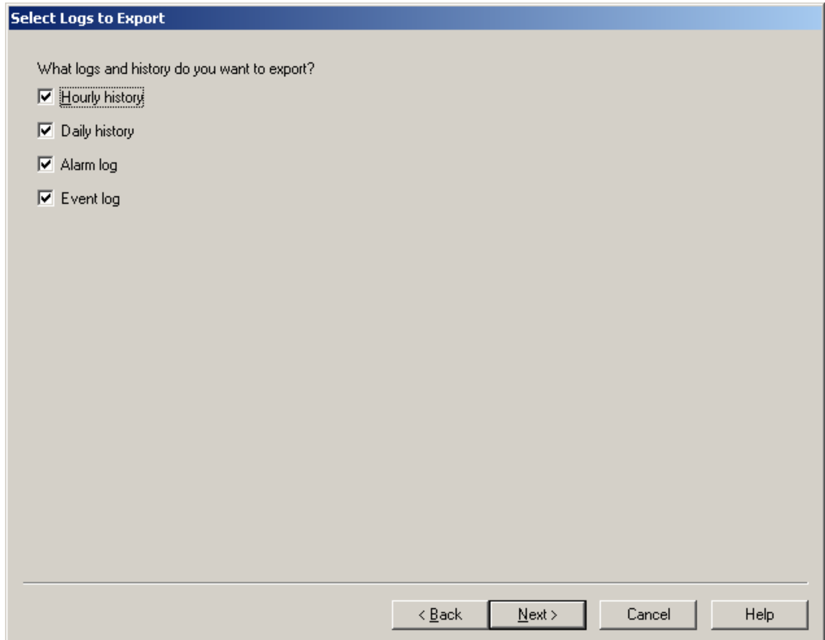
The **Save As** dialog allows you to specify the file to export the data to.

The **Save** button exports the data to the selected file.

The **Cancel** button the export command and closes the dialogs.

- Click the **Next>** button to complete the Read Logs and Flow history wizard and close the dialog.

Export Data to CSV



Select **Hourly history** to export the hourly history data.

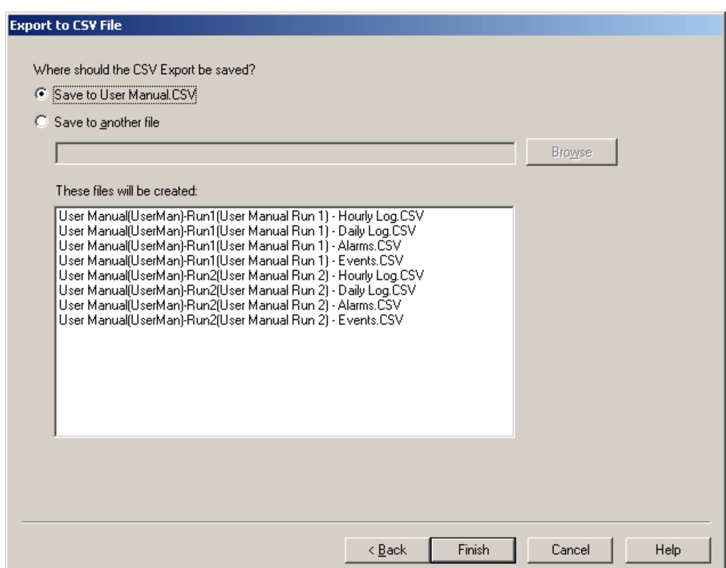
Select **Daily history** to export the daily history data.

Select **Alarm log** to export the alarm log data.

Select **Event log** to export the event log data.

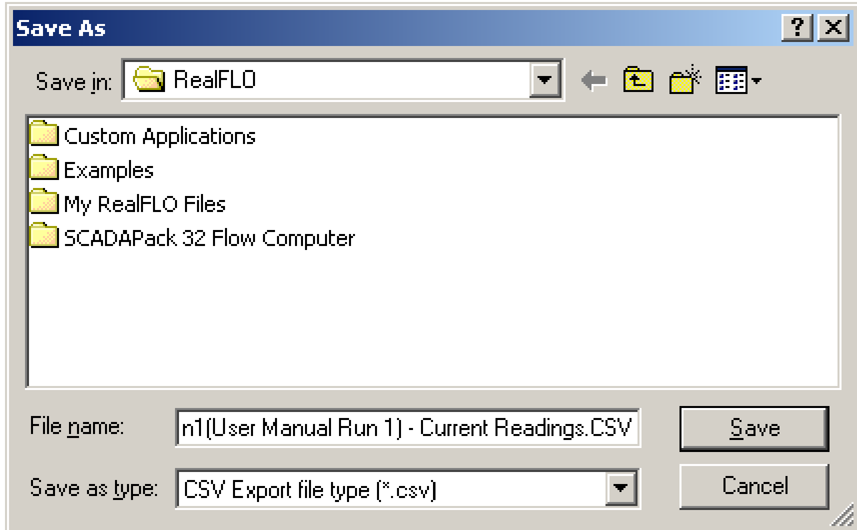
The **Next>** button moves to the Save CSV Export step in the wizard.

Save CSV Export



Select **Save to *File name.CSV*** to save the CSV Export data to the currently opened file. The name of the current file is shown in place of *file name.CSV.* The files that that will be created are shown in the display window.

Select **Save to another file** to save the CSV Export data to a different file name and location. Enter the name in the window or select **Browse** to open the Save As dialog and select a name and location.



You may change the file name to any suitable name. The suggested file name format is defined in the **CSV Export Options** command.

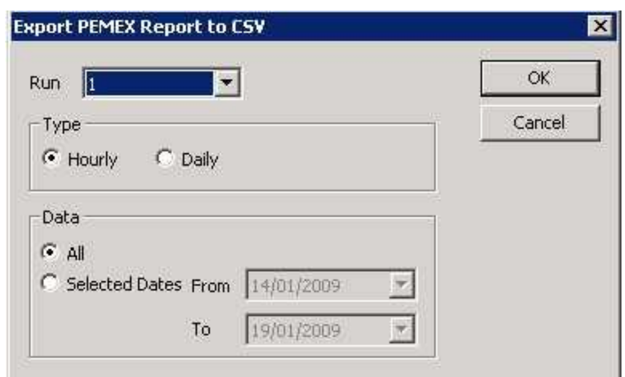
The **Save As** file selection dialog appears for views. The Save As dialog allows you to specify the file to export the data to.

The **Save** button in the **Save As** dialog exports the data to the selected file.

The **Cancel** button in the **Save As** dialog cancels the export command and closes dialogs.

Export PEMEX Report to CSV

This option is only available in the PEMEX version of Realflo.



Select **Run** number to export the history data for a specific meter run.

Select **Hourly history** to export the history data.

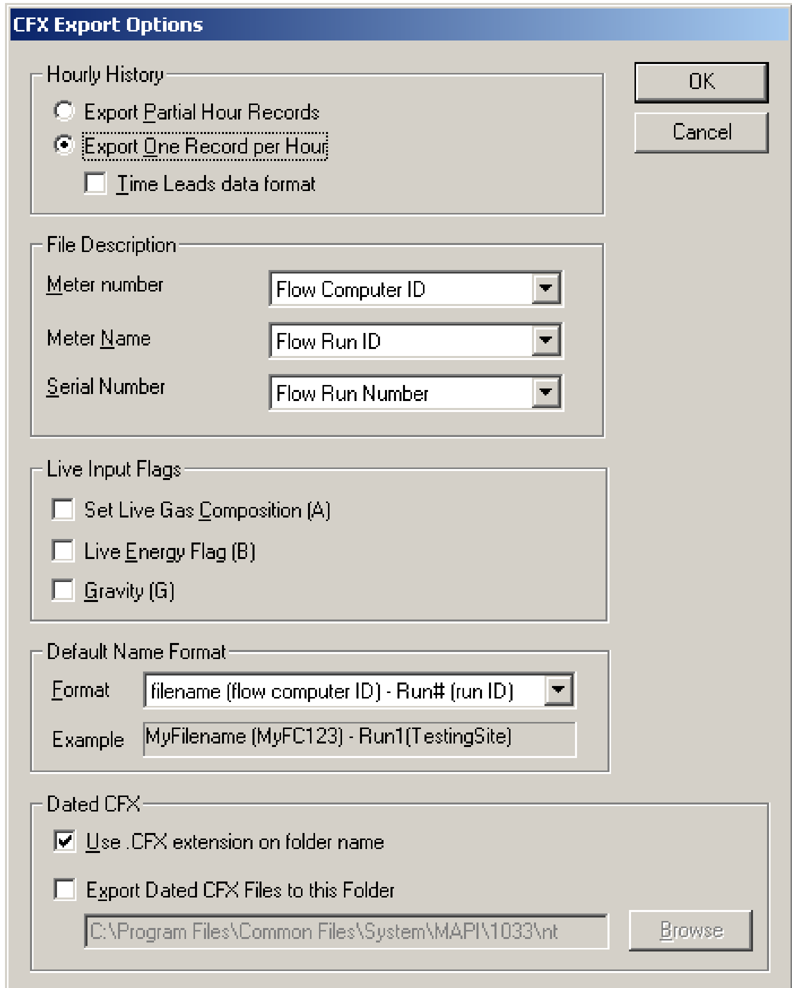
Select **Data** to specify the dates for which to export the history data. .

Click **OK** to open the **Save As** dialog.

Click **Save** to save the hourly history data.

CFX Export Settings

The CFX Export Options dialog sets options for exporting to Flow-Cal CFX files. The settings in this dialog apply to files opened by Realflo. They are stored in the Windows registry.



The Hourly History section defines how records from the hourly history are exported.

- Select **Export Partial Hour Records** to export the records as they appear in Realflo. Some hours may contain more than one record due to power cycling or configuration changes. This is the default selection.
- Select **Export One Record per Hour** to export only one record per hour. Multiple records within an hour are merged into a single record for exporting. Hours that are not yet complete are not merged or exported.

The following hourly record fields are summed: volume, mass, energy, pulses (turbine type).

The following hourly record fields are averaged: termperature, static pressure, differential pressure (orifice types), relative density, flow product or flow extension. See Input Averaging on page 948 for more information.

- Select **Time Leads Data Format** to export the date and time at the start of the period. The time stamp on the record is the time at the start of the hour, even if the first record to be merged started later than that time.

This option is enabled only when **Export One Record per Hour** is checked. This option is unchecked by default.

The **File Description** section defines some descriptive parameters in the CFX file.

- **Meter Number** defines the meter number parameter. The options are *none*, *Flow Computer ID*, *Flow Run ID* and *Flow Run Number*. The default value is *Flow Computer ID*. The parameter is 17 characters long in the file.
- **Meter Name** defines the meter name parameter. The options are *none*, *Flow Computer ID*, *Flow Run ID* and *Flow Run Number*. The default value is *Flow Run ID*. The parameter is 49 characters long in the file.
- **Serial Number** defines the meter serial number parameter in the file. The options are *none*, *Flow Computer ID*, *Flow Run ID* and *Flow Run Number*. The default value is *Flow Run Number*. The parameter is 11 characters long in the file.

The **Live Inputs Flags** section defines which live input flags are set by Realflo. The CFX file contains four flags in the Live Inputs parameter. Realflo sets the T (temperature) flag to Y (live data). The other flags are normally set to N (not live), but can be modified using the following options.

- Check **Set Live Gas Composition Flag** when there is a program that updates the gas composition. This is flag A (analysis). This option is unchecked by default.
- Check **Set Live Energy Flag** when there is a program that updates the energy. This is flag B (heating value). This option is unchecked by default.
- Check **Set Live Gravity Flag** when there is a program that updates the specific gravity (relative density). This is flag G (gravity). This option is unchecked by default.

The **Default Name Format** section defines what file names Realflo suggests when exporting. The names are combinations of the file name; Flow Computer ID; flow run number; and flow run ID.

Format selects the name format. The valid values are listed below. The default is to include the file name; Flow Computer ID; flow run number; and flow run ID.

  - file name (Flow Computer ID) - Run# (run ID)
  - file name (Flow Computer ID) - Run#
  - file name (Flow Computer ID) - run ID
  - file name - Run# (run ID)
  - file name - Run#
  - file name - run ID
  - Flow Computer ID - Run# (run ID)
  - Flow Computer ID - Run#
  - Flow Computer ID - run ID
  - Run# (run ID)
  - run ID

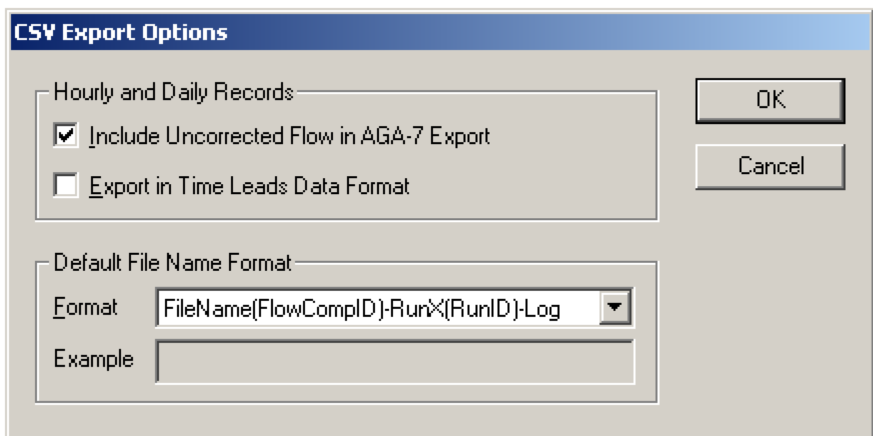
- The **Example** control shows the file name that will be suggested for the current file.

The **Dated CFX** section defines where and how CFX files are exported.

- Select **Use .CFX extension on folder names** to create folders with a CFX extension when exporting Dated CFX files. The data for each month is stored in its own folder when using the Dated CFX format. The folder name may have a CFX extension or not. This option is unchecked by default.
- Select **Export Dated CFX Files to the Folder** to define a common folder for exports. Exported data is placed in this folder. The option is unchecked by default. When checked, the edit control holds the destination folder that will appear in the Save As dialog. Use Browse to search for another folder.

CSV Export Settings

The CSV Export Options command defines whether optional data is exported to CSV files. The settings in this dialog apply to files opened by Realflo. They are stored in the Windows registry.



The **Hourly and Daily Records** section of the dialog defines optional data to include and how the data is time stamped.

- Select the **Include Uncorrected Flow in AGA-7 Export** option to export the Uncorrected Data column from the Hourly History Log and Daily History Log. This option applies to AGA-7 only. The option is unchecked by default.
- Select the **Export in Time Leads Data Format** option to export time stamps that mark the start of the period. Uncheck the option to export time stamps that mark the end of the period (Realflo format). This applies to the the Hourly History and Daily History only. The control is unchecked by default.

The **Default File Name Format** section defines the file name that is suggested by Realflo when data is exported. The names are combinations of the file name; Flow Computer ID; flow run number; and flow run ID.

The **Format** list selects the name format. The name is made up of the identifier format and a view format. The valid values for the identifier are listed below. The default is to include the file name; Flow Computer ID; flow run number; and flow run ID.

  - file name (Flow Computer ID) - Run# (run ID) - Type
  - file name (Flow Computer ID) - Run# - Type
  - file name (Flow Computer ID) - run ID - Type
  - file name - Run# (run ID) - Type
  - file name - Run# - Type
  - file name - run ID - Type
  - Flow Computer ID - Run# (run ID) - Type
  - Flow Computer ID - Run# - Type
  - Flow Computer ID - run ID - Type
  - Run# (run ID) - Type
  - run ID - Type

When the logs are exported the word **Type** is replaced by the following, according to the export selected.

  - Alarms
  - Events
  - Hourly Log
  - Daily Log
  - Current Readings
  - Custom View Name

- The **Example** control shows the file name that will be suggested for the current file.

Maintenance

The Maintenance section of the Realflo main page contains ***Calibrate Inputs***, ***Change Orifice Plate*** and ***Force Inputs*** buttons.

Click the ***Calibrate Inputs*** button to start the Calibrate Inputs wizard, which will lead you through the steps to connect to a flow computer and calibrate the measurement inputs.

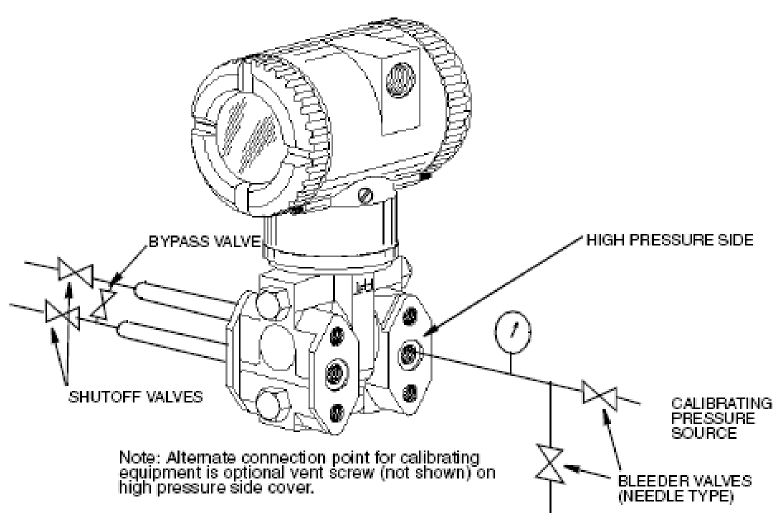
Click the ***Change Orifice Plate*** button to start the Change Orifice Plate wizard, which will lead you through the steps to connect to a flow computer and change the orifice plate for a meter run.

Click the ***Force Inputs*** button to start the Force Inputs wizard, which will lead you through the steps to connect to a flow computer and force the inputs.

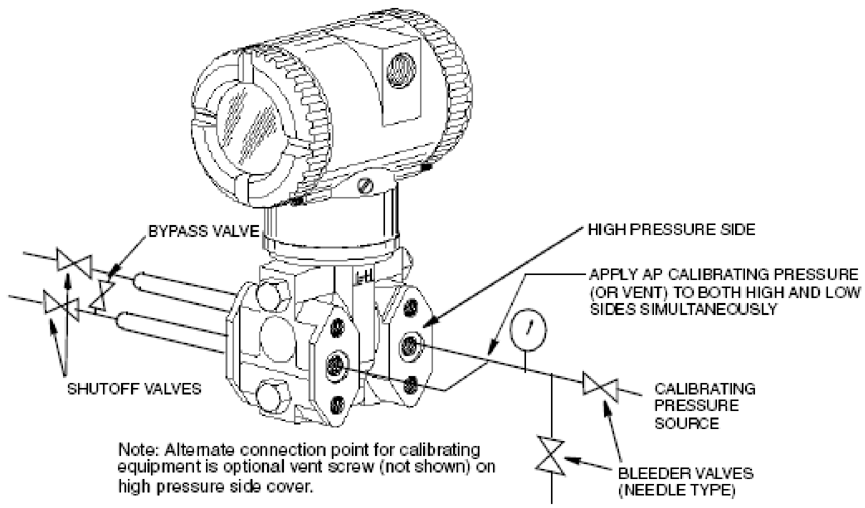
Connections for SCADAPack Sensor Calibration

It should be noted that when an Absolute (Static) Pressure calibration is performed the bypass or cross feed valve on the manifold needs to be open. When performing a Differential Pressure calibration the bypass valve needs to be closed.

Differential Pressure Calibration Connections



Absolute Pressure Calibration Connections



Calibrate Inputs

The Calibrate Inputs wizard is used to calibrate the temperature sensor, static pressure sensor, and differential pressure sensor or pulse counter input. The calibration dialogs lead you through the calibration procedure.

When more than one sensor is selected, they are forced and then the calibration cycle will be allowed for each sensor in turn. This allows multiple variable transmitters such as the MVT to be calibrated.

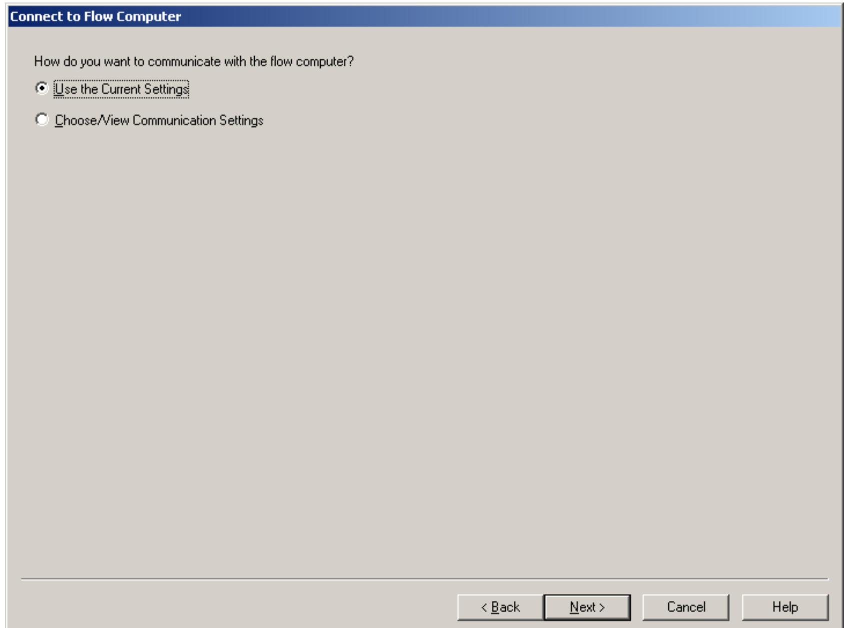
⚠WARNING
The same input sensor can be used for more than one flow run. When the sensor is calibrated for one run, Realflo only forces the input value for that run. When the sensor is disconnected to do the calibration, the live input to the other run will be disconnected and the value will not be correct. The flow computer does not support forcing of inputs during calibration on more than one run.

For each step in the wizard a dialog is presented to enter the parameters for the step. Each dialog contains four buttons to allow navigation through the wizard.

- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.
- **Cancel** cancels the operation and closes the wizard. Steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.
- **Help** opens the user manual.

Connect to Flow Computer

The connect to flow computer step defines the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two selections.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo. (The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are:

- COM 1 (serial port on the PC)
- 9600 baud
- no parity
- 8 Data bits
- 1 Stop bit

The default Modbus address Realflo will connect to is station 1.

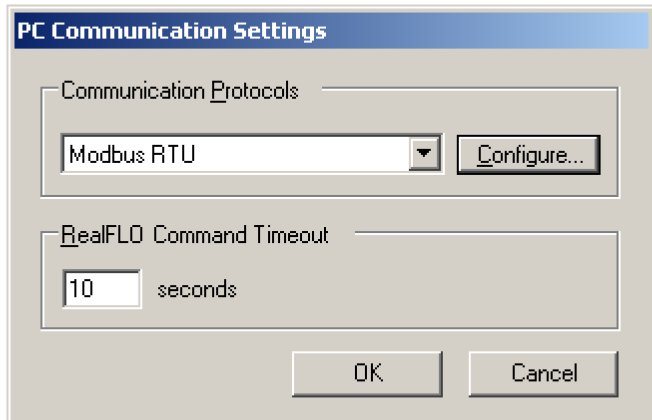
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click the **Next>** button to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

See the section **Communication** >> **PC Communication Settings Command** in the **Realflo Expert Mode Reference** section of this manual for complete details on the parameter settings in this dialog.

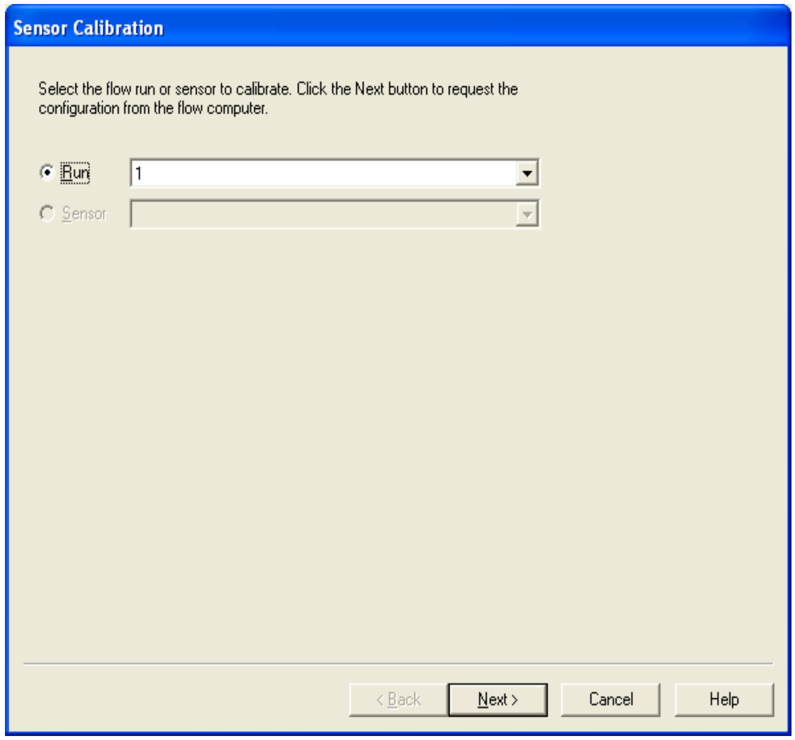
You need to know the communication settings for the connection to the flow computer to use this step.



- Once the communication settings have been selected click the **OK>** button to close the dialog and begin communication with the flow computer.

Sensor Calibration

When the ***Calibration*** command is selected the Sensor Calibration dialog is displayed. The **Run**, or **Sensor**, to be calibrated is selected from this dialog.



This dialog allows the selected meter run or Sensor to be calibrated.

Select the **Run** radio button and then select a meter run to calibrate. Transmitters used for the meter run may be calibrated. This section is disabled if every run is using external sensors.

- Follow the steps in the **Run Calibration Procedure**.

Select the **Sensor** radio button and select one of the tags to calibrate a Sensor or Transmitter. The tags that have been configured will be in Sensor selection box.

- Follow the steps in the **Sensor Calibration Procedure**.

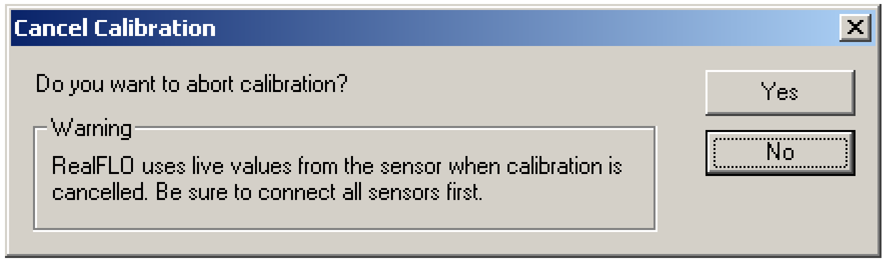
The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The back button is not enabled on the first step since there is no previous step.

The **Next>** button starts the calibration procedure. After the Run, or sensor, is selected, the configuration for the run is read from the flow computer. The Run, or sensor calibration page for the run is then displayed.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



⚠WARNING
Realflo uses live values from the sensor when calibration is cancelled. Connect sensors first.

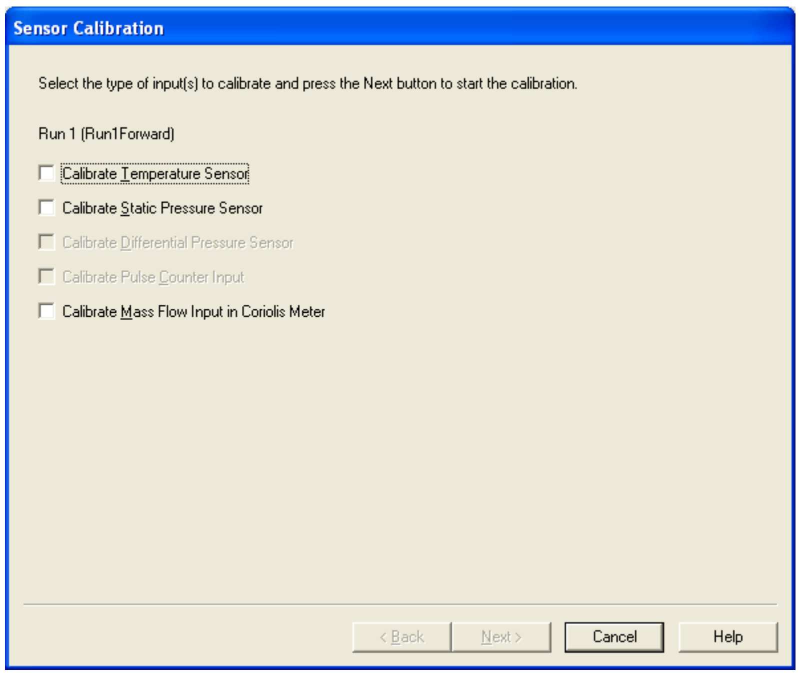
Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Run Calibration Procedure

When the **Run** radio button is selected the Run Calibration dialog is displayed. The transmitters for the run are selected for calibration from this dialog.

⚠WARNING
Realflo uses live values from the sensor when calibration is cancelled. Connect sensors first. The same input sensor can be used for more than one flow run. When the sensor is calibrated for one run, Realflo only forces the input value for that run. When the sensor is disconnected to do the calibration, the live input to the other run will be disconnected and the value will not be correct. The flow computer does not support forcing of inputs during calibration on more than one run.



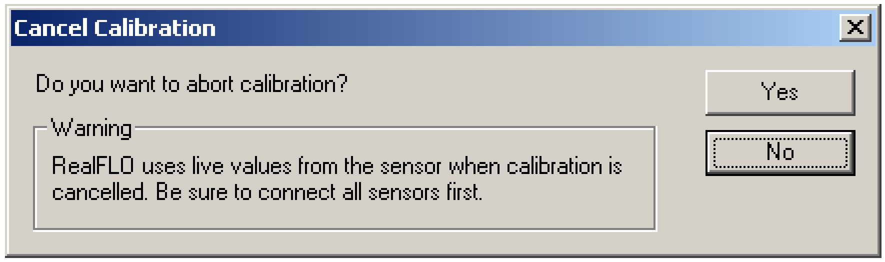
Select the sensors to be calibrated by checking the appropriate boxes. More than one sensor may be selected for calibration.

The **<Back** button is not enabled as this is the initial step.

The **Next>** button completes the selections and opens the Step 1: Force Value dialog.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



WARNING

Realflo uses live values from the sensor when calibration is cancelled. Connect sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

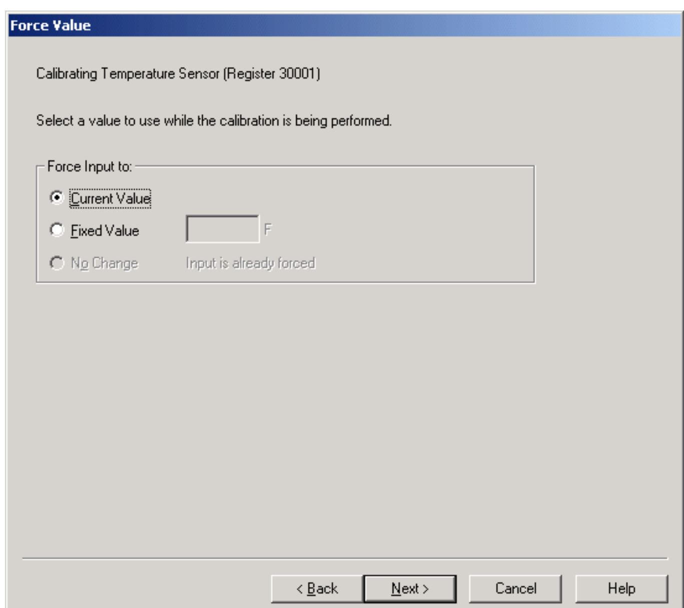
The **Help** button displays the online help file.

Calibration Step 1: Force Value

The flow calculations continue to execute while calibrating sensors. The sensor value needs to be forced to either the current value or a fixed value during calibration. This dialog lets you select the current value of the input or a fixed value of your choice.

If a sensor was forced before starting the execution of a calibration, the sensor will remain in a forced state after the calibration process is completed or even if the calibration process is cancelled before completion.

When more than one sensor is selected, they need to be forced to a current or fixed value before any of the other steps are performed. A ***Step 1: Force Value*** dialog will be presented for each sensor selected for calibration.



The input register associated with this input is displayed to aid you in determining which input you are calibrating.

- Check the **Current Value** radio button to use the current value for the sensor.

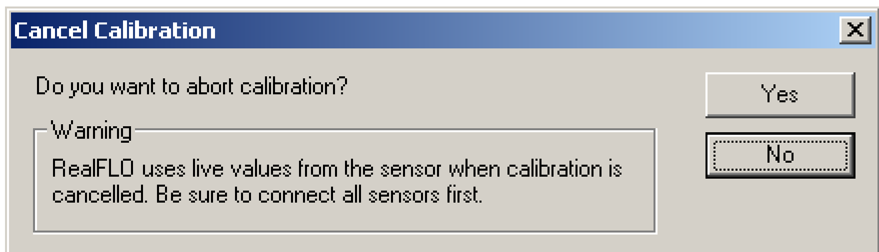
- Check the **Fixed Value** radio button and enter a value to use for the calibration in the entry box.
- The **No Change** radio button will be selected if the value is currently forced. (You may still select one of the other two radio buttons if desired).

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

When the **Next>** button is pressed Realflo records the start of calibration for the sensor in the event log. The sensor input is forced. The sensor may now be disconnected from the process.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



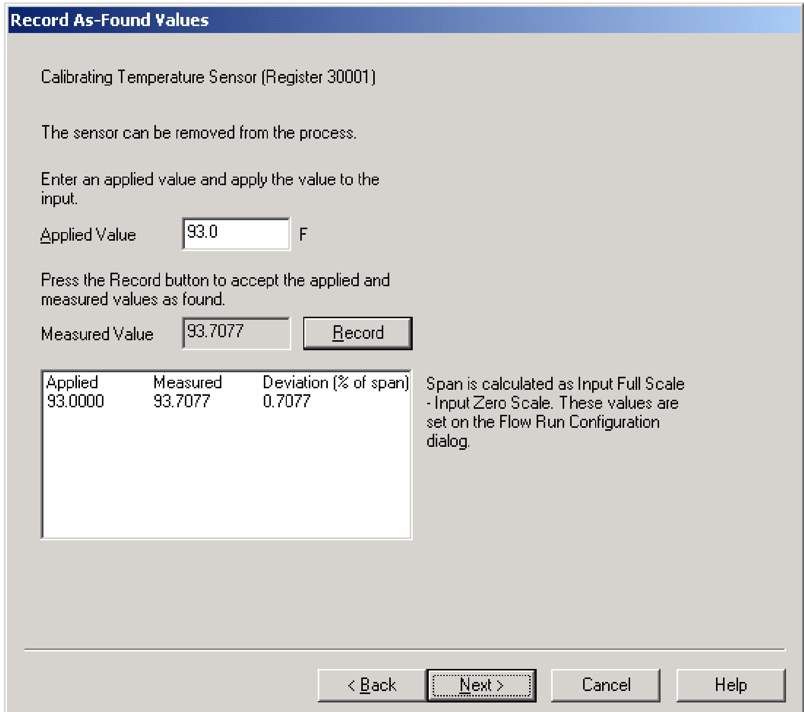
WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 2: Record As Found Values

As-found readings indicate how the sensor was calibrated before adjustment. These can be used to correct flow measurement errors resulting from an out of calibration sensor. Follow the procedure your company has set for taking as-found readings. You need to record at least one as-found reading.



To take as-found readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.
- Check the measured value from the process in the **Measured Value** box. When it has settled, click on the **Record** button to record an as-found reading.

Repeat the process to record additional readings.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

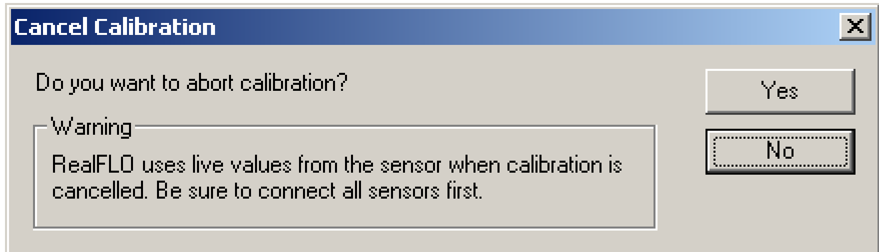
```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The **Next>** button proceeds to the next step.

The **Cancel** button is greyed and an **as found** reading needs to be recorded.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



⚠WARNING

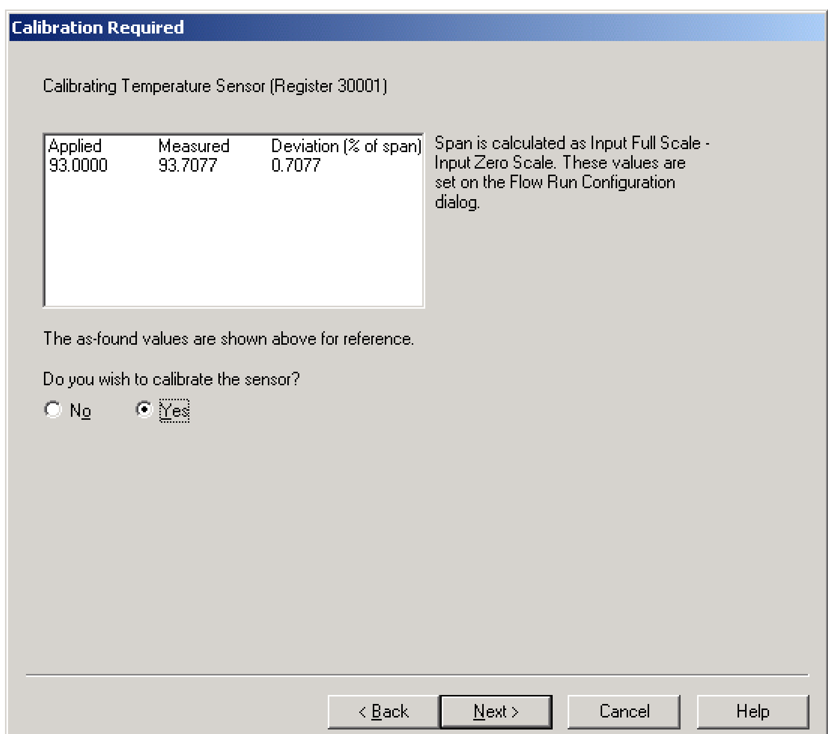
Realflo uses live values from the sensor when calibration is cancelled. Connect sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 3: Calibration Required

The as-found readings indicate if calibration is required. Examine the list of as-found readings. If the sensor is in need of calibration, select **Yes**. Otherwise select **No**.



As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The

measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

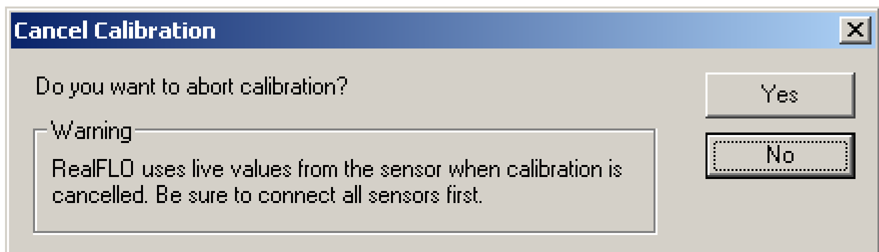
```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The **Next>** button proceeds to the next step.

The **Cancel** button is greyed and an as found reading needs to be recorded.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



⚠WARNING

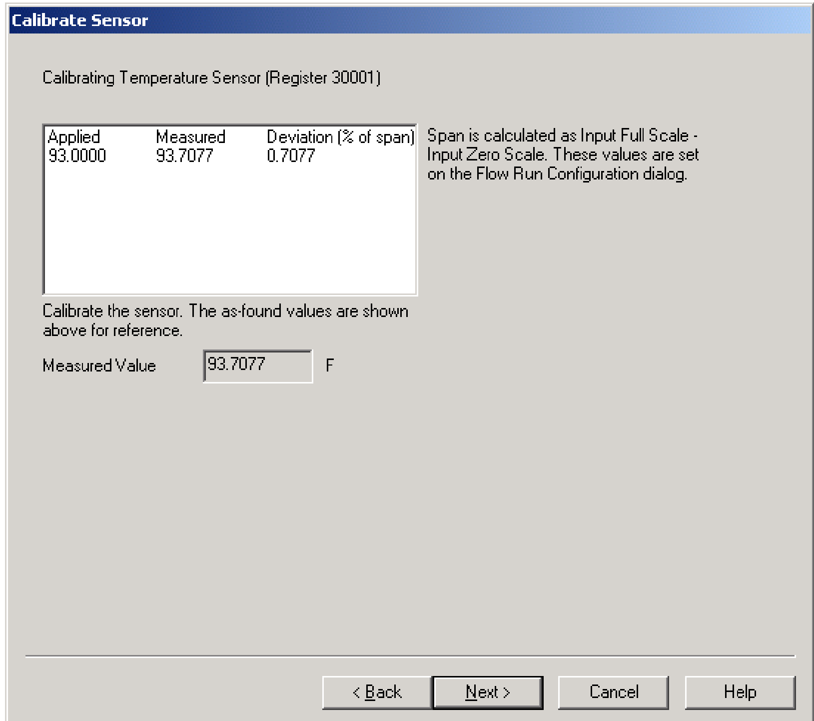
Realflo uses live values from the sensor when calibration is cancelled. Connect sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 4: Calibrate Sensor

This dialog aids you in calibrating a sensor by displaying the measured value from the sensor and the as-found readings.



Follow the procedure your company or the sensor supplier has set to calibrate the sensor. When the sensor calibration is complete, you may wish to check the as-left measurements that will be recorded in the next step.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

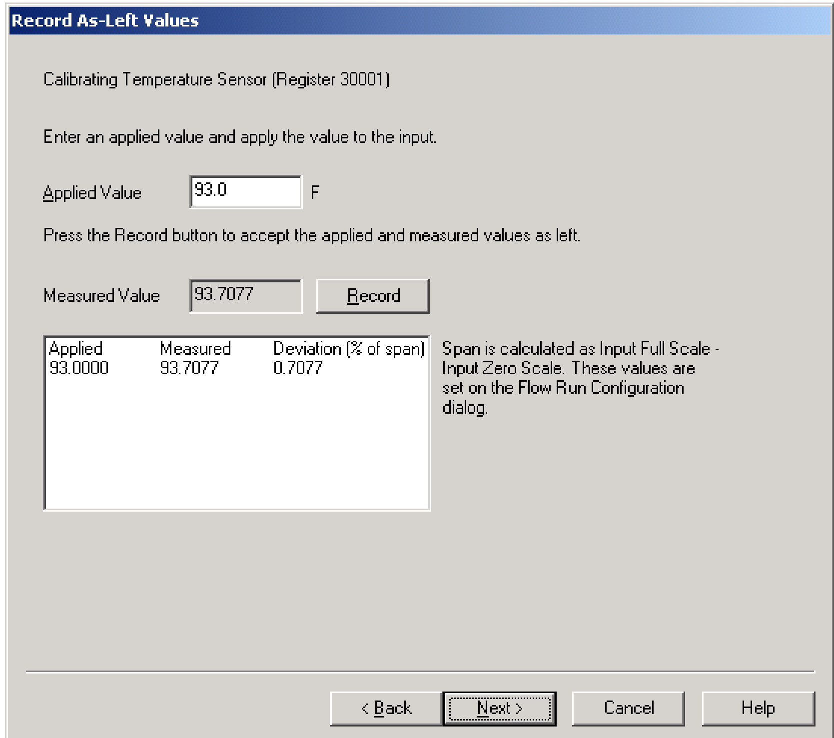
For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

Click on the **Next>** button when the calibration is complete.

Calibration Step 5: Record As Left Values

As-left readings indicate how the sensor was calibrated. These can be used to verify sensor calibration. Follow the procedure your company has set for taking as-left readings. You need to record at least one as-left reading.



To take as-left readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.
- Check the measured value from the process. When it has settled, click on the **Record** button to record an as-left reading.

Repeat the process to record additional readings.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

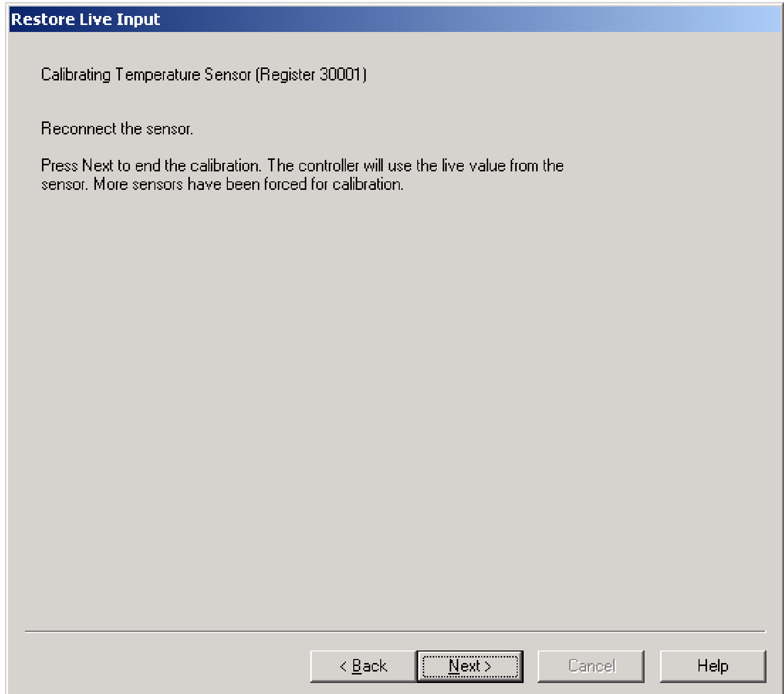
For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

- When required readings are taken, click on the **Next>** button.

Calibration Step 6: Restore Live Input

The sensors need to be reconnected to the process and the input hardware before calibration is complete. Reconnect sensors and verify connections are correct.

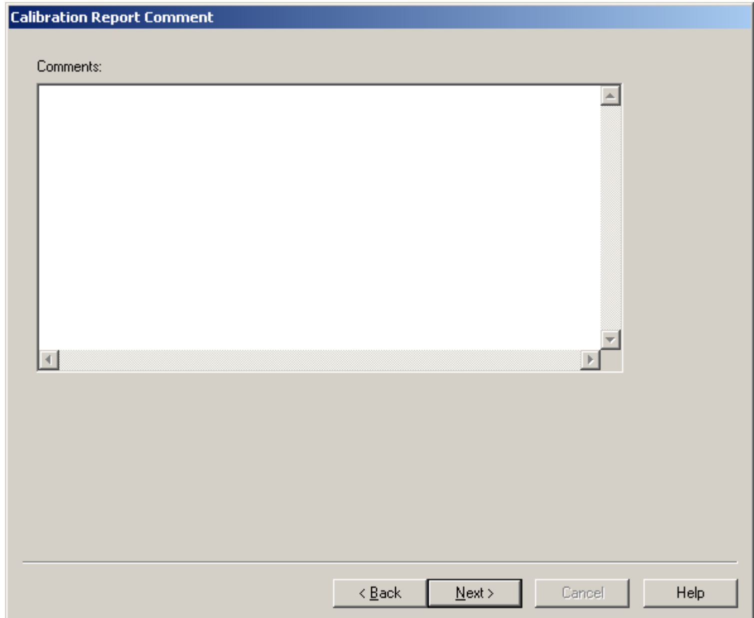


- Click on the **Next** button when the sensor is connected.

⚠WARNING
Realflo uses live values from the sensor when calibration is cancelled. Connect sensors first.

Calibration Step 6: Calibration Report Comment

Realflo creates, stores, and prints calibration reports for each calibration session performed. Comments may be added to the calibration report using the Calibration Report Comment dialog as shown below.

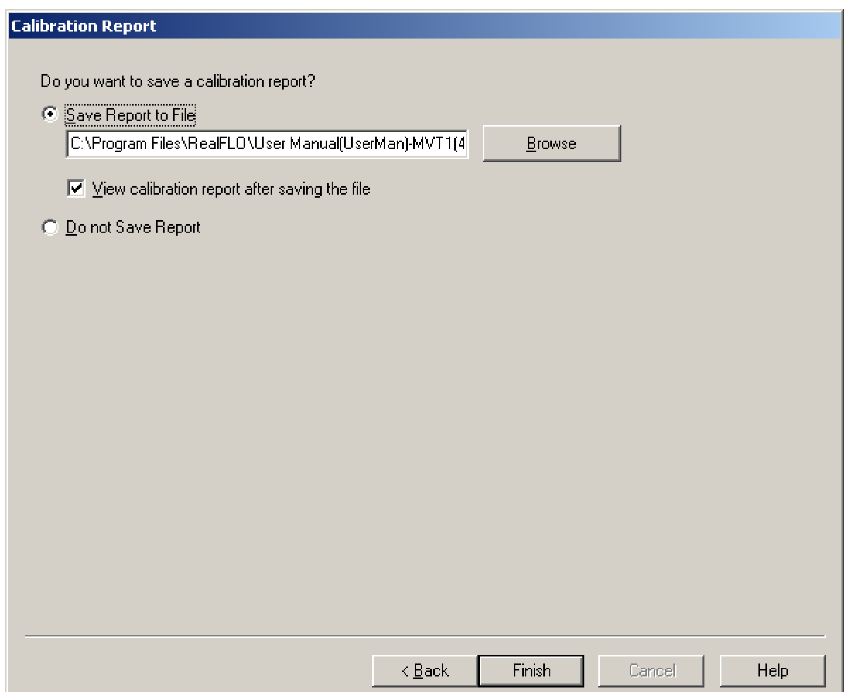


Enter any comments or leave the window blank.

- Click the **Next** button when completed entering comments.

Calibration Step 7: Calibration Report

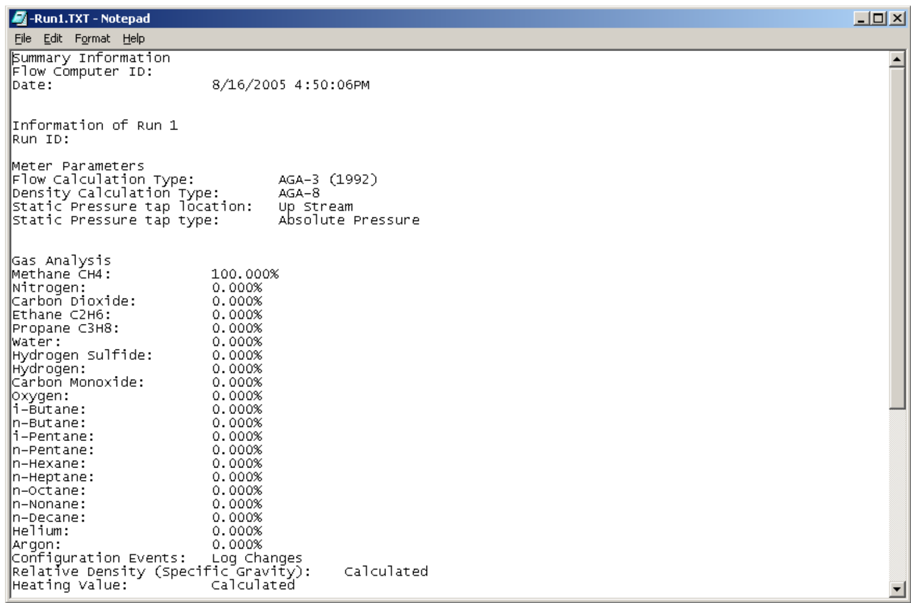
The Calibration Report dialog allows the saving of the calibration report.



- Select **Save Report to File** to save the report.

- Type the name of the report in the Save Report to File window. The default location and name are specified on the ***Calibration Report Options*** dialog.
- Select **Browse** to select a different file name.
- Check **View Calibration Report After Saving the File** to view the saved calibration report file. Default is checked.
- Select **Do not Save Report** to skip saving the calibration report.
- Click the Finis button to complete the calibration process.

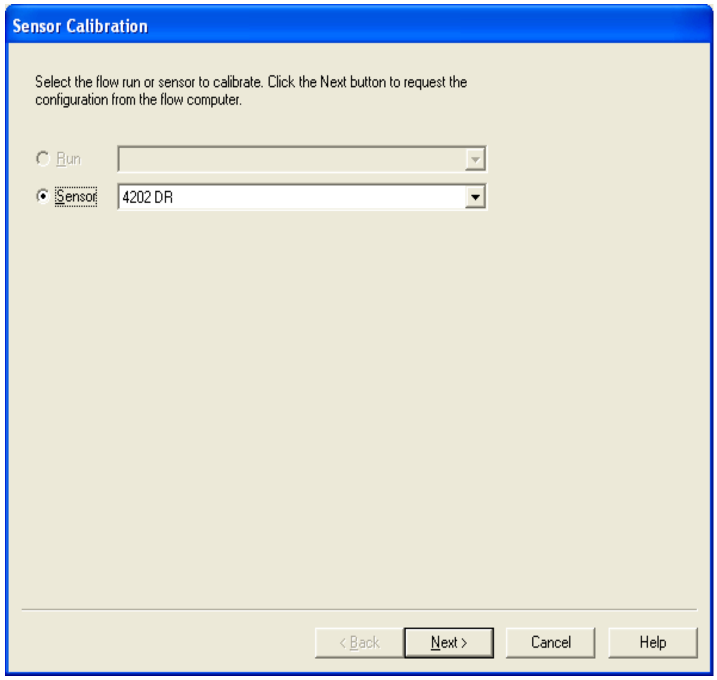
If selected the Calibration report will be displayed as shown below.




```
Summary Information
Flow Computer ID:
Date:                   8/16/2005 4:50:06PM


Information of Run 1
Run ID:

Meter Parameters
Flow Calculation Type:          AGA-3 (1992)
Density Calculation Type:       AGA-8
Static Pressure tap location:   Up Stream
Static Pressure tap type:       Absolute Pressure


Gas Analysis
Methane CH4:            100.000%
Nitrogen:               0.000%
Carbon Dioxide:         0.000%
Ethane C2H6:            0.000%
Propane C3H8:           0.000%
Water:                  0.000%
Hydrogen Sulfide:       0.000%
Hydrogen:               0.000%
Carbon Monoxide:        0.000%
Oxygen:                 0.000%
i-Butane:               0.000%
n-Butane:               0.000%
i-Pentane:              0.000%
n-Pentane:              0.000%
n-Hexane:               0.000%
n-Heptane:              0.000%
n-Octane:               0.000%
n-Nonane:               0.000%
n-Decane:               0.000%
Helium:                 0.000%
Argon:                  0.000%
Configuration Events:   Log Changes
Relative Density (Specific Gravity):    Calculated
Heating Value:          Calculated
```

Sensor Calibration Procedure

When the Sensor radio button is selected in the Sensor Calibration dialog the Sensor Calibration dialog is displayed.



The transmitter number, transmitter tag name, the communication port and the transmitter address associated with this sensor are displayed to aid you in determining which input you are calibrating.

- Check the **Calibrate Temperature Sensor** check box to select the temperature sensor for calibration. This will add the ***Temperature*** to the Calibration order list box.
- Check the **Calibrate Static Pressure Sensor** check box to select the static pressure sensor for calibration. This will add the ***Static Pressure*** to the Calibration order list box.
- Check the **Calibrate Differential Pressure Sensor** check box to select the differential pressure sensor for calibration. This will add the ***Diff. Pressure*** to the Calibration order list box.

The **Calibration Order** list displays the list of sensors to be calibrated. Sensors are calibrated in order from the top of the list.

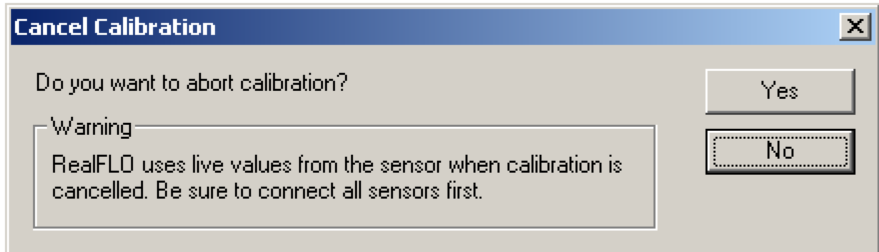
- Select **Move Up** button to move the specified item in the list up. The button is disabled if highlight item is on the top of the list or the list is empty.
- Select **Move Down** button to move the specified item in the list down. The button is disabled if highlight item is on the bottom of the list or the list is empty.

The **<Back** button is not enabled as this is the initial step.

The **Next>** button completes the selections and opens the Step 1: Force Value dialog.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



WARNING

Realflo uses live values from the sensor when calibration is cancelled. Connect sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

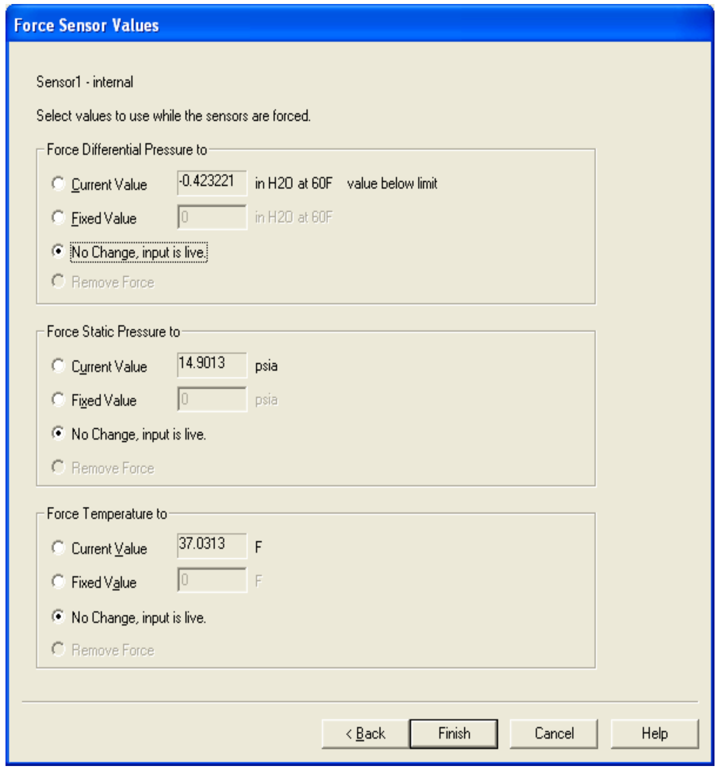
The **Help** button displays the online help file.

Calibration Step 1: Force Value

The flow calculations continue to execute while calibrating sensors. The sensor value needs to be forced to either the current value or a fixed value during calibration. This dialog lets you select the current value of the input or a fixed value of your choice.

If a sensor was forced before starting the execution of a calibration, the sensor will remain in a forced state after the calibration process is completed or even if the calibration process is cancelled before completion.

When more than one sensor is selected, they need to all be forced to a current or fixed value before any of the other steps are performed.



Select the value you wish to use, for each sensor, by clicking the appropriate radio button for each sensor.

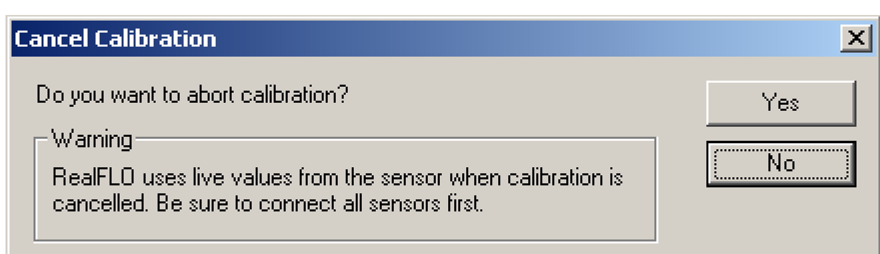
- Check the **Current Value** radio button to use the current value for the sensor.
- Check the **Fixed Value** radio button and enter a value to use for the calibration in the entry box.
- The **No Change** radio button will be selected if the value is currently forced. (You may still select one of the other two radio buttons if desired).

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

When the **Next>** button is pressed Realflo records the start of calibration for the sensor in the event log. The sensor input is forced. The sensor may now be disconnected from the process.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



WARNING

Realflo uses live values from the sensor when calibration is cancelled. Connect sensors first.

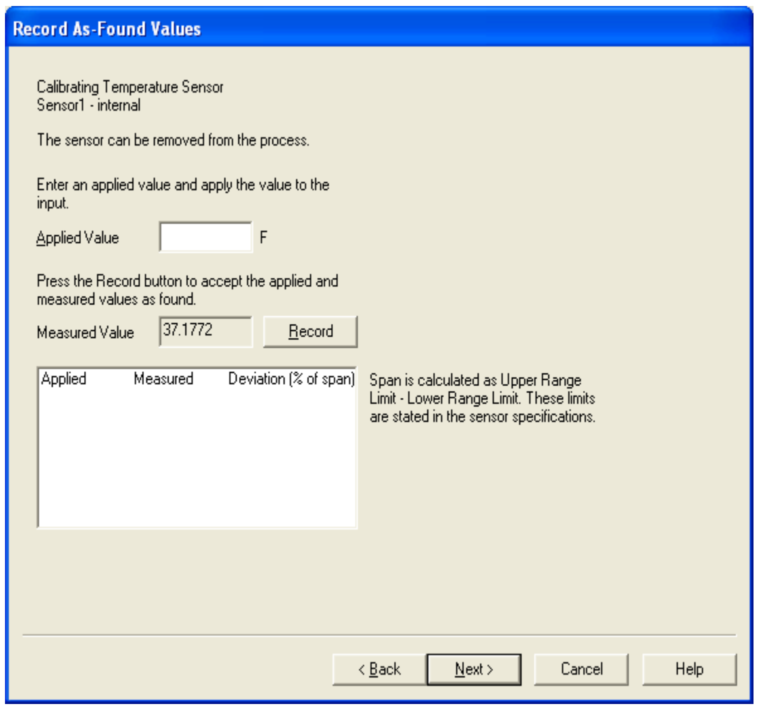
Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 2: Record As- Found Values

As-found readings indicate how the sensor was calibrated before adjustment. These can be used to correct flow measurement errors resulting from an out of calibration sensor. Follow the procedure your company has set for taking as-found readings. You need to record at least one as-found reading.

Realflo will record As Found values to the unit type selected for the meter run. If the units type for the meter run and the MVT are not the same then the MVT units are scaled to the meter run units.



To take as-found readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.
- Check the measured value from the process in the **Measured Value** box. When it has settled, click on the **Record** button to record an as-found reading.

Repeat the process to record additional readings.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The

measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For MVT Calibration the **deviation** is calculated as follows. The operating limits are read from the flow computer.

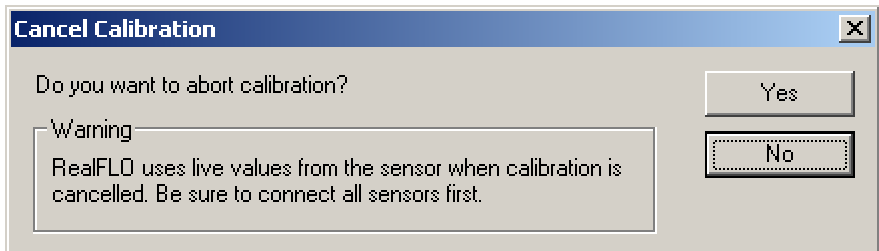
```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The **Next>** button proceeds to the next step.

The **Cancel** button is greyed and an as found reading needs to be recorded.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



⚠WARNING

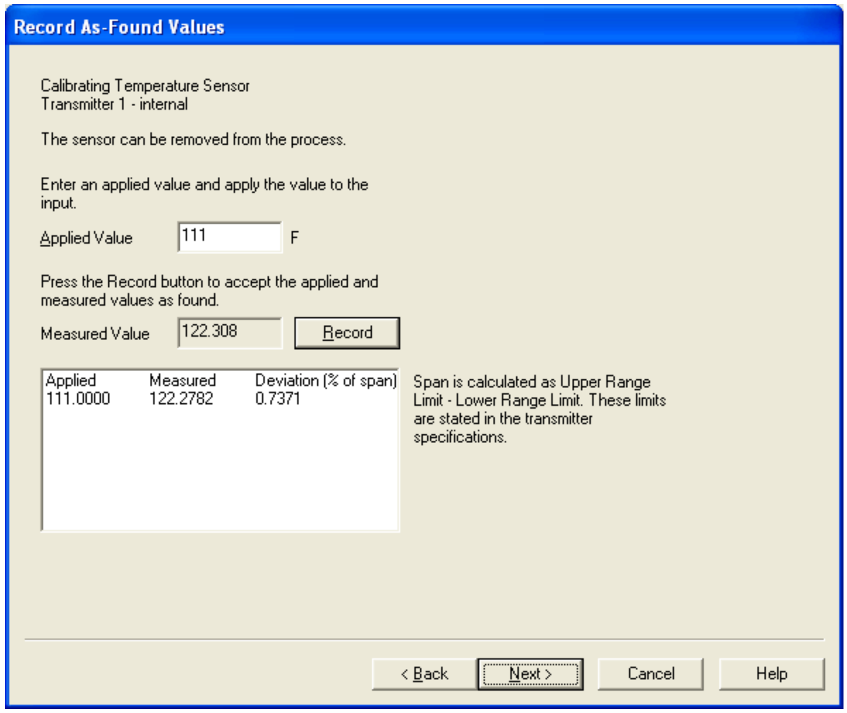
Realflo uses live values from the sensor when calibration is cancelled. Connect sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 3: Calibration Required

The as-found readings indicate if calibration is required. Examine the list of as-found readings. If the sensor is in need of calibration, select **Yes**. Otherwise select **No**.



As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

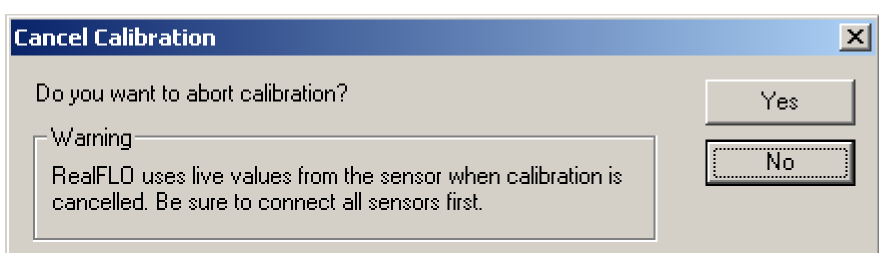
```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The **Next>** button proceeds to the next step.

The **Cancel** button is greyed and an as found reading needs to be recorded.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



⚠WARNING
Realflo uses live values from the sensor when calibration is cancelled. Connect sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

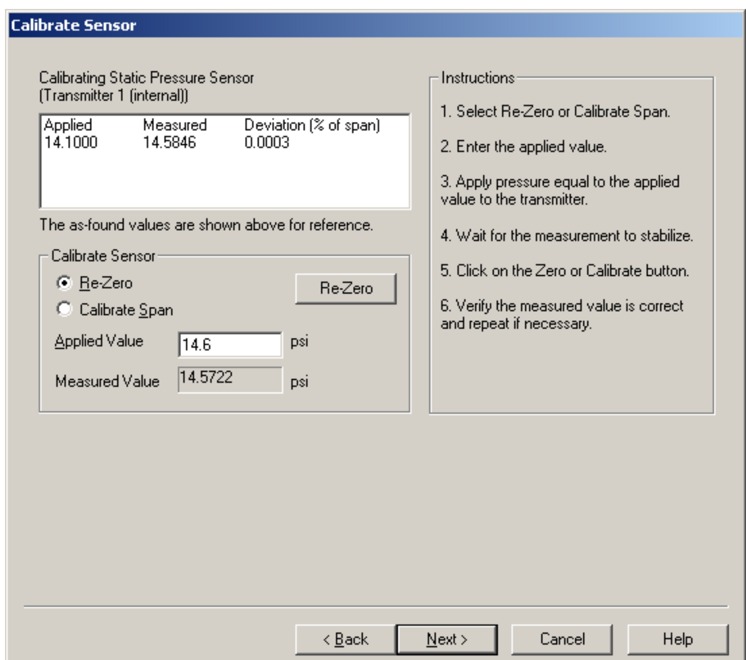
Calibration Step 4: Calibrate SCADAPack 4102, 4202, or 4203

Step three in the calibration procedure varies depending on the type of transmitter being calibrated. Use this section if you are calibrating a SCADAPack 4102, 4202 or 4203 transmitter. Use the Calibration Step 4: Calibrate 4101 for the SCADAPack 4101 transmitter and use Calibration Step 4: Calibrate 3905 for the 3095 transmitter.

This dialog aids you in calibrating a sensor by displaying the measured value from the sensor and the as-found readings.

Follow the procedure your company or the sensor supplier has set to calibrate the sensor. When the sensor calibration is complete, you may wish to check the as-left measurements that will be recorded in the next step..

- The Static Pressure can only have a span calibration performed if at least 5% of the rated pressure is applied.
- The RTD Zero can only be adjusted +/- 1% of the RTD upper limit, typically 8.5 degrees C, relative to the settings used when a reset sensor command was last issued.



The list box displays as-found values listed in the list of ***Record As-Found Values*** dialog.

The **Measured Value** displays the measured value from the sensor.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

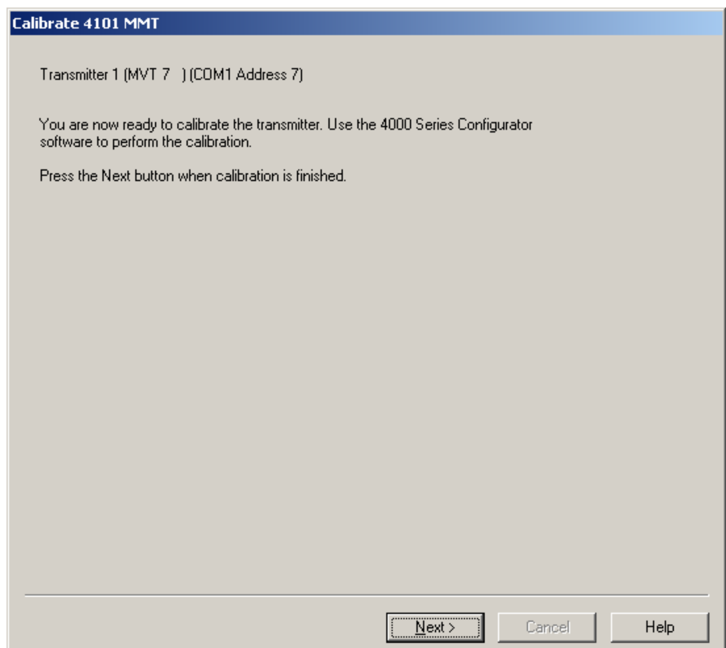
For MVT Calibration the deviation is calculated as follows. The operating limits are read from the flow computer.

```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

Calibration Step 4: Calibrate SCADAPack 4101

Step three in the calibration procedure varies depending on the type of transmitter being calibrated. Use this section if you are calibrating a SCADAPack 4101, 4202 or 4203 transmitter.

The as-found readings, for each sensor, will indicate if calibration is required for the sensor. You are prompted to use the SCADAPack 4000 Configurator application to perform the calibration. The SCADAPack 4000 Configurator software is installed from the Control Microsystems Hardware Documentation CD.



The **Next>** button proceeds to the next step.

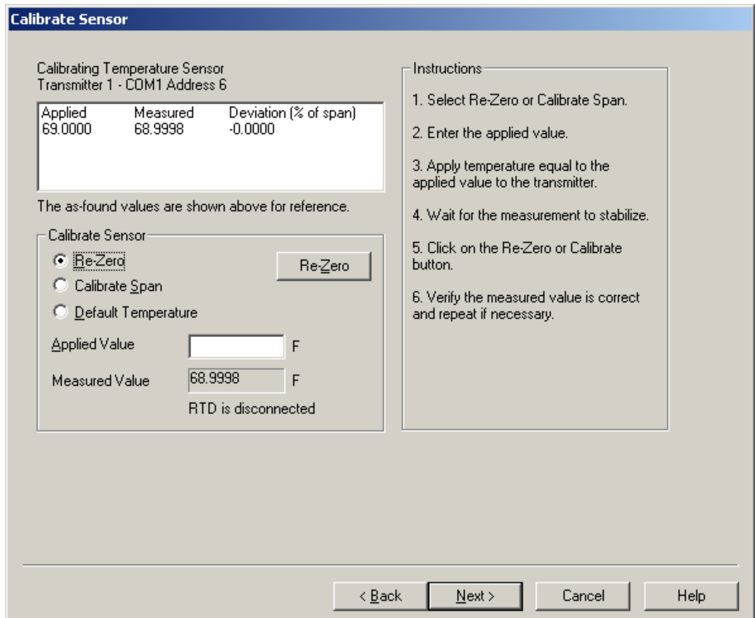
The **Help** button displays the online help file.

Calibration Step 4: Calibrate 3095 MVT

Step four in the calibration procedure varies depending on the type of transmitter being calibrated. Use this section if you are calibrating a 3095 MVT transmitter.

This dialog aids you in calibrating a sensor by displaying the measured value from the sensor and the as-found readings.

Follow the procedure your company or the sensor supplier has set to calibrate the sensor. When the sensor calibration is complete, you may wish to check the as-left measurements that will be recorded in the next step.



The list box displays as-found values listed in the list of ***Record As-Found Values*** dialog.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For MVT Calibration the deviation is calculated as follows. The operating limits are read from the flow computer.

```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

The Calibrate Sensor section of the Calibrate Sensor dialog displays the current calibration settings and selectable radio buttons for configuring the sensor calibration.

The Radio buttons enable the changing of the zero and span for the Temperature, Static Pressure and Differential Pressure sensors. For Temperature sensors, an additional radio button allows the user to fix the Temperature value in the event the temperature reading is outside the configured limits.

- Select the **Re-Zero** radio button to enable a new entry in the **Applied Value** field. This field displays the current zero value. The button is labeled **Re-Zero** if the **Re-Zero** radio button is selected. Clicking the **Re-Zero** button writes the zero applied value to the transmitter immediately.

- Select the **Calculate Span** radio button to enable a new entry in the **Applied Value** field. This field displays the current span value. The button is labeled **Calibrate** if the **Calibrate Span** radio button is selected. Clicking the **Calibrate** button writes the span applied value to the transmitter immediately.

When calibrating the temperature sensor you may select the **Default Temperature** radio button to enable a new entry in the **Applied Value** field. The button is labeled **Set** if the **Default Temperature** radio button is selected. The transmitter returns the fixed temperature value if the RTD is not working, or if the RTD is not connected. The valid range is –40 to 1200 °F or –40 to 648.89 °C. The default value is 60 °F or 15.56 °C. The new fixed temperature point is written to the transmitter immediately.

The **Measured Value** displays the measured value from the sensor.

Realflo records the points at which MVT calibration was performed in the event log.

Each time the **Re-Zero** button is clicked the following information is recorded.

Event Name	Target Re-zero Temperature
New Value	The applied value entered by the user
Previous Value	The measured value from the flow computer

Each time the **Calibrate** button is clicked the following information is recorded.

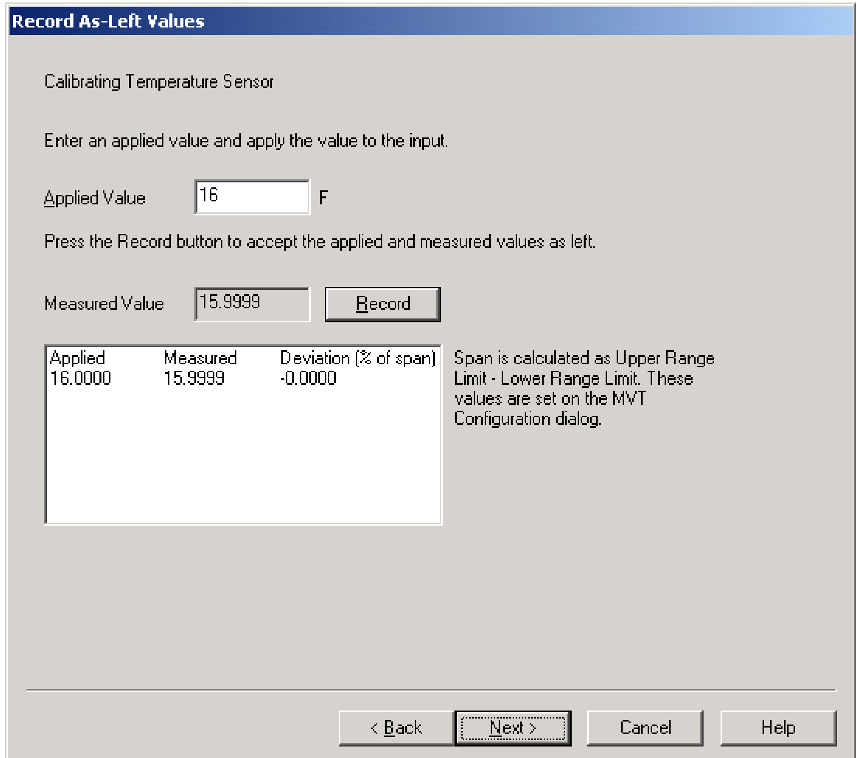
Event Name	Target Temperature Span
New Value	The applied value entered by the user
Previous Value	The measured value from the flow computer

Each time the **Set Default** button is clicked the following information is recorded.

Event Name	Set Default Temperature
New Value	The applied value entered by the user
Previous Value	The measured value from the flow computer

Calibration Step 4: Record As Left Values

As-left readings indicate how the sensor was calibrated. These can be used to verify sensor calibration. Follow the procedure your company has set for taking as-left readings. You need to record at least one as-left reading.



Realflo will record As Found values to the units type selected for the meter run. If the units type for the meter run and the MVT are not the same then the MVT units are scaled to the meter run units.

To take as-left readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.
- Check the measured value from the process. When it has settled, click on the **Record** button to record an as-left reading.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For MVT Calibration the deviation is calculated as follows. The operating limits are read from the flow computer.

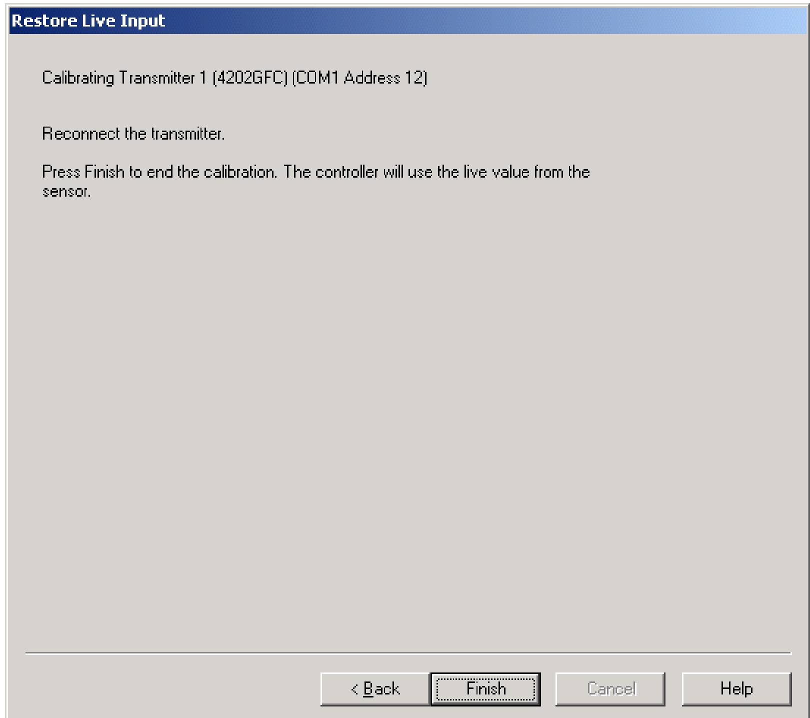
```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

Repeat the process to record additional readings.

- When required readings are taken, click on the **Next>** button.

Calibration Step 5: Restore Live Input

The sensors need to be reconnected to the process and the input hardware before calibration is complete. Reconnect sensors and verify connections are correct.

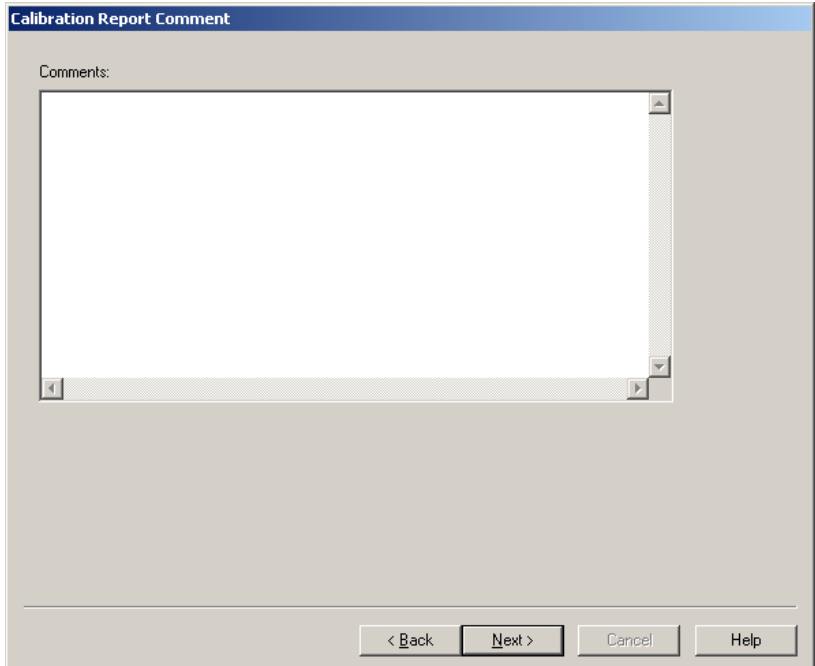


- Click on the **Finish** button when the sensor is connected.

WARNING
The live value from sensors is used as soon as the **Finish** button is clicked. Connect sensors first.

Calibration Step 6: Calibration Report Comment

Realflo creates, stores, and prints calibration reports for each calibration session performed. Comments may be added to the calibration report using the Calibration Report Comment dialog as shown below.

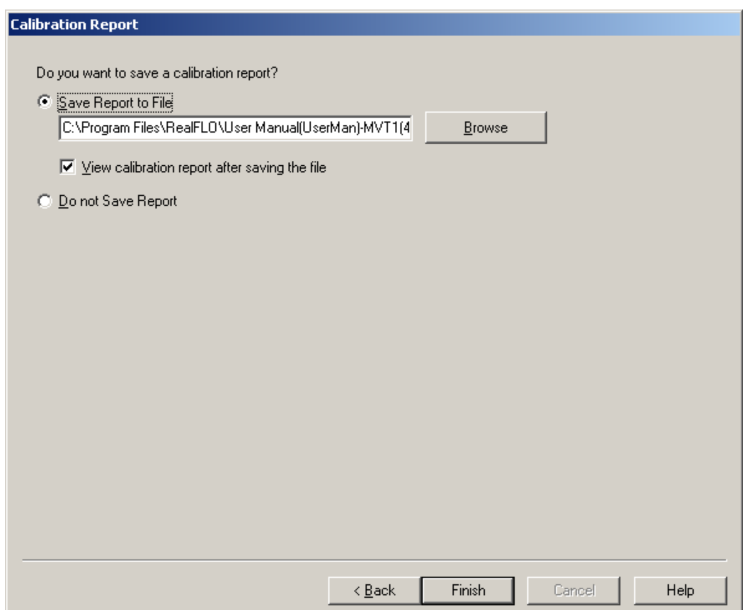


Enter any comments or leave the window blank.

- Click the **Next** button when completed entering comments.

Calibration Step 7: Calibration Report

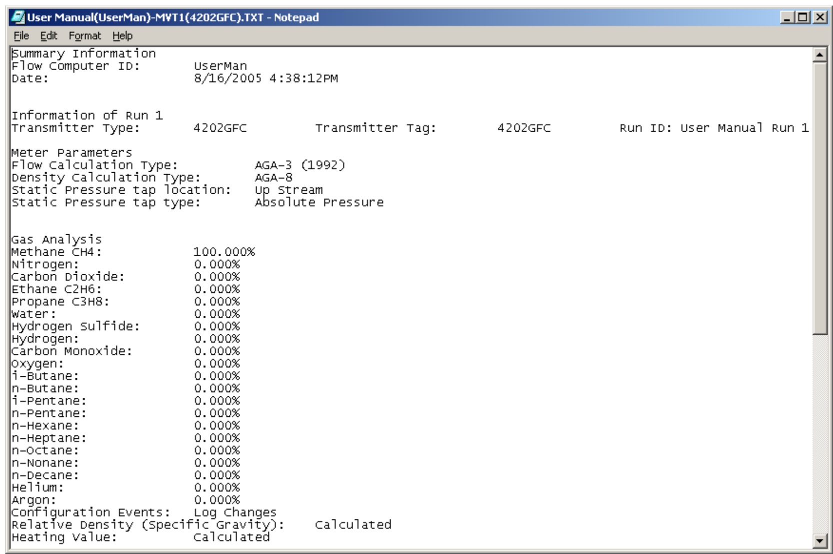
The Calibration Report dialog allows the saving of the calibration report.



- Select **Save Report to File** to save the report.

- Type the name of the report in the Save Report to File window. The default location and name are specified on the ***Calibration Report Options*** dialog.
- Select **Browse** to select a different file name.
- Check **View Calibration Report After Saving the File** to view the saved calibration report file. Default is checked.
- Select **Do not Save Report** to skip saving the calibration report.
- Click the Finis button to complete the calibration process.

If selected the Calibration report will be displayed as shown below.


User Manual(UserMan)-MVT1(4202GFC).TXT - Notepad
File Edit Format Help

```
Summary Information
Flow Computer ID:        UserMan
Date:                    8/16/2005 4:38:12PM


Information of Run 1
Transmitter Type:        4202GFC        Transmitter Tag:        4202GFC        Run ID: User Manual Run 1

Meter Parameters
Flow Calculation Type:          AGA-3 (1992)
Density Calculation Type:       AGA-8
Static Pressure tap location:   Up Stream
Static Pressure tap type:       Absolute Pressure


Gas Analysis
Methane CH4:             100.000%
Nitrogen:                0.000%
Carbon Dioxide:          0.000%
Ethane C2H6:             0.000%
Propane C3H8:            0.000%
Water:                   0.000%
Hydrogen Sulfide:        0.000%
Hydrogen:                0.000%
Carbon Monoxide:         0.000%
Oxygen:                  0.000%
i-Butane:                0.000%
n-Butane:                0.000%
i-Pentane:               0.000%
n-Pentane:               0.000%
n-Hexane:                0.000%
n-Heptane:               0.000%
n-Octane:                0.000%
n-Nonane:                0.000%
n-Decane:                0.000%
Helium:                  0.000%
Argon:                   0.000%
Configuration Events:    Log Changes
Relative Density (Specific Gravity):    Calculated
Heating Value:           Calculated
```

Change Orifice Plate

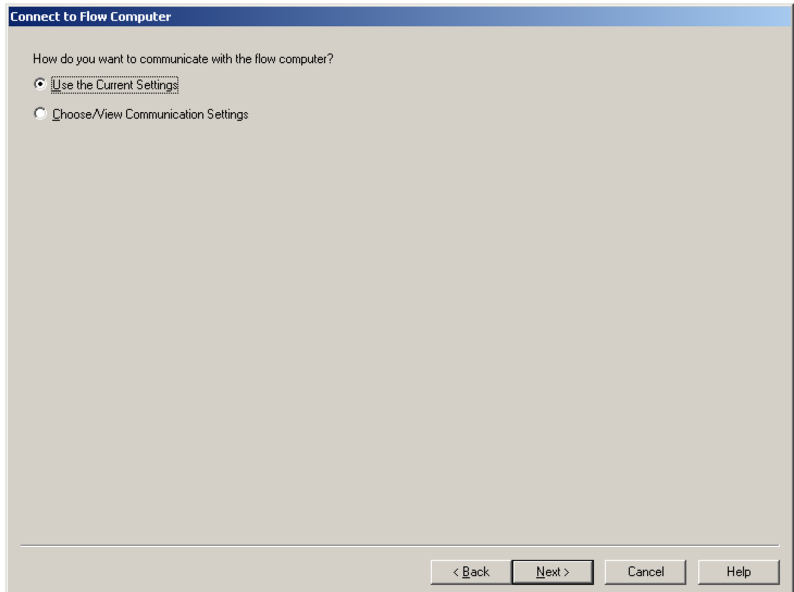
The Change Orifice Plate wizard enables the orifice plate to be changed for AGA-3 meter runs. This wizard supports Dual Chamber Orifice fittings and Singe Chamber Orifice fittings. This wizard will prompt you through the plate change procedure.

For each step in the wizard a dialog is presented to enter the parameters for the step. Each dialog contains four buttons to allow navigation through the wizard.

- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.
- **Cancel** cancels the operation and closes the wizard. Steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.
- **Help** opens the user manual.

Connect to Flow Computer

The connect to flow computer step defines the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two selections.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo. (The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are:

- COM 1 (serial port on the PC)
- 9600 baud
- no parity
- 8 Data bits
- 1 Stop bit

The default Modbus address Realflo will connect to is station 1.

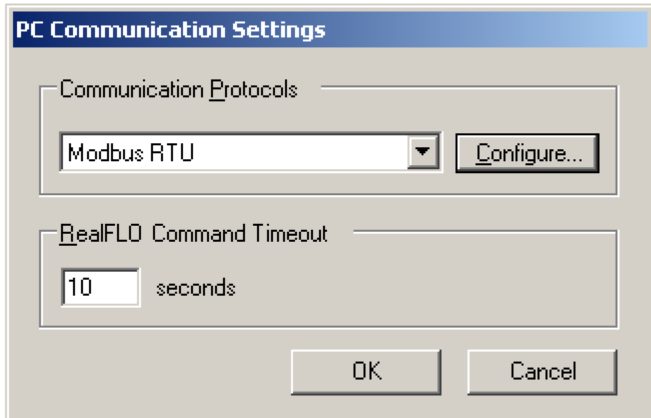
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click the **Next>** button to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

See the section **Communication** >> **PC Communication Settings Command** in the **Realflo Expert Mode Reference** section of this manual for complete details on the parameter settings in this dialog.

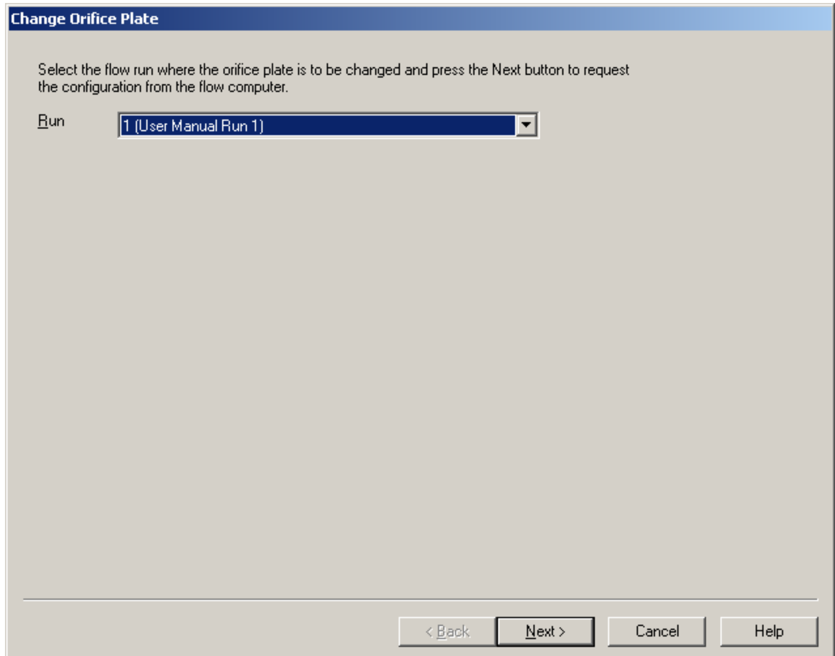
You need to know the communication settings for the connection to the flow computer to use this step.



- Once the communication settings have been selected click the **OK>** button to close the dialog and begin communication with the flow computer.

Select Meter Run

This step selects which meter run the orifice plate is to be changed.

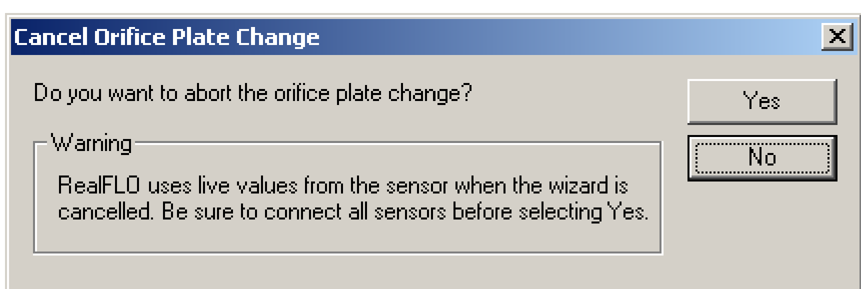


The **Run** dropdown selection displays runs using AGA –3 flow calculations. Select the run to change or inspect the orifice plate.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Next>** button completes the run selection and the wizard moves to the next step. This button is greyed if there are no flow runs configured to use the AGA-3 flow calculation.

The **Cancel** button aborts the plate change and displays the following message.



- Click **Yes** to abort the calibration.
- Click **No** to continue with the plate change. The default button is No.

WARNING
Realflo uses live values from the sensor when the plate change is cancelled.

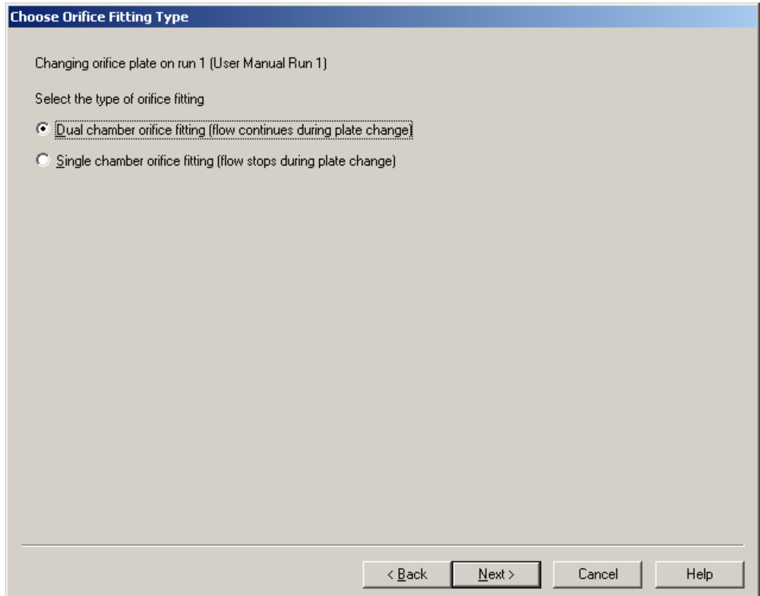
Connect sensors first.

Realflo does not erase any events from the flow computer when the plate change is cancelled. Realflo restores live values (ends forcing) when Cancel is clicked.

The **Help** button displays the online help file.

Choose Orifice Fitting Type Step

This page allows the user to select the type of orifice fitting.



Select **Dual Chamber Orifice Fitting** if a dual chamber fitting is present. Flow accumulation with estimated values will continue during the plate change.

Select **Singe Chamber Orifice Fitting** if a single chamber fitting is present. Flow accumulation will stop during the plate change.

The **Next** button moves to the next step.

- The next step is described in the section **Dual Chamber Orifice** if a dual chamber fitting is selected.
- The next step is described in the section **Single Chamber Orifice** if a single chamber fitting is selected.

The **Cancel** button closes the dialog and stops the plate change procedure.

The **Help** button displays the online Help file.

Dual Chamber Orifice

A dual chamber orifice allows the user to change, or inspect, the orifice plate without stopping the flow. These are generally large custody transfer sites where the orifice fitting is bypassed during the change or inspection procedure.

The Change Orifice Plate Command forces the Static Pressure, Differential Pressure and Temperature inputs to a fixed value during the orifice plate change or inspection procedure. This command is disabled if the Update Readings command is enabled. The flow is estimated during the procedure using the fixed values.

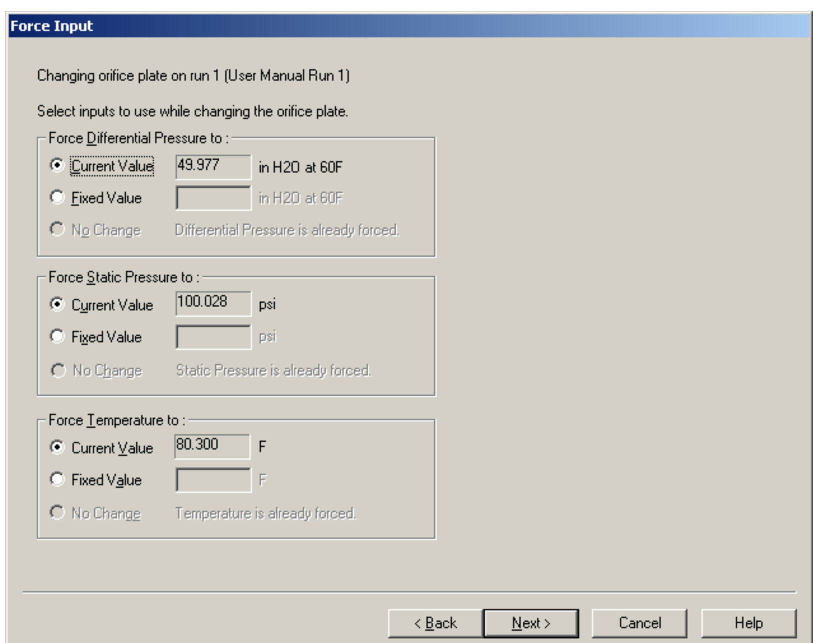
This command allows a user to place a flow run into estimation mode to allow an orifice plate to be changed or inspected. Changing the orifice plate involves the following steps.

- Set the estimated flow to be used during the orifice plate change by forcing inputs to fixed values.
- Change the orifice size.
- Complete the orifice plate change and resume normal flow measurement.

The Flow Computer ID is checked when the Change Orifice Plate command is selected. If the Flow Computer ID does not match the ID Realflo displays the message “ `The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file`.” The command is aborted.

Force Input Step

This step forces the flow run inputs. An estimated flow will be calculated while the plate change is in progress. The current values are updated every second.



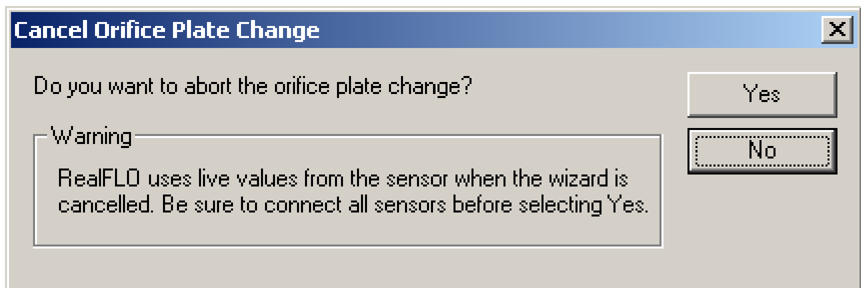
Select the value you wish to use, for each sensor, by clicking the appropriate radio button for each sensor.

- Check the **Current Value** radio button to use the current value for the sensor.
- Check the **Fixed Value** radio button and enter a value to use for the calibration in the entry box.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Next>** button completes the force inputs step and the wizard moves to the next step. Realflo records the start of the plate change procedure in the event log and forces the sensor inputs.

The **Cancel** button aborts the plate change and displays the following message.



- Click **Yes** to abort the calibration.
- Click **No** to continue with the plate change. The default button is No.

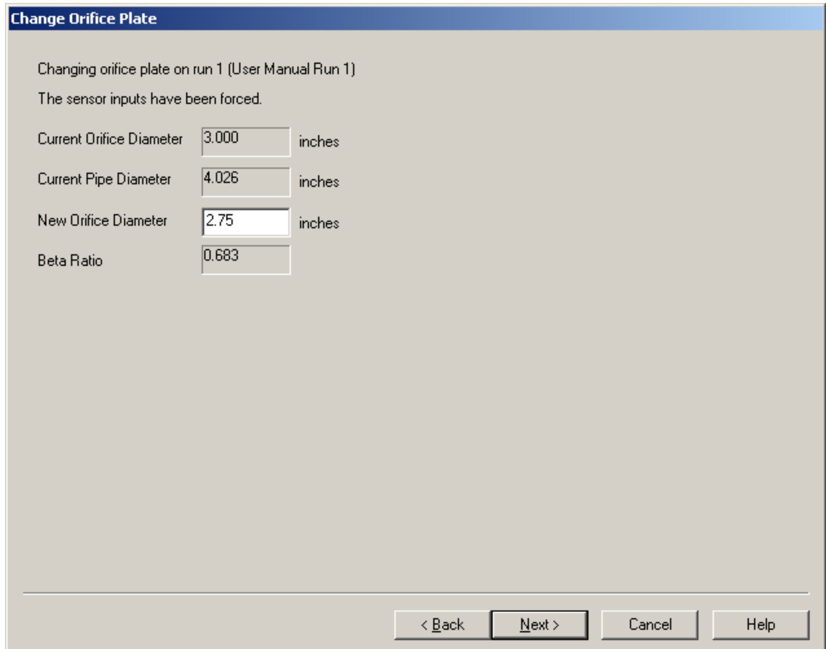
WARNING
Realflo uses live values from the sensor when the plate change is cancelled. Connect sensors first.

Realflo does not erase any events from the flow computer when the plate change is cancelled. Realflo restores live values (ends forcing) when Cancel is clicked.

The **Help** button displays the online help file.

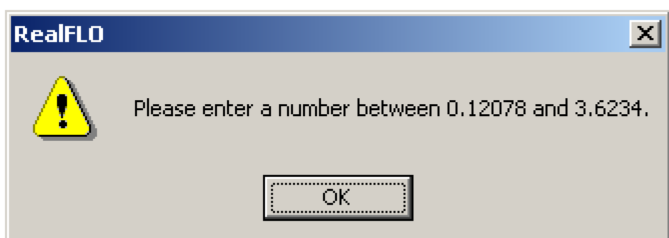
Change Orifice Plate Step

The orifice plate can now be changed. The forced inputs are used while the change is in progress. This dialog allows you to enter the new orifice plate diameter.



The **Current Orifice Diameter** and **Current Pipe Diameter** are displayed for reference.

Enter the new orifice size in the **New Orifice Diameter** entry box. If the diameter is not valid, Realflo displays the following a message box.



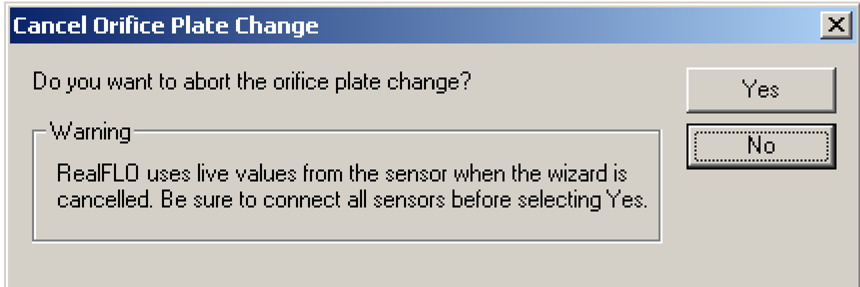
You need to enter a valid orifice diameter. Click the OK button to return to the Change Orifice dialog.

The **Beta Ratio** is calculated and displayed for orifice diameter changes.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Next>** button completes the change orifice step and the wizard moves to the last step.

The **Cancel** button aborts the plate change and displays the following message.



- Click **Yes** to abort the calibration.
- Click **No** to continue with the plate change. The default button is No.

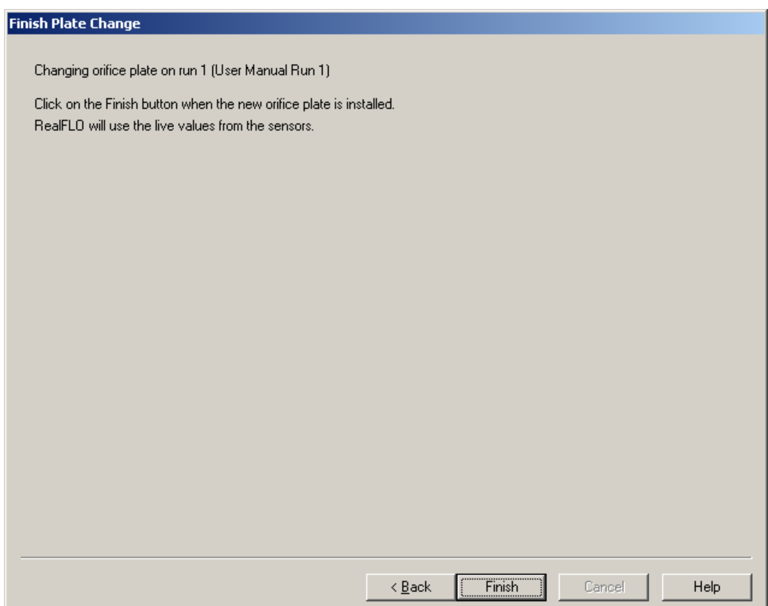
⚠ WARNING
Realflo uses live values from the sensor when the plate change is cancelled. Connect sensors first.

Realflo does not erase any events from the flow computer when the plate change is cancelled. Realflo restores live values (ends forcing) when Cancel is clicked.

The **Help** button displays the online help file.

Complete Orifice Plate Change

The Finish Plate Change is the last step in the Plate Change wizard.



The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Finish** button completes the orifice plate change wizard and closes the dialog. Realflo restores the sensor live values

The **Help** button displays the online help file.

Single Chamber Orifice

A single chamber orifice requires the flow be stopped while an orifice plate is changed.

The Change Orifice Plate command prompts the user to stop the flow before changing the plate and start the flow after changing the plate.

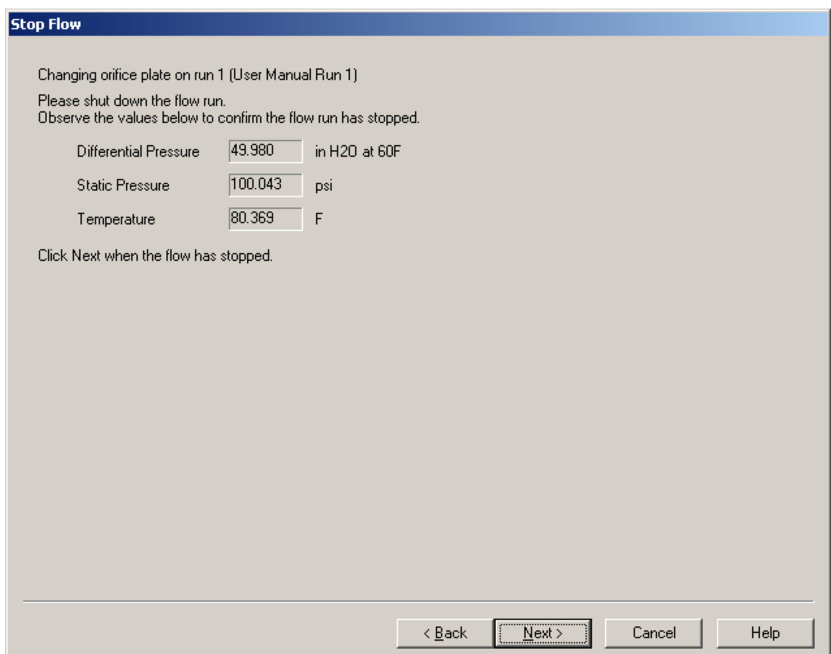
Changing the orifice plate involves the following steps.

- Confirm that flow has stopped.
- Change the orifice size.
- Complete the orifice plate change.

The Flow Computer ID is checked when the Change Orifice Plate command is selected. If the Flow Computer ID does not match the ID Realflo displays the message " `The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file`." The command is aborted.

Stop Flow Step

This step stops the flow run. The current inputs can be monitored while the flow is stopped.



The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

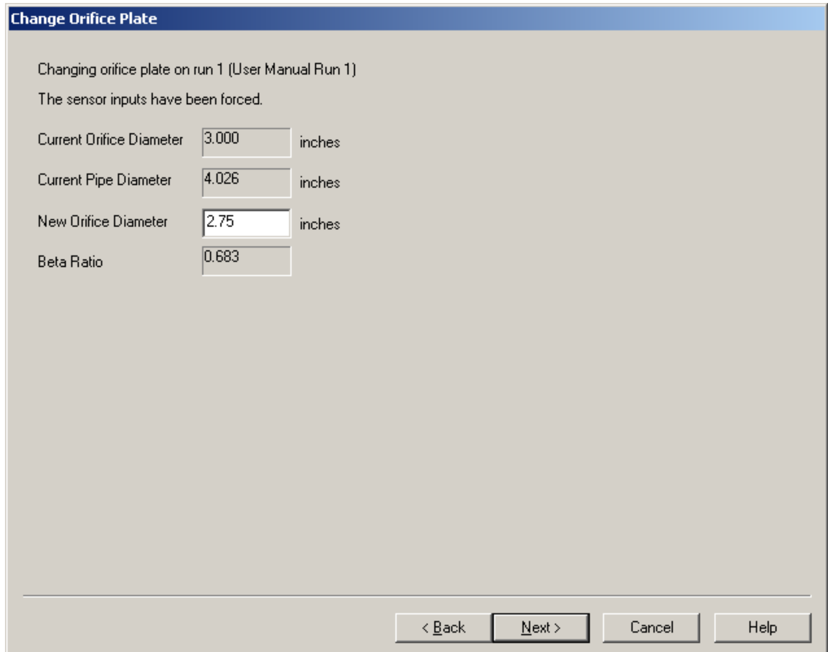
The **Next>** button completes the Stop Flow step and the wizard moves to the next step. Realflo records the start of the plate change procedure in the event log and forces the sensor inputs.

The **Cancel** button aborts the plate change and closes the wizard.

The **Help** button displays the online help file.

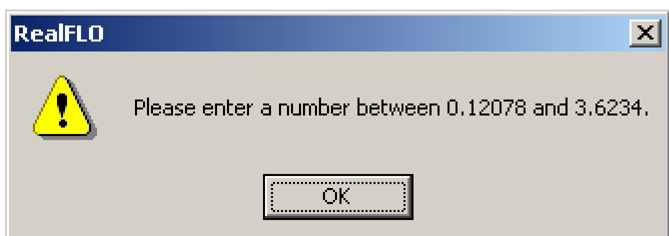
Change Orifice Plate Step

The orifice plate can now be changed. The forced inputs are used while the change is in progress. This dialog allows you to enter the new orifice plate diameter.



The **Current Orifice Diameter** and **Current Pipe Diameter** are displayed for reference.

Enter the new orifice size in the **New Orifice Diameter** entry box. If the diameter is not valid, Realflo displays the following a message box.



You need to enter a valid orifice diameter. Click the OK button to return to the Change Orifice dialog.

The **Beta Ratio** is calculated and displayed for orifice diameter changes.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up.

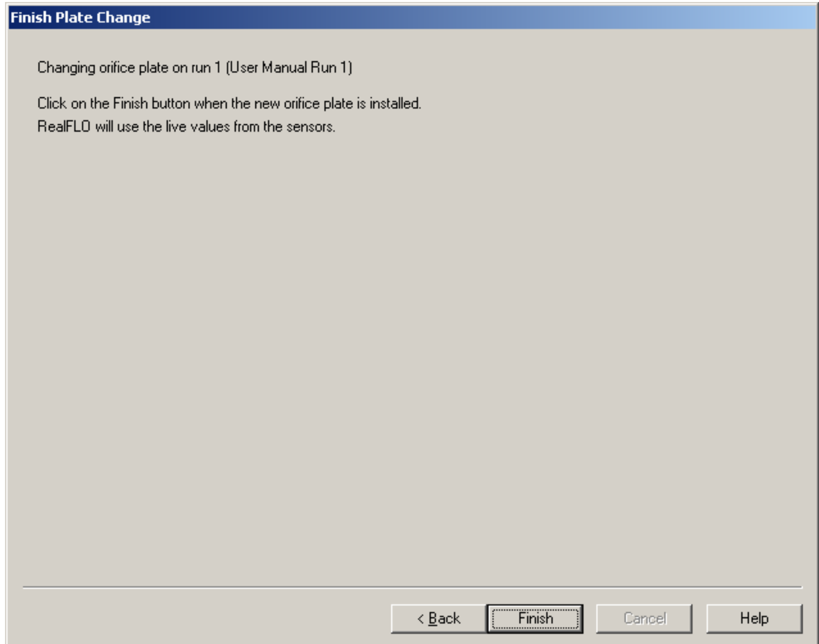
The **Next>** button completes the change orifice step and the wizard moves to the last step.

The **Cancel** button aborts the plate change and closes the wizard.

The **Help** button displays the online help file.

Complete Orifice Plate Change

The Finish Plate Change is the last step in the Plate Change wizard.



The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up.

The **Finish** button completes the orifice plate change wizard and closes the dialog. Realflo restores the sensor live values

The **Help** button displays the online help file.

Force Inputs

The Force Sensor wizard allows forcing and unforcing of the value of the temperature sensor, static pressure sensor, differential pressure sensor, or pulse counter input. Flow calculations continue to execute while sensors are forced.

The flow computer ID is checked when the Force Inputs command is selected. If the flow computer ID does not match the ID in the dialog Realflo displays the error message " `The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file.`" The command is aborted,

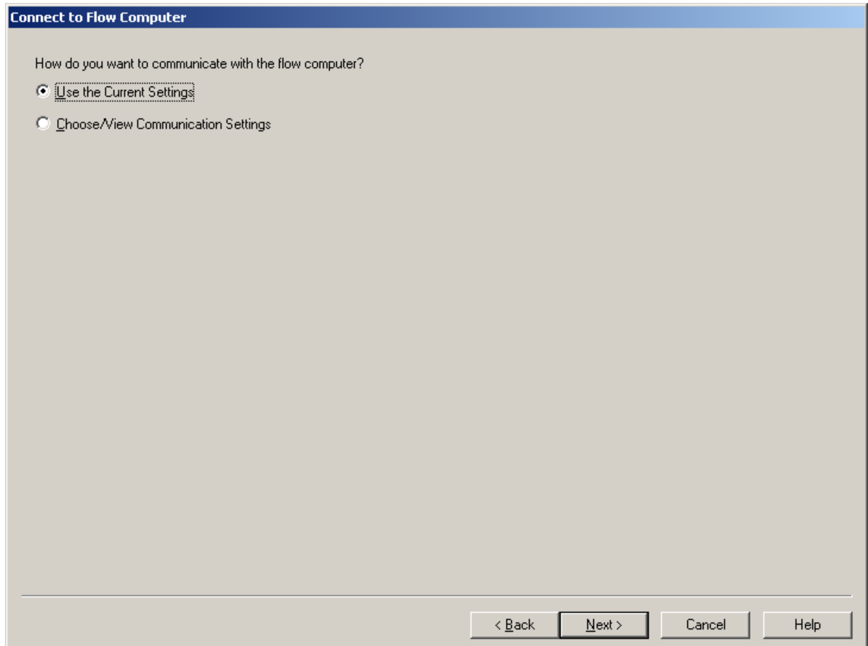
For each step in the wizard a dialog is presented to enter the parameters for the step. Each dialog contains four buttons to allow navigation through the wizard.

- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.
- **Cancel** cancels the operation and closes the wizard. Steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.

- **Help** opens the user manual.

Connect to Flow Computer

The connect to flow computer step defines the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two selections.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo. (The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are:

- COM 1 (serial port on the PC)
- 9600 baud
- no parity
- 8 Data bits
- 1 Stop bit

The default Modbus address Realflo will connect to is station 1.

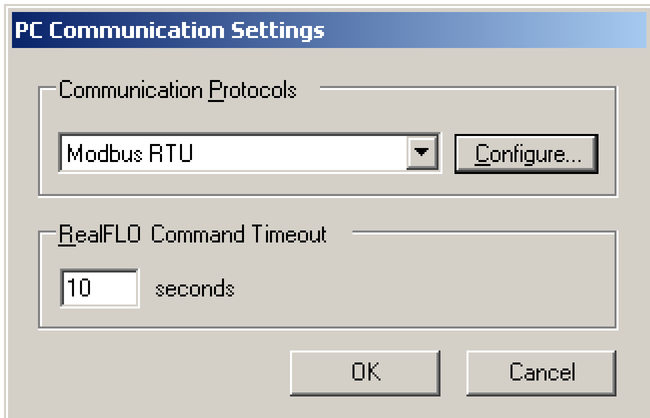
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click the **Next>** button to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

See the section **Communication** >> **PC Communication Settings Command** in the **Realflo Expert Mode Reference** section of this manual for complete details on the parameter settings in this dialog.

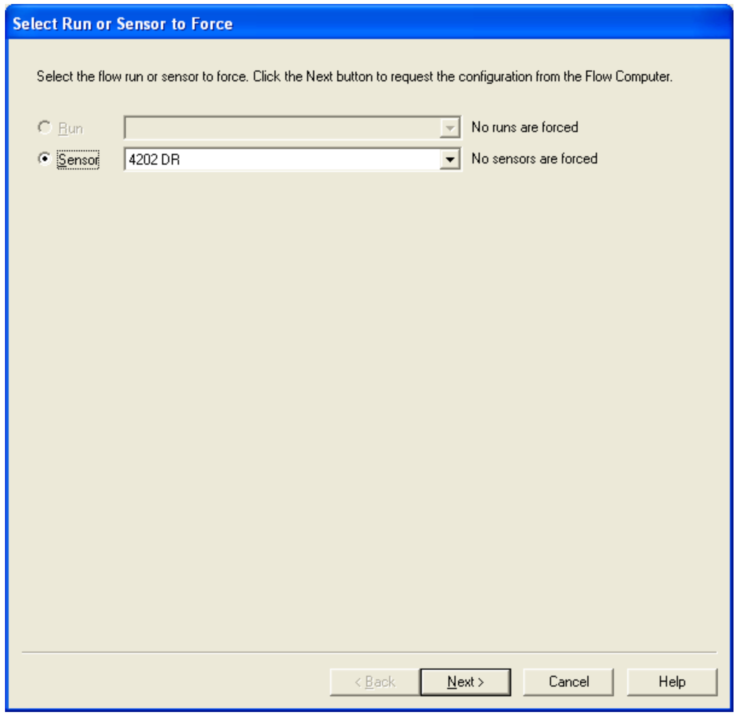
You need to know the communication settings for the connection to the flow computer to use this step.



- Once the communication settings have been selected click the **OK>** button to close the dialog and begin communication with the flow computer.

Select Run or Transmitter to Force

This step selects the run or transmitter to force.



Select **Run** to force the sensor inputs for a flow run using analog or pulse sensors. Select the run to be forced from the dropdown list. The Run controls are disabled if there are no runs using analog or pulse sensors.

See the section **Force Run Inputs** below for information on forcing Run inputs.

Select **Sensor** to force the inputs from an external transmitter. Select the sensor to be forced from the dropdown list beside it. The '**Sensor**" control is disabled if there are no transmitters configured.

See the section **Force Transmitter Sensor** Inputs below for information on forcing transmitter inputs.

The **Back** button is disabled, as this is the first step in the wizard.

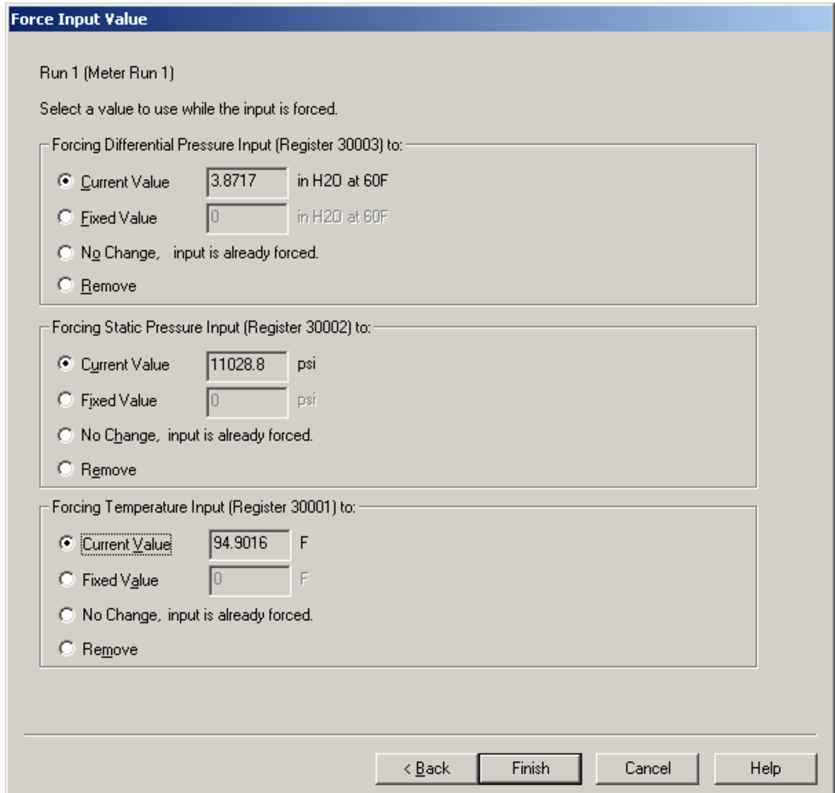
The **Next** starts the force procedure.

The **Cancel** closes the wizard.

The **Help** displays the online help file.

Force Run Inputs

When the Force Run is selected the Force Input Values dialog is displayed as shown below. The Force Input Values step selects the analog inputs of a flow run which will be forced or unforced. It displays the inputs that can be forced.



The Force Input Value dialog contains sections for Force Differential Pressure Input, Force Static Pressure Input and Force Temperature Input. When AGA-7 calculation type is used the dialog contains a section for Force Pulse Counter Input instead of Force Differential Pressure Input.

For each input the following parameters are available:

- Select **Current Value** to use the current value for the sensor. The current value is shown beside the control and updates continuously.
- Select **Fixed Value** to use a fixed value. Type the value in the edit box.
- Select **No Change, input is already forced** to leave the input in its current state. This is selected by default if the value is already forced. This is disabled if the input is not forced.
- Select **Remove** to remove the existing forcing. This button is disabled if the input is not forced.

The **Back** button moves back to the Select Run or Transmitter to Force step. Backing up does not erase events from the flow computer event log, or remove forcing from inputs previously processed.

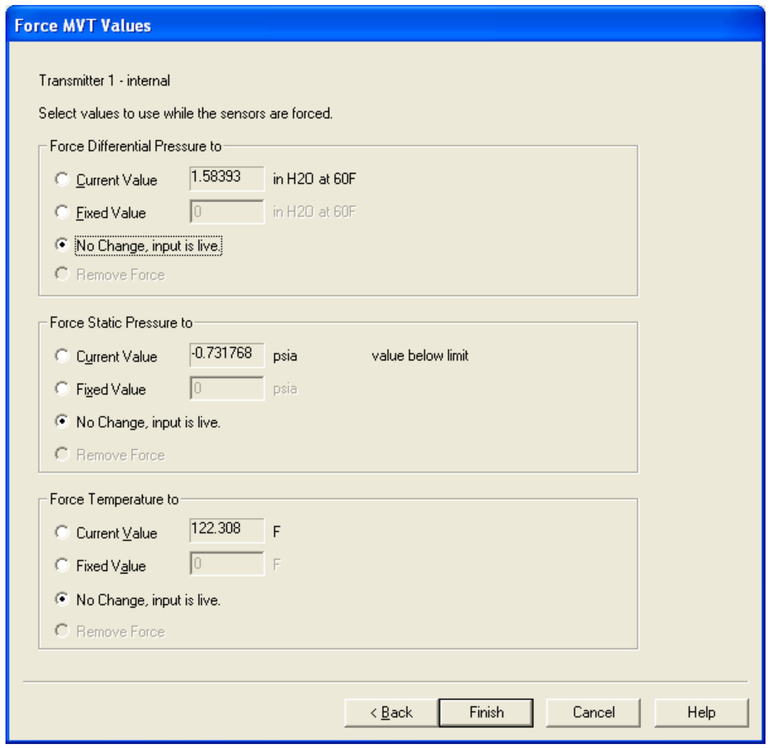
The **Finish** button completes the Force Input Value process and closes the dialog.

The **Cancel** button closes the wizard. This does not undo any changes. Any input that is already forced will remain forced.

The **Help** displays the online help file.

Force Sensor Inputs

This step shows the selected sensor inputs. The inputs can be forced to the current value or a fixed value, left as it is, or the forcing can be removed. The transmitter number, transmitter tag name, the communication port and the transmitter address associated with this sensor transmitter are displayed to aid you in determining which input you are forcing.



The Sensor Values dialog contains sections for Force Differential Pressure, Force Static Pressure and Force Temperature.

For each input the following parameters are available:

- Select **Current Value** to use the current value for the sensor. The current value is shown beside the control and updates continuously.
- Select **Fixed Value** to use a fixed value. Type the value in the edit box.
- Select **No Change, input is already forced** to leave the input in its current state. This is selected by default if the value is already forced. This is disabled if the input is not forced.
- Select **Remove Force** to remove the existing forcing. This button is disabled if the input is not forced.

If an input on a run is not forced currently, the initial (default value of the Fixed Value field) needs to be the default input value for the field. If the input type is a sensor and the Values on Sensor Fail field is set to use default value in the Run Configuration dialog.

The **Back** button moves back to the Select Run or Transmitter to Force step. Backing up does not erase events from the flow computer event log, or remove forcing from inputs previously processed.

The **Finish** button completes the Force Input Value process and closes the dialog.

The **Cancel** button closes the wizard. This does not undo any changes. Any input that is already forced will remain forced.

The **Help** displays the online help file.

The same transmitter can be used for more than one flow run. Realflo forces the value for each run.

Configuration

The Configuration section of the Realflo main page contains a ***View and Change Configuration*** button. Click the ***View and Change Configuration*** button to start the View and Change Configuration wizard. The wizard will lead you through the steps to connect to a flow computer and view and modify the configuration.

For each step in the wizard, a dialog is presented to enter the parameters for the step. Each dialog contains four buttons to allow navigation through the wizard.

View and Change Configuration Wizard

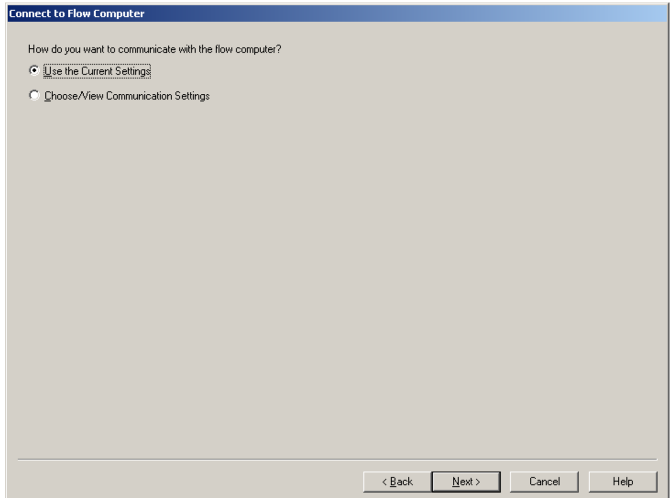
The View and Change Configuration wizard will lead you through the steps to connect to a flow computer and view and modify the configuration.

For each step in the wizard a dialog is presented to enter the parameters for the step. Each dialog contains four buttons to allow navigation through the wizard.

- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.
- **Cancel** cancels the operation and closes the wizard. Steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.
- **Help** opens the user manual.

Connect to Flow Computer

The connect to flow computer step defines the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two selections.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo. (The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are:

- COM 1 (serial port on the PC)
- 9600 baud
- no parity
- 8 Data bits
- 1 Stop bit

The default Modbus address Realflo will connect to is station 1.

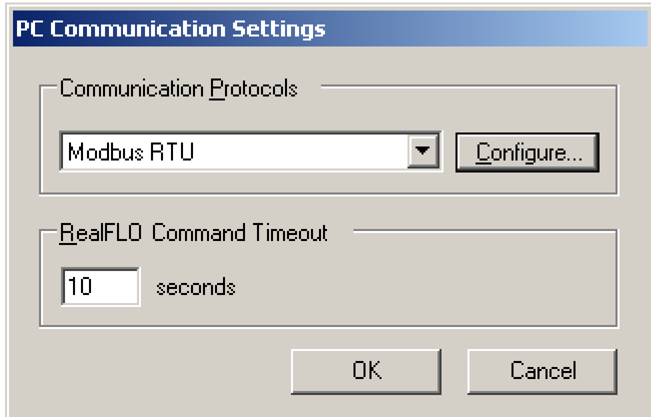
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click the **Next>** button to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

See the section **Communication** >> **PC Communication Settings Command** in the **Realflo Expert Mode Reference** section of this manual for complete details on the parameter settings in this dialog.

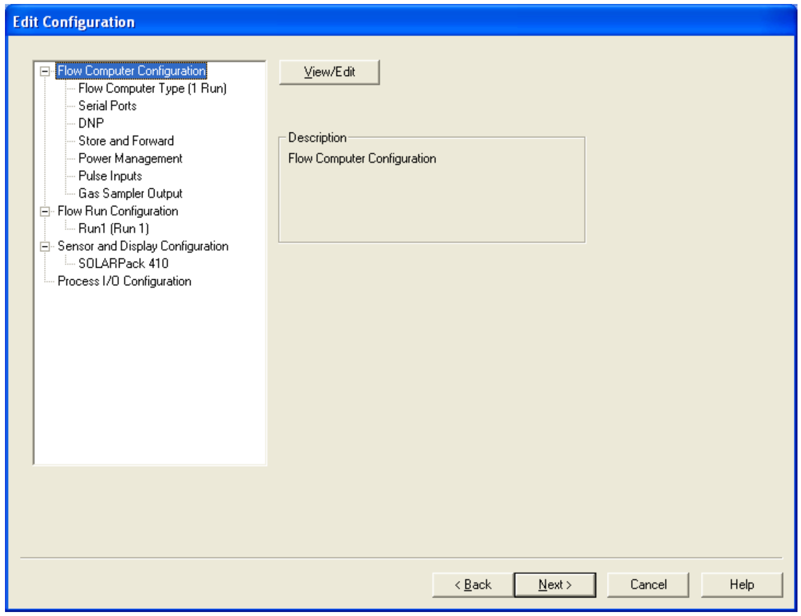
You need to know the communication settings for the connection to the flow computer to use this step.



- Once the communication settings have been selected click the **OK>** button to close the dialog and begin communication with the flow computer.

Edit Configuration

The Edit Configuration dialog allows the viewing and editing of the flow computer parameters.



The **Edit Configuration** dialog displays parameter types associated with a flow computer in the tree structure at the right side of the dialog.

The **Description** field displays an overview of each of the parameter types.

- Click on a parameter type and a short description of the parameter is displayed in the Description field.

The **View/Edit** button displays the configuration dialog for a selected parameter.

- Click on a parameter type to highlight it and then click the View/Edit button to open the configuration dialog for the parameter.

Parameters in the tree are completely described in other sections of this user manual. A list of the parameters and the location of the complete description is shown below.

Flow Computer Configuration

- For complete information on **Flow Computer Type** parameters refer to the **Realflo Expert Mode Reference>> Configuration Menu >> Setup** section.
- For complete information on **Serial Ports** parameters refer to the **Realflo Expert Mode Reference>> Configuration Menu >> Serial Ports** section of this user manual.
- For complete information on **Register Assignments** parameters refer to **Realflo Expert Mode Reference>> Configuration Menu >>Register Assignment** section of this user manual.
- For detailed information on **DNP** configuration refer to the **DNP** section.

Flow Run Configuration

- For complete information on **Flow Run Configuration** refer to the **Realflo Expert Mode Reference>> Configuration Menu >>Flow Run** section.

Sensor and Display Configuration

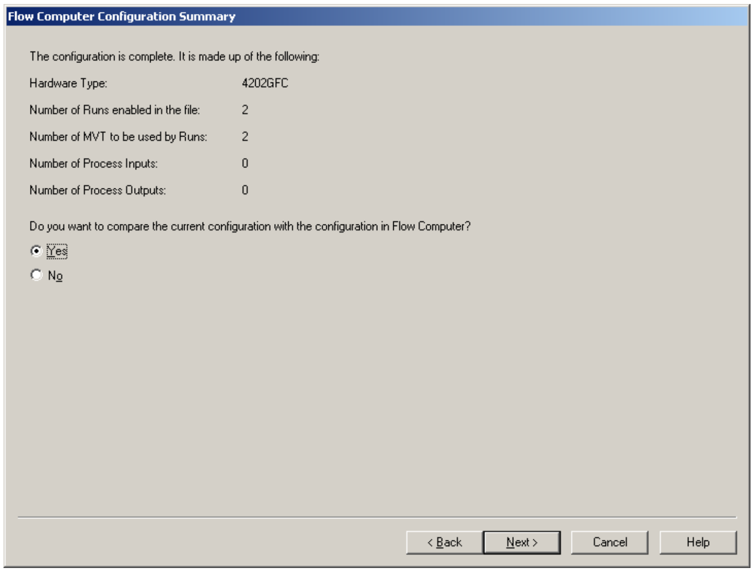
- For complete information on **Sensor and Display Configuration** refer to the **Realflo Expert Mode Reference>> Configuration Menu >>Sensor and Display** section.

Process I/O configuration

For complete information on **Process I/O Configuration** refer to the **Realflo Expert Mode Reference>> Configuration Menu >>Process I/O** section.

Flow Computer Configuration Summary

This step displays a summary of the flow computer settings.



A summary of the flow computer configuration is shown.

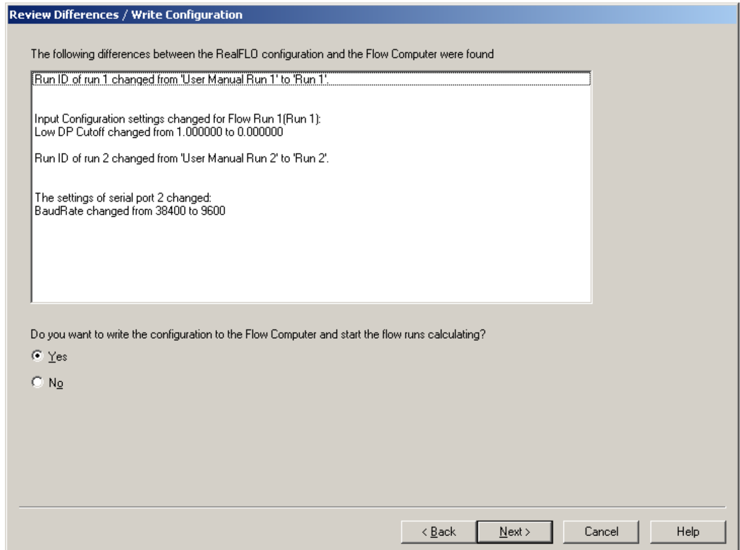
The current configuration can be compared with the configuration in the target flow computer.

Select **Yes** to compare the configurations. The next step is **Review Differences.**

Select **No** to not compare the configurations. The next step is **Save File.**

Review Differences

This step displays a summary of changes in the flow computer configuration. The user may select to write to the flow computer or not



A summary of the differences is the configuration is shown.

Select **Yes** to write the configuration to the flow computer. The configuration is written to the flow computer. The Start Executing command will be written for each flow run. The communication progress dialog shows the stages of writing.

Select **No** to write the configuration to the flow computer later.

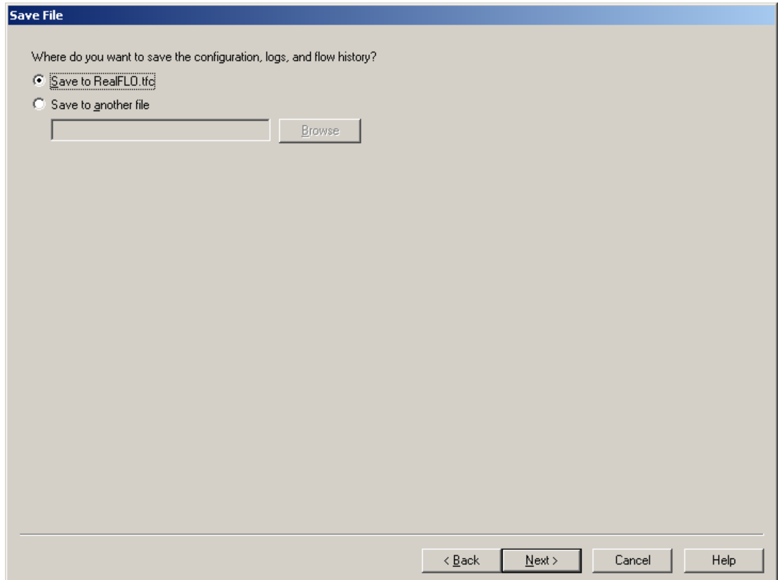
Click **Next** to perform the selected action.

In Flow Computer versions 6.73 and older, when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers. The Actual registers are not updated until a new Density calculation is started with the new values. The new values are not available to SCADA host software reading the Actual registers until a until a new Density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers and in the Actual registers. This allows a SCADA host to immediately confirm the new values were written to the flow computer. The new gas values are not used by the flow computer until a new density calculation is started.

Save File

This step selects where to save the configuration file.



Select the **Save to Realflo.tfc** to save the configuration file to the default file location.

Select the **Save to another file** to either enter a file name or use the Browse button to open the **Save As** dialog.

Switch to Expert Mode

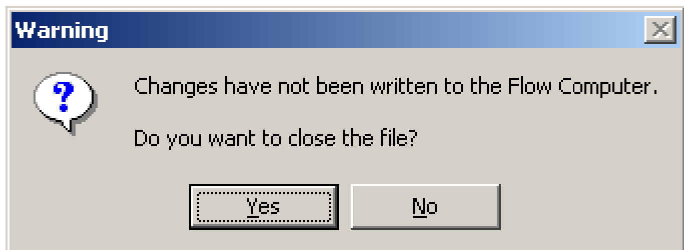
The Switch to Expert Mode button closes the Maintenance Mode window and opens the Expert Mode window. Files are not closed and connections to flow computers are not lost when the Switch to Expert Mode button is selected.

Realflo User Manual

The Realflo User Manual button opens this manual.

Exit Realflo

The Exit Realflo button closes Realflo. Realflo will display a message if any files are not saved or not yet written to the flow computer.



Realflo Expert Mode Reference

The Realflo display window is divided into the following areas. Each area is described in the following sections of this manual.

- **Display Window** on page **203**
- **File Menu** on page **210**
- **Edit Menu** on page **226**
- **View Menu** on page **243**
- **Configuration Menu** on page **260**
- **Communication Menu** on page **465**
- **Window Menu** on page **526**
- **Help Menu** on page **527**

User Interface Components

The **Title Bar** is located along the top of the Realflo window and contains application file information and window control functions.

The **Menu Bar** provides access to Realflo commands. This reference contains complete information on Realflo menu commands.

The **Tool Bar** is located below the Menu Bar and provides quick mouse access to many Realflo functions.

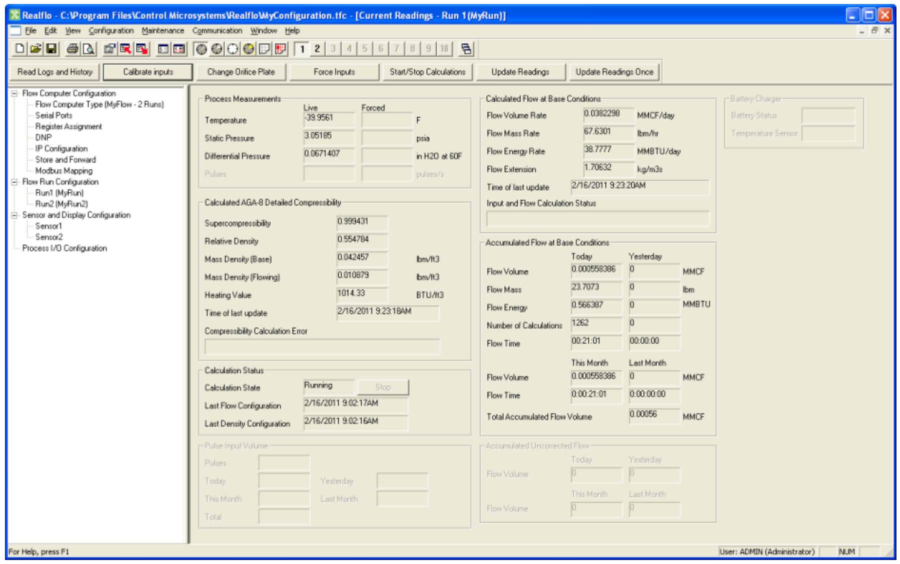
The **Maintenance Tool Bar** is a docking toolbar and provides single button access to flow computer maintenance functions.

The **Configuration Tool Bar** is a docking toolbar and provides a structured tree of flow computer configuration data.

The **Status Bar** is displayed across the bottom of the application window and describes actions of menu items as you use the arrow keys or mouse to navigate through menus.

Display Window

The Expert Mode display window is shown below.



Current Readings

The Current Readings view is divided into five sections:

The **Process Measurements** section displays the live and forced values for the flow calculation process inputs. The live values show the value read from the sensor. The forced values show the inputs to the flow calculation when they are forced. The Forced values are disabled when the input is live. The forced values are shown in red when the value is forced.

The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types. Process measurements not used by the flow calculation are disabled.

Forced values are not displayed for flow computers older than 6.0.

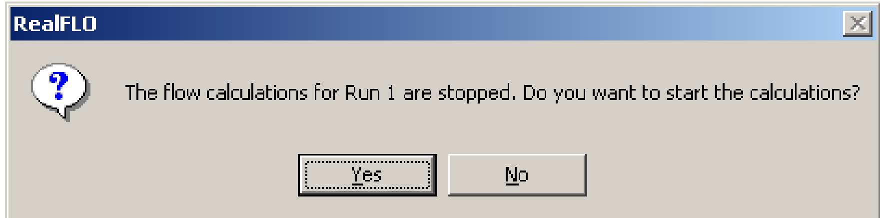
The **Calculated Compressibility** section displays the results of the compressibility calculation selected in the ***Input Configuration*** property page. The time of the last compressibility calculation update and any compressibility calculation errors are also displayed in this section. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

The **Calculation Status** section displays the Calculation State of the flow computer calculations for the run. Refer to the Calculation Control command in the Flow Computer menu for further information on flow calculation control. The Calculation State can be changed using the start or stop button beside the Calculation State display.

- When the Current Readings are being updated and the calculation is **stopped** or **not set** then the button is labeled **Start**.
- When the Current Readings are being updated and the calculation is **running** then the button is labeled **Stop**.
- When the Current Readings are not being updated the button is disabled and no text is displayed on it.

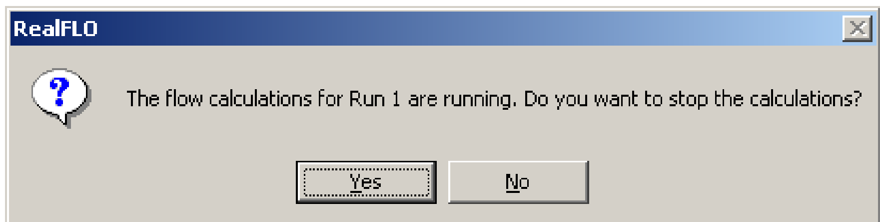
Click on the button to change the Calculation State.

If the calculations are stopped the following message box is displayed.



- If **Yes** is selected the flow calculations for the run are started.
- If **No** is selected the message box is closed and no further action is taken.

If the calculations are running the following message box is displayed.



- If **Yes** is selected the flow calculations for the run are stopped.
- If **No** is selected the message box is closed and no further action is taken.

The **Last Flow Configuration** displays the time stamp of the last time the flow configuration was changed.

The **Last Density Configuration** displays the time stamp of the last time the compressibility configuration was changed.

The Last Flow Configuration and Last Density Configuration values are not displayed for flow computers older than 6.0.

The **Calculated Flow at Base Conditions** displays the instantaneous Flow Volume Rate, Flow Volume Rate and Flow Energy Rate at base conditions. The Flow Extension is displayed when the run is configured for AGA-3 (1990) calculations. The Flow Product is displayed when the run is configured for AGA-3 (1990) calculations. The Uncorrected Volume is displayed when the run is configured for AGA-7 calculations. The time of the last flow calculation and any flow calculation errors are also displayed. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

The **Accumulated Flow at Base Conditions** section displays the accumulated flow at base conditions for the current contract day, the number of flow calculations and the flow time for the current contract day (Today) and the previous contract day (Yesterday). Data is copied from the current contract day (Today) to the previous contract day (Yesterday) at the end of the contract day, as measured by the real time clock. Data is not copied when a new day is started for other reasons. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

This section also displays the accumulated flow volume and flow time for the current month and the previous month. Data is copied from the current month (This Month) to the previous month (Last Month) at the end of the contract day at the end of the month, as measured by the real time clock.

The **Total Accumulated Flow at Base Conditions** section displays the total accumulated flow volume at base conditions. The accumulator holds a number between 0 and 999,999,999,999. It rolls over when the accumulated value is equal or greater than 1,000,000,000,000. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

The **Accumulated Uncorrected Flow** section displays the total calculated uncorrected flow volume (AGA-7 only) for the current contract day, the previous contract day, the current month and the last month.

Title Bar

The title bar is located along the top of a window. It contains the name of the application, Realflo, and the currently opened flow computer file. The current view and meter run are displayed in brackets. The title bar provides commands for control of the opened application and the window display.

To move the window, drag the title bar. You can also move dialog boxes by dragging their title bars.

The application control menu button is the Realflo icon in the upper left corner of the Realflo window. When selected the following commands are displayed.

Use the **Restore Command** to return the active window to its size and position before you chose the Maximize or Minimize command.

Use the **Move Command** to display a four-headed arrow so you can move the active window or dialog box with the arrow keys. This command is unavailable if you maximize the window. Using the mouse drag the window title bar to location required.

Use the **Size Command** to display a four-headed arrow so you can size the active window with the arrow keys. This command is unavailable if you maximize the window. Use the mouse to drag the size bars at the corners or edges of the window.

Use the **Minimize Command** to reduce the Realflo window or the view window to an icon. Use the mouse by clicking the minimize icon on the title bar.

Use the **Maximize Command** to enlarge the active window to fill the available space. Use the mouse by clicking the maximize icon on the title bar; or double-click the title bar.

Use the **Close Command** to close the active window or dialog box. Double-clicking a Control-menu box is the same as choosing the Close command. If you have multiple windows open for a single document, the Close command on the document Control menu closes only one window at a time. You can close all windows at once with the Close command on the File menu. Keyboard keys CTRL+F4 closes a document window and ALT+F4 closes the Realflo window or dialog box.

Use the **Next Window Command** to switch to the next open document window. Realflo determines which window is next according to the order in which you opened the windows. Use the keyboard keys CTRL+F6.

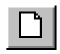
Use the **Previous Window Command** to switch to the previous open document window. Realflo determines which window is previous according to the order in which you opened the windows. Use the keyboard keys SHIFT+CTRL+F6.

Standard Toolbar

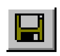
The Standard toolbar is displayed across the top of the application window, below the menu bar. The toolbar provides quick mouse access to many tools used in Realflo.

To hide or display the Toolbar, choose **Toolbar** from the **View** menu.

The following commands and functions are displayed on the Toolbar.


Create a new file


Open an existing file. Realflo displays the Open dialog box, in which you can locate and open the desired file.


Save the active file with its current name. If you have not named the document, Realflo displays the Save As dialog box.


Print data from the active view.


View data as it would be printed.


Edit Flow Computer configuration.

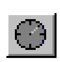

Edit Flow Computer configuration.

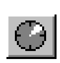

Read configuration from controller.

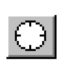

Write configuration to the controller.


Enable/Disable updating of Current Readings view.


Read Logs/History from Flow Computer for the meter run.

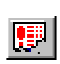

Display the Current Readings view for the meter run.


Display the Hourly History view for the meter run.

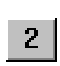

Display the Daily History view for the meter run.


Display the Hourly Gas Quality History view for the meter run.

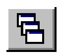

Display the Event Log view for the meter run.


Displays the Alarm Log view for the meter run.

Show Run 1 in the current view. The view type is not changed.



Show Run 2 in the current view. The view type is not changed.

3	Show Run 3 in the current view. The view type is not changed.
4	Show Run 4 in the current view. The view type is not changed.
5	Show Run 5 in the current view. The view type is not changed.
6	Show Run 6 in the current view. The view type is not changed.
7	Show Run 7 in the current view. The view type is not changed.
8	Show Run 8 in the current view. The view type is not changed.
9	Show Run 9 in the current view. The view type is not changed.
10	Show Run 10 in the current view. The view type is not changed.
	Select whether all views or only the current view are affected by the Run 1, Run 2 and Run 3 commands.

The toolbar may:

- Remain stationary along one side of its parent window;
- Be dragged and docked, or attached, by the user to any side or sides of the parent window you specify;
- Be floated, or detached from the frame window, in its own mini-frame window so the user can move it around to any convenient position; and
- Be re-sized while floating.

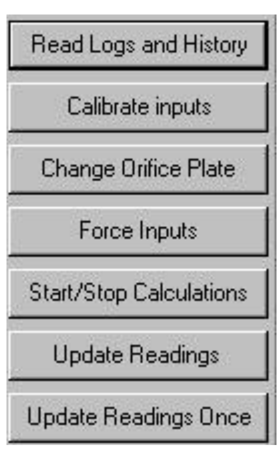
To move the toolbar, click on the background of the toolbar. Drag the toolbar to the new location and release the mouse button.

Maintenance Toolbar

The maintenance toolbar organizes the maintenance operations together.

The maintenance toolbar is a docking toolbar. Its initial position is below the main toolbar. You can move it, undock it, or hide it.

The following commands and functions are displayed on the toolbar.



The Maintenance Toolbar may:

- Remain stationary below the main toolbar;
- Be dragged and docked, or attached, to either side of the parent window;
- Be floated, or detached from the frame window, in its own mini-frame window so the you can move it around to any convenient position; and
- Be resized while floating. The button layout automatically changes as the toolbar is resized.

To move the toolbar, click the title bar of the toolbar. Drag the toolbar to the new location and release the mouse button.

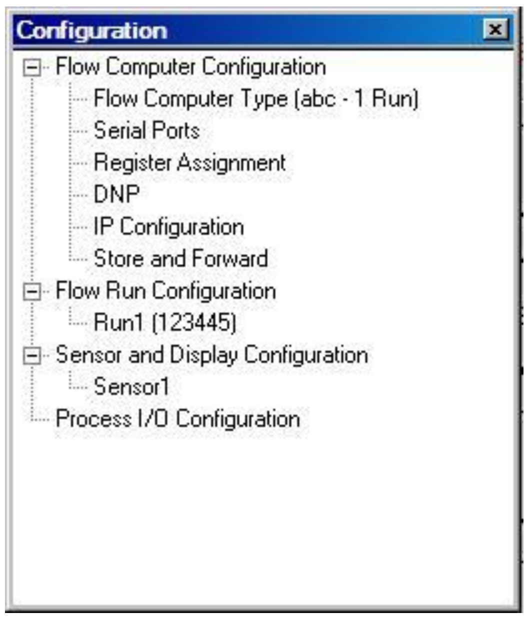
The toolbar can be enabled or disabled from the View menu. A check mark appears next to the menu item when the Maintenance Toolbar is displayed.

Configuration Toolbar

The configuration toolbar organizes configuration data in one place.

The configuration toolbar is a docking toolbar. Its initial position is on the left side of the Realflo window. You can move it, dock it, or hide it. or hidden by the user.

The configuration toolbar contains a tree of configurable items. Leaves are grouped under nodes. Double-clicking a leaf will open the dialog or property sheet for the item.



The toolbar may:

- Remain stationary along one side of its parent window;
- Be dragged and docked, or attached, by the user to either side of the parent window you specify;
- Be floated, or detached from the frame window, in its own mini-frame window so the user can move it around to any convenient position; and
- Be re-sized while floating.

To move the toolbar, right click anywhere in the toolbar and select Allow Docking. The toolbar can be moved to a new location.

To close the toolbar, right click anywhere in the toolbar and select Hide.

Status Bar

The Status Bar is displayed across the bottom of the application window. The left area of the status bar describes actions of menu items as you use the arrow keys to navigate through menus. It also shows messages that describe the actions of toolbar buttons as you depress them, before releasing them. If after viewing the description of the toolbar button command you wish not to execute the command, then release the mouse button while the pointer is off the toolbar button.

The Username and security level are shown at the bottom right of the Status Bar. This provides an indication of the security level of the user. Some configuration toolbar items may be disabled depending of the security level of the user.

The right areas of the status bar indicate which of the following keys are latched down:

CAP Indicates the Caps Lock key is latched down.

NUM Indicates the Num Lock key is latched down.

SCRL Indicates the Scroll Lock key is latched down.

To hide or display the Status Bar, choose **Status Bar** from the **View** menu.

Scroll Bars

Scroll bars are displayed at the right and bottom edges of the document window. The scroll boxes inside the scroll bars indicate your vertical and horizontal location in the document. You can use the mouse to scroll to other parts of the document.

Scroll bars appear only when needed. If there is no visible data the scroll bar will not be shown.

Menu Bar

The menu bar displays the commands for configuration, communication, monitoring, and security and file management functions available with Realflo. Menu commands are displayed by clicking the mouse button on the menu item or by pressing the **alt** key and the underlined letter of the menu item.

File Menu

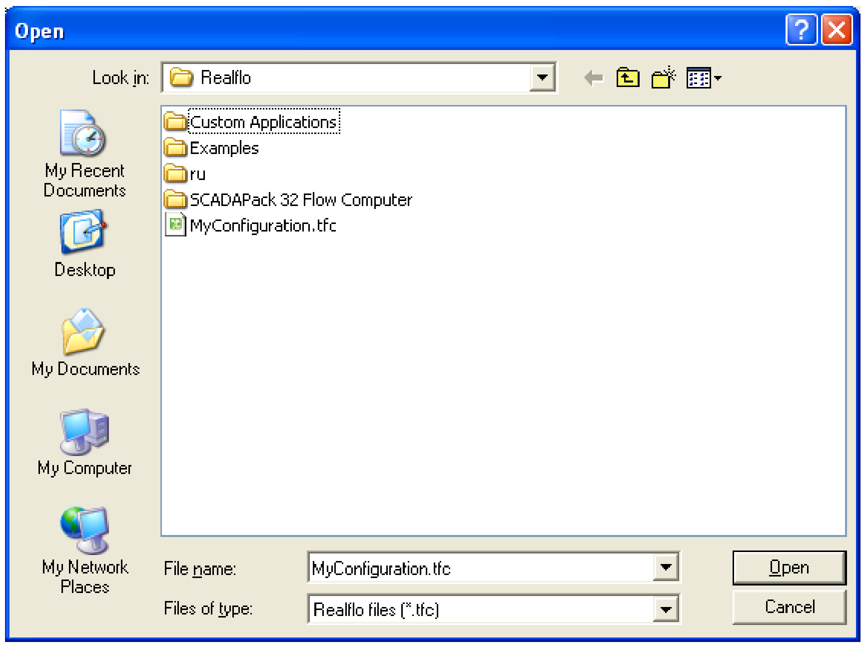
The File menu contains commands to create, open and save Realflo files. File menu commands allow data to be exported to spreadsheet (csv), Flow-Cal (cfx) files and to be printed. User accounts are also configured using this menu.

New Command

Use this command to create a new Realflo file. When selected this command opens the New File Wizard. See the section **Realflo Wizards >> New File Wizard** for complete details on using the wizard.

Open Command

Use this command to open an existing Realflo file. When the Open command is used the File Open Dialog is displayed.



The following options allow you to specify which file to open.

The **Look In:** box lists the available folders and files.

The **File Name:** box allows you to type or select the file name you want to open. This box lists files with the extension you select in the Files of Type box.

The **Files of Type:** box lists the types of files Realflo can open. Realflo can open flow computer (TFC) files and flow computer Template files (RTC).

When any account other than the ADMIN account has been created in the Realflo file the user needs to log on to an account when a flow computer file is opened. See the **Accounts** section for details.

The **Open** button opens the selected file and closes all views for runs that are not supported by the file that is opened.

The **Cancel** button closes the dialog without opening a file.

Only one flow computer file can be open at a time in Realflo. To view data from more than one flow computer at a time, start another copy of Realflo.

Close Command

Use this command to close all Realflo windows for the flow computer. Realflo suggests that you save changes to the flow computer file. If you close a flow computer file without saving, configuration changes made and data that has been read from the flow computer since the last time you saved it are not saved. Before closing an untitled file, Realflo displays the **Save As** dialog box and suggests that you name and save the file.

Save Command

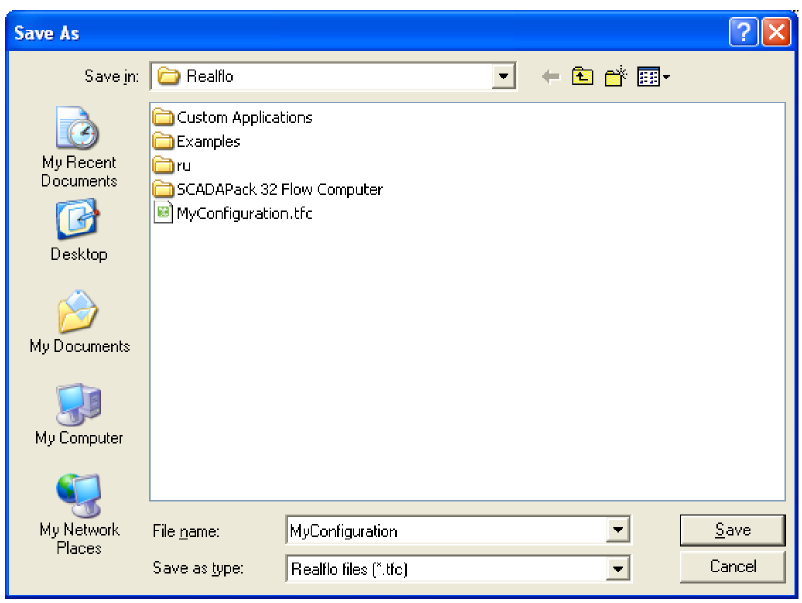
Use this command to save the flow computer file to its current name and directory. Saving a file saves the flow computer configuration, Hourly and Daily history, and the Event and Alarm logs.

When you save a file for the first time, Realflo displays the Save As dialog box so you can name your file. If you want to change the name or directory of the file, before you save it, choose the Save As command.

Realflo 6.70 files are compatible with files saved using earlier versions of Realflo.

Save As Command

Use this command to save and name the flow computer file. Realflo displays the Save As dialog box so you can name your file.



The following options allow you to specify the name and location of the file you're about to save:

The **Save in:** box lists the available folders and files.

The **File name:** box allows entry of a new file name to save a file with a different name. Realflo adds the extension you specify in the *Save As type* box.

The **Save as type:** box lists the types of files Realflo can save. Realflo can open flow computer (TFC) files and flow computer Template files (RTC).

If the open file is a flow computer file and the Save as Type is a template file, Realflo will ask if the flow computer file should be saved before converting it to a template.

The **Save** button saves the file to the specified location.

The **Cancel** button closes the dialog without saving.

To save a file with its existing name and directory, use the Save command.

Flow Computer File Types

Realflo uses separate files for flow computer configuration, current reading data, daily history data, hourly history data, alarm and event log data, process I/O configuration and custom views. All files are saved with the same file name and different file extensions. The table below indicates the file types and extensions.

File Type	*File Contents*	*Extension*
Configuration	Configuration of the Flow Computer	TFC
Daily history	Historical data for daily history view	TFD
Hourly history	Historical data for hourly history view	TFH
Gas Quality History	Historical data for gas quality history view	TFG
Event log	Historical data for event log	TFE
Alarm log	Historical data for alarm log	TFA
Current readings	Current readings data	TFR
Settings	Configuration data not relating to flow calculations	TFS
Process I/O	Process I/O configuration data	TFP
Custom Views	Custom Views configuration	TFV
Settings	Additional configuration data not relating to flow calculations. Includes SolarPack settings.	TFX

Template File Types

Realflo uses separate files for templates. All files are saved with the same file name and different file extensions. The table below indicates the file types and extensions.

File Type	*File Contents*	*Extension*
Configuration	Flow Computer configuration	RTC
Settings	Configuration data not relating to flow calculations	RTS
Process I/O	Process I/O configuration	RTP
Custom Views	Flow Run and Custom Views configuration	RTV

Managing Realflo Files

When copying Realflo files from one PC to another, copy all the files for a flow computer.

If history, event or alarm logs have grown too large, move the history and log files to another directory. New files will be created the next time you read logs from the flow computer. If you export the data first, you can have easy access to the archived data from a spreadsheet and current data from Realflo.

If you have created a copy of a flow computer for configuration of a new unit, you can delete the hourly and daily history, event and alarm logs by deleting the files with the TFD, TFH, TFE and TFA extensions.

Export Command

The Export command is used to select the type of file format to export Realflo data to. There are five selections:

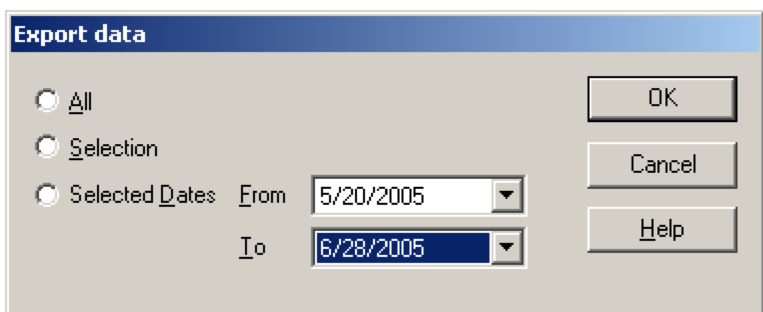
- Export to CSV
- Export to CFX
- CSV Export Options
- CFX Export Options
- Export PEMEX Report

Export to CSV

Use the Export to CSV command to export the flow computer configuration data and the data from any view. Data is exported in the CSV (comma-separated values) format. This format can be read by spreadsheet and database software.

Data is exported from the current window. Select the window containing the view you wish to export or change the view in the current window using the **View** menu.

When the Export command is selected the **Export data** dialog appears for views that support the selection of records for exporting, such as the hourly history, daily history or event log views. For views not supporting the selection of records, for example, configuration views, the Save As dialog is opened.



The **All** radio button selects all the data in the current view. This is the default button if no data is selected.

The **Selection** radio button selects the data that is currently selected in the view. This is the default button if data is selected.

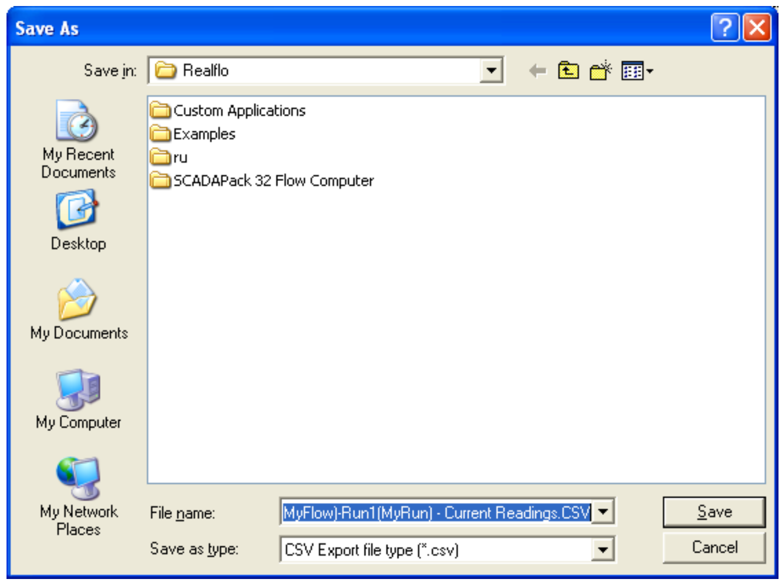
The **Selected Dates** radio button selects the data from the contract days in the **From** and **To** dropdown lists.

- The **From** dropdown list selects the oldest contract day. This control is enabled when the **Selected Dates** radio button is selected.

- The **To** dropdown list selects the recent contract day. This control is enabled when the **Selected Dates** radio button is selected.

Clicking the **Cancel** button or pressing the ***Escape*** key closes the dialog.

The **OK** button opens the **Save As** file selection dialog, with the file type CSV active. A file name is suggested for each type of file that is exported.



You may change the file name to any suitable name. The suggested file name format is defined in the **CSV Export Options** command.

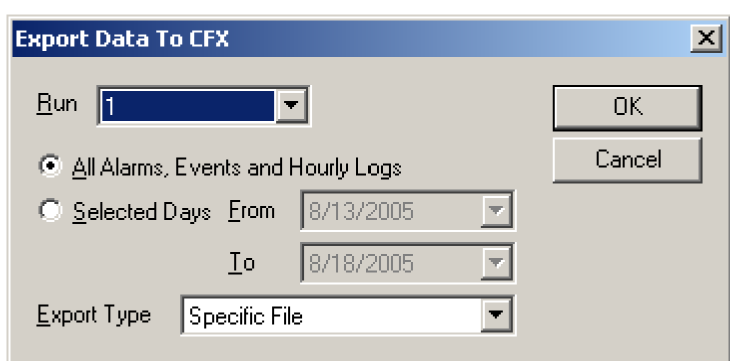
The **Save As** file selection dialog appears for views. The Save As dialog allows you to specify the file to export the data to.

The **Save** button in the **Save As** dialog exports the data to the selected file.

The **Cancel** button in the **Save As** dialog cancels the export command and closes dialogs.

Export to CFX

Use the Export to CFX command to export data in the Flow-Cal CFX format. This format is designed for importing into Flow-Cal. Data is exported to the CFX file from one flow run. The file includes data from the configuration, current readings, alarm log, event log and hourly history log.



The **Run** dropdown list selects the flow run to export. The default value is the flow run of the active view.

The **All Alarms, Events and Hourly Logs** radio button selects all of the data in the flow run. This is the default button.

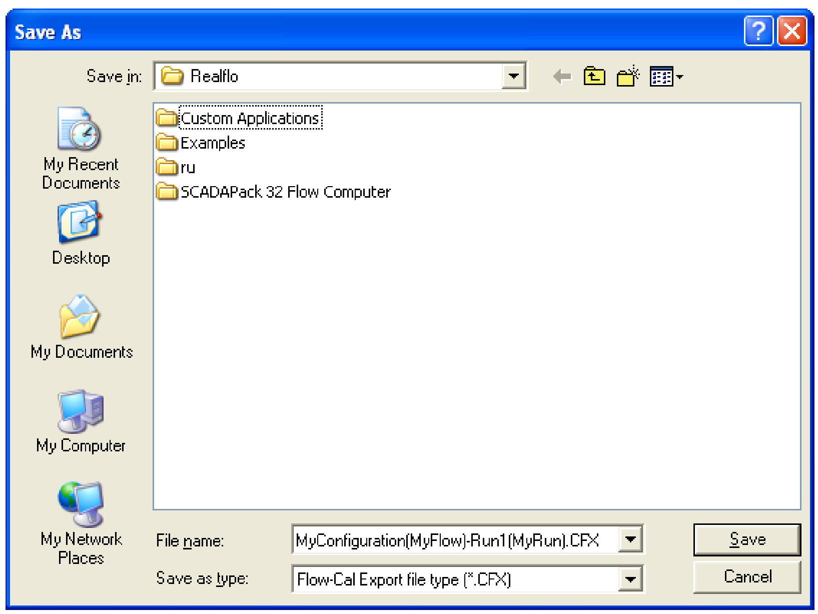
The **Selected Days** radio button selects the data from the contract days in the **From** and **To** dropdown lists.

- The **From** dropdown list selects the oldest contract day. This control is enabled when the **Selected Days** radio button is selected.
- The **To** dropdown list selects the recent contract day. This control is enabled when the **Selected Days** radio button is selected.

The **Export Type** dropdown list selects how export files are stored.

- Select **Specific File** to export to a single file. A standard file save dialog opens to allow you to select the file name. The default file name is **<Realflo file name>(<FC ID>) - <Run Number> (<Run ID>).CFX.**
- Select **Dated CFX** to export one file per day to a single folder per run. Realflo exports one file for each day. The file name is based on the time and date according to the CFX standard (YYYYMMDD.CFX).

A separate folder is created for each run. The folder is named **<Realflo file name>(<FC ID>) - <Run Number> (<Run ID>).CFX.**



The **Save As** file selection dialog appears for views. The Save As dialog allows you to specify the file to export the data to.

The **Save** button in the **Save As** dialog exports the data to the selected file.

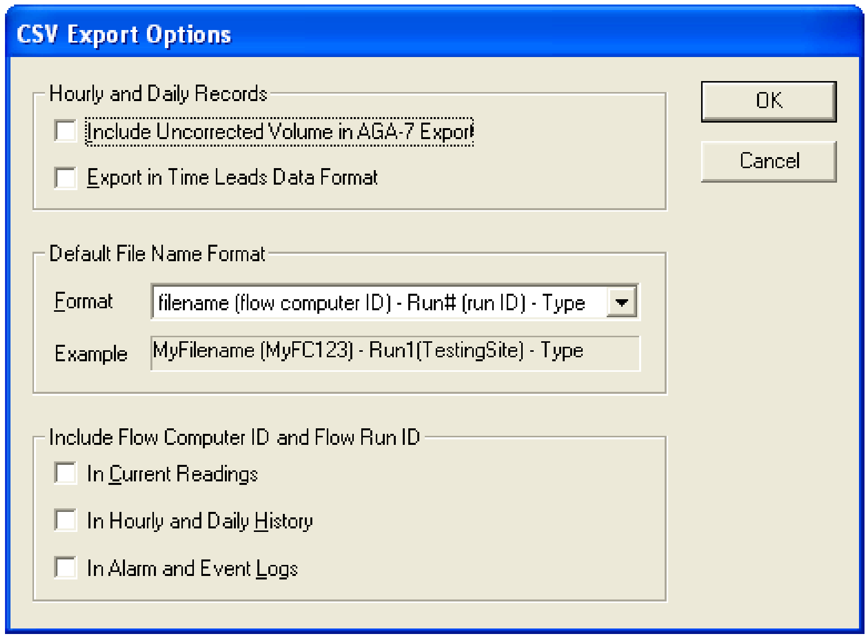
The **Cancel** button in the **Save As** dialog cancels the export command and closes dialogs.

CFX File Version

Data is exported in the CFX version 5 format. This format is not supported by some older versions of Flow-Cal. An upgrade may be available from Flow-Cal to allow older versions to read this file format. Contact Flow-Cal for details.

CSV Export Options Dialog

The CSV Export Options command defines whether optional data is exported to CSV files. The settings in this dialog apply to files opened by Realflo. They are stored in the Windows registry.



The **Hourly and Daily Records** section of the dialog defines optional data to include and how the data is time stamped.

- Select the **Include Uncorrected Flow in AGA-7 Export** option to export the Uncorrected Data column from the Hourly History Log and Daily History Log. This option applies to AGA-7 only. The option is unchecked by default.
- Select the **Export in Time Leads Data Format** option to export time stamps that mark the start of the period. Uncheck the option to export time stamps that mark the end of the period (Realflo format). This applies to the the Hourly History and Daily History only. The control is unchecked by default.

The **Default File Name Format** section defines the file name that is suggested by Realflo when data is exported. The names are combinations of the file name; Flow Computer ID; flow run number; and flow run ID.

- The **Format** list selects the name format. The name is made up of the identifier format and a view format. The valid values for the identifier are listed below. The default is to include all information.
  - file name (Flow Computer ID) - Run# (run ID) - Type
  - file name (Flow Computer ID) - Run# - Type
  - file name (Flow Computer ID) - run ID - Type
  - file name - Run# (run ID) - Type
  - file name - Run# - Type
  - file name - run ID - Type
  - Flow Computer ID - Run# (run ID) - Type

  - Flow Computer ID - Run# - Type
  - Flow Computer ID - run ID - Type
  - Run# (run ID) - Type
  - run ID - Type

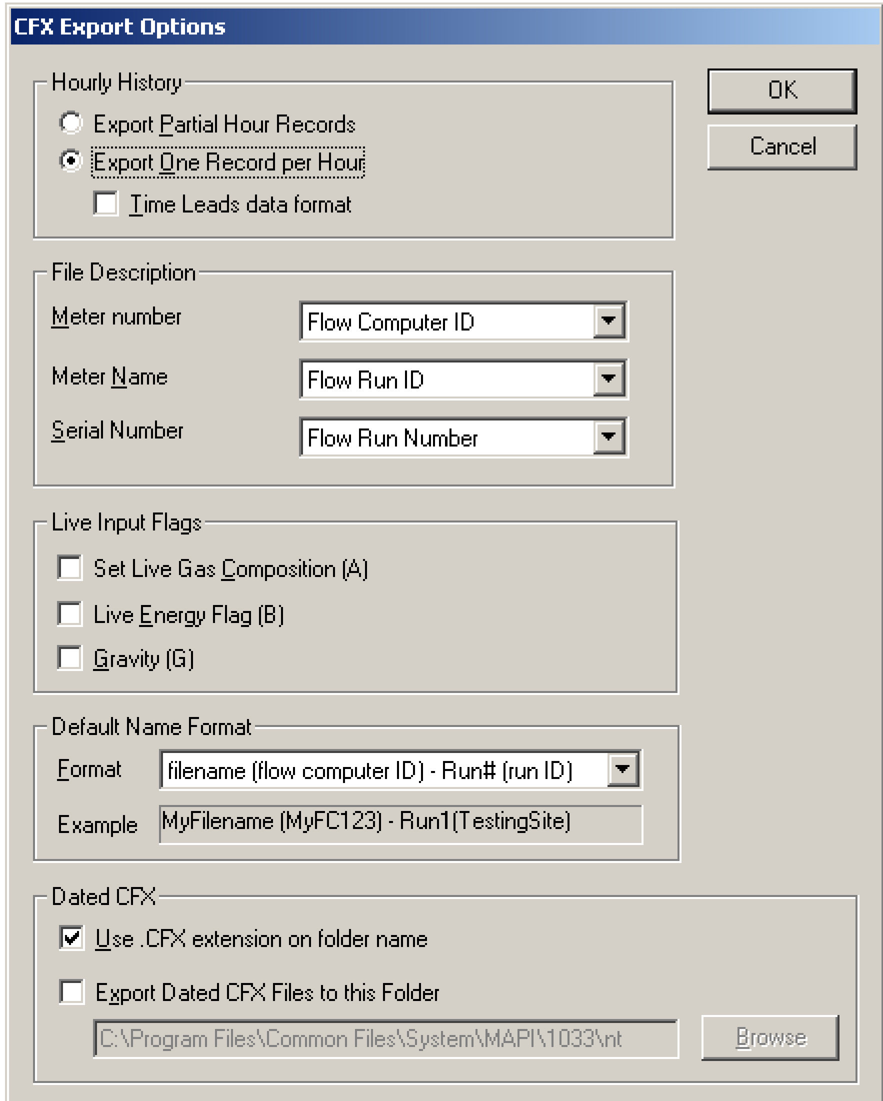
When the logs are exported the word **Type** is replaced by the following, according to the export selected.

  - Alarms
  - Events
  - Hourly Log
  - Daily Log
  - Current Readings
  - Custom View Name

- The **Example** control shows the file name that will be suggested for the current file.

CFX Export Options Dialog

The CFX Export Options dialog sets options for exporting to Flow-Cal CFX files. The settings in this dialog apply to files opened by Realflo. They are stored in the Windows registry.



The Hourly History section defines how records from the hourly history are exported.

- Select **Export Partial Hour Records** to export the records as they appear in Realflo. Some hours may contain more than one record due to power cycling or configuration changes. This is the default selection.
- Select **Export One Record per Hour** to export only one record per hour. Multiple records within an hour are merged into a single record for exporting. Hours that are not yet complete are not merged or exported.

The following hourly record fields are summed: volume, mass, energy, pulses (turbine type).

The following hourly record fields are averaged: termperature, static pressure, differential pressure (orifice types), relative density, flow product or flow extension. See Input Averaging on page 948 for more information.

- Select **Time Leads Data Format** to export the date and time at the start of the period. The time stamp on the record is the time at the start of the hour, even if the first record to be merged started later than that time. This option is enabled only when **Export One Record per Hour** is checked. This option is unchecked by default.

The **File Description** section defines some descriptive parameters in the CFX file.

- **Meter Number** defines the meter number parameter. The options are *none*, *Flow Computer ID*, *Flow Run ID* and *Flow Run Number*. The default value is *Flow Computer ID*. The parameter is 17 characters long in the file.
- **Meter Name** defines the meter name parameter. The options are *none*, *Flow Computer ID*, *Flow Run ID* and *Flow Run Number*. The default value is *Flow Run ID*. The parameter is 49 characters long in the file.
- **Serial Number** defines the meter serial number parameter in the file. The options are *none*, *Flow Computer ID*, *Flow Run ID* and *Flow Run Number*. The default value is *Flow Run Number*. The parameter is 11 characters long in the file.

The **Live Inputs Flags** section defines which live input flags are set by Realflo. The CFX file contains four flags in the Live Inputs parameter. Realflo sets the T (temperature) flag to Y (live data). The other flags are normally set to N (not live), but can be modified using the following options.

- Check **Set Live Gas Composition Flag** when there is a program that updates the gas composition. This is flag A (analysis). This option is unchecked by default.
- Check **Set Live Energy Flag** when there is a program that updates the energy. This is flag B (heating value). This option is unchecked by default.
- Check **Set Live Gravity Flag** when there is a program that updates the specific gravity (relative density). This is flag G (gravity). This option is unchecked by default.

The **Default Name Format** section defines what file names Realflo suggests when exporting. The names are combinations of the file name; Flow Computer ID; flow run number; and flow run ID.

- **Format** selects the name format. The valid values are listed below. The default is to include all information.
    - file name (Flow Computer ID) - Run# (run ID)
    - file name (Flow Computer ID) - Run#
    - file name (Flow Computer ID) - run ID
    - file name - Run# (run ID)
    - file name - Run#
    - file name - run ID
    - Flow Computer ID - Run# (run ID)

- Flow Computer ID - Run#
- Flow Computer ID - run ID
- Run# (run ID)
- run ID

- The **Example** control shows the file name that will be suggested for the current file.

The **Dated CFX** section defines where and how CFX files are exported.

- Select **Use .CFX extension on folder names** to create folders with a CFX extension when exporting Dated CFX files. The data for each month is stored in its own folder when using the Dated CFX format. The folder name may have a CFX extension or not. This option is unchecked by default.
- Select **Export Dated CFX Files to the Folder** to define a common folder for exports. Exported data will be placed in this folder. The option is unchecked by default. When checked, the edit control holds the destination folder that will appear in the Save As dialog. Use Browse to search for another folder.

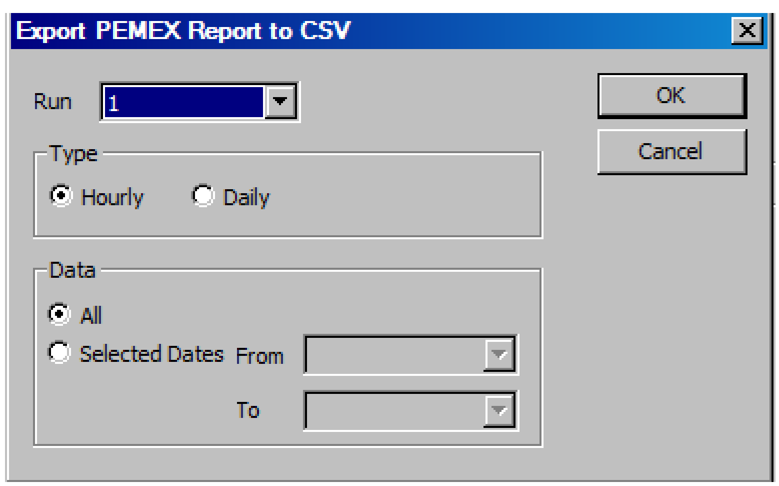
Export PEMEX Report to CSV

Use the Export PEMEX Report to CSV command to export the flow computer configuration data and the data from any view. Data is exported in the CSV (comma-separated values) format. This format can be read by spreadsheet and database software.

Data is exported from the current window. Select the window containing the view you wish to export or change the view in the current window using the **View** menu.

When the Export command is selected, the **Export PEMEX Report to CVS** dialog appears for views that support the selection of records for exporting, such as the hourly history, daily history or event log views.

This menu item is only visible if Realflo PEMEMX is launched.



Select the **Run** to export from the Run dropdown list.

The **Type** radio button lets you export hourly or daily records.

For views not supporting the selection of records, for example, Configuration views, the Save As dialog opens.

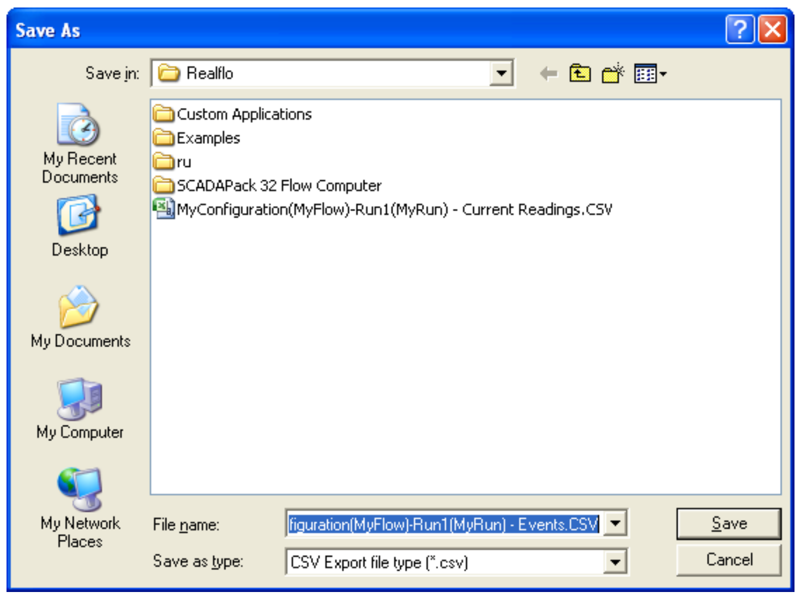
The **All** radio button selects all the data in the current view. This is the default button if no data is selected.

The **Selected Dates** radio button selects the data from the contract days in the **From** and **To** dropdown lists.

- The **From** dropdown list lets you select the oldest contract day. This control is enabled when the **Selected Dates** radio button is selected.
- The **To** dropdown list lets you select the recent contract day. This control is enabled when the **Selected Dates** radio button is selected.

Clicking the **Cancel** button or pressing the ***Escape*** key closes the dialog.

The **OK** button opens the **Save As** file selection dialog, with the file type CSV active. A file name is suggested for each type of file that is exported.



You may change the file name to any suitable name. The suggested file name format is defined in the **CSV Export Options** command.

The **Save As** file selection dialog appears for views. The Save As dialog allows you to specify the file to export the data to.

The **Save** button in the **Save As** dialog exports the data to the selected file.

The **Cancel** button in the **Save As** dialog cancels the export command and closes dialogs.

Print Command

Use this command to print data from the current view. Realflo displays the **Print** dialog. The following options allow you to specify the printer, the print range and the number of copies.

The **Name** drop-down list box displays a list of configured printers.

The **Properties** button defines the settings for the selected printer.

The Print range radio buttons selects the data to be printed.

The **All** radio button prints all the data in the current view. This is the default button if no data is selected.

The **Pages** radio button allows the printing of selected pages.

The **Selection** radio button prints the data that is currently selected in the view. This is the default button if data is selected.

The **Number of copies** selection indicates how many copies to print.

If the printer selected in the Name box supports collating print jobs you may select **Collate**, otherwise the control is grayed out.

The **OK** button prints the report.

Selecting the **Cancel** button or pressing the *Escape* key closes the dialog.

Print Preview Command

Use this command to see how your printed report will look. The command opens a special view that shows data as it will be printed.

To preview a report from a view select the window containing the view you wish to print or change the view in the current window using selections from the **View** menu.

When hourly history, daily history or log views are selected you can select records to print that interest you by left-clicking the mouse button on them.

A row of control buttons is available at the top of this view. These control buttons are described below.

The **Print** button prints the report as shown.

The **Next Page** button displays the next page. It is grayed if there are no more pages.

The **Prev Page** button displays the previous page. It is grayed if there are no pages before the current page.

The **Two Page** button changes the display to show two pages at a time. The *One Page* button changes the display to show one page at a time.

The **Zoom In** button enlarges the page displayed so you can see details on the report.

The **Zoom Out** button shrinks the page displayed so you see how the page is formatted.

The **Close** button closes the Print Preview view.

Print Setup Command

Use this command to define how reports are printed. The font, page headings, margins, and the size of the columns on the hourly history, daily history or event log reports can be changed. Select from the options described below.

The page headings section selects what is printed in the header of each report page.

Selecting **Title** prints the title of the report centered on the page.

Selecting **Date and Time** prints the date and time in the upper left-hand corner of the page. The date and time are printed in the long time format defined from the Windows Control Panel.

Selecting **Page Numbers** prints “Page” and the page number in the upper right hand corner of the page. The **Start At** edit box selects where the page numbers start.

The Margins section defines the page margins.

Left is the size of the left-hand margin on the page.

Right is the size of the right hand margin on the page.

Top is the size of the top margin on the page.

Bottom is the size of the bottom margin on the page.

Measurement Units is the units of measurement for the margins. It is one of Inches or mm. The units are converted into the other measurement system when this control is changed.

The selected font section defines the font used for printing reports. The currently selected font is shown.

The **Change Font** button opens a font selection dialog. The user may choose the font for printing reports.

The column width section defines the widths of the columns on specific reports.

The **Report** dropdown list selects the report to edit.

The **Column** dropdown list displays columns on the selected report.

The **Width** edit box displays the current column width and allows it to be changed.

The **Reset Report** button resets columns on the current report to their default widths.

Select the **OK** button to use the new settings.

Select the **Cancel** button or press the *Escape* key to close the dialog.

The **Printer** button opens the Printer dialog.

The **Help** button displays help for this dialog.

Print Setup Command in PEMEX Mode

Use this command to define how reports are printed when Realflo is operating in PEMEX mode. The font, page headings, margins, and the size of the columns on the hourly history, daily history or event log reports can be changed. Select from the options described below.

The page headings section selects what is printed in the header of each report page.

Selecting **Title** prints the title of the report centered on the page.

Selecting **Date and Time** prints the date and time in the upper left-hand corner of the page. The date and time are printed in the long time format defined from the Windows Control Panel.

Selecting **Page Numbers** prints “Page” and the page number in the upper right hand corner of the page. The **Start At** edit box selects where the page numbers start.

The Margins section defines the page margins.

Left is the size of the left-hand margin on the page.

Right is the size of the right hand margin on the page.

Top is the size of the top margin on the page.

Bottom is the size of the bottom margin on the page.

Measurement Units is the units of measurement for the margins. It is one of Inches or mm. The units are converted into the other measurement system when this control is changed.

The selected font section defines the font used for printing reports. The currently selected font is shown.

The **Change Font** button opens a font selection dialog. The user may choose the font for printing reports.

The column width section defines the widths of the columns on specific reports.

The **Report** dropdown list selects the report to edit.

The **Column** dropdown list displays columns on the selected report.

The **Width** edit box displays the current column width. To print a PEMEX Report, the default column widths need to be:

Column	**Width**
Start Time and date (regional format)	21
End Time and date (regional format)	21
Time with active flow (seconds)	10
Volume (1^{st} base condition)	12
Energy (1^{st} base condition)	18
Temperature	12
Pressure	14
Differential pressure/Average frequency	12
Relative density	16
Flow extension/Uncorrected volume	12
Number of alarms	5
Number of events	5
Up time (minutes)	5
Volume (2^{nd} base condition)	12
Heating value	12

Column	Width
Quality	5

The **Reset Report** button resets columns on the current report to the required default settings when operating in PEMEX mode.

Select the **OK** button to use the new settings.

Select the **Cancel** button or press the *Escape* key to close the dialog.

The **Printer** button opens the Printer dialog.

The **Help** button displays help for this dialog.

Recent Files List

Use the numbers and file names listed at the bottom of the File menu to open the last four files you closed. Choose the number that corresponds with the file you want to open.

Exit Command

Use this command to exit from Realflo. If changes have been made to the flow computer file, you will be asked if you want to save them.

Edit Menu

The edit menu commands allow selected data to be copied to the clipboard. The selected data is then available for use in other applications.

Copy Command

Use this command to copy selected data onto the clipboard. This command is unavailable if the view does not contain data that can be selected. Copying data to the clipboard replaces the contents previously stored there.

Select All Command

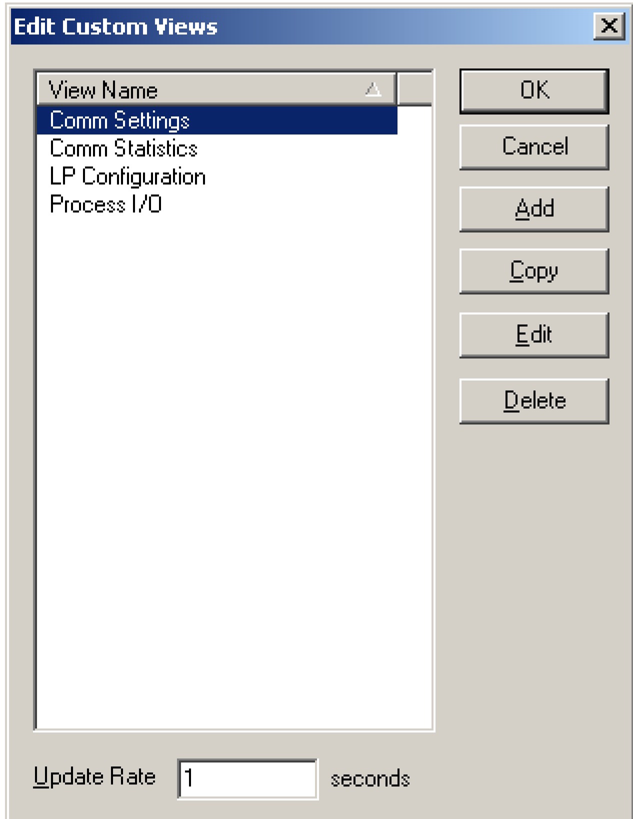
Use this command to select all the records in the current view. This command is unavailable if the view does not contain data that can be selected.

Custom Views Command

Custom views provide a means for users to display and modify register data used in their custom applications. Custom applications include Telepace or IEC 61131-3 and custom C or C++ programs that are running on a controller in addition to the gas flow computer application. Any register the SCADAPack controller may be added to one or more custom views.

The Custom Views command is used to create and edit custom views. When Custom Views are created they are assigned an Access Level for security purposes. The access levels are based on the User Account Access levels, described in the **Accounts** section. Based on the user’s access level, views may be viewed or edited and initial values may be written to the registers in the view.

When the Custom Views command is selected the **Edit Custom Views** dialog is displayed.



The **View Name** list displays the views that are available to the current user. Views that require a higher access level are not displayed. Refer to the **Accounts** section for more information on Access Levels. If there are no views created the list is blank.

- Click on a view in the list to select it.
- Double-click on a view in the list to edit it.
- Use Ctrl-click or Shift-click to select multiple views.
- Click on the column headings to sort the data. Clicking once sorts the data in ascending order. Clicking again sorts the data in descending order.

The buttons at the side of the Edit Custom Views dialog are used to create and edit Custom Views.

- Click the **Add** button to open the Edit Table View dialog and add a new Custom Views.
- Click the **Copy** button to copy a selected Custom Views. The Edit Table View dialog is opened with a copy of the selected view. This button is disabled if no view is selected or if multiple views are selected.
- Click the **Edit** button to edit the selected Custom Views. The Edit Table View dialog is opened and will contain the selected view. This button is disabled if no view is selected or if multiple views are selected.
- Click the **Delete** button to delete the selected view or Custom Views. The button is disabled if no view is selected. After deletion the next view in the list is selected, or the last view in the list is selected.

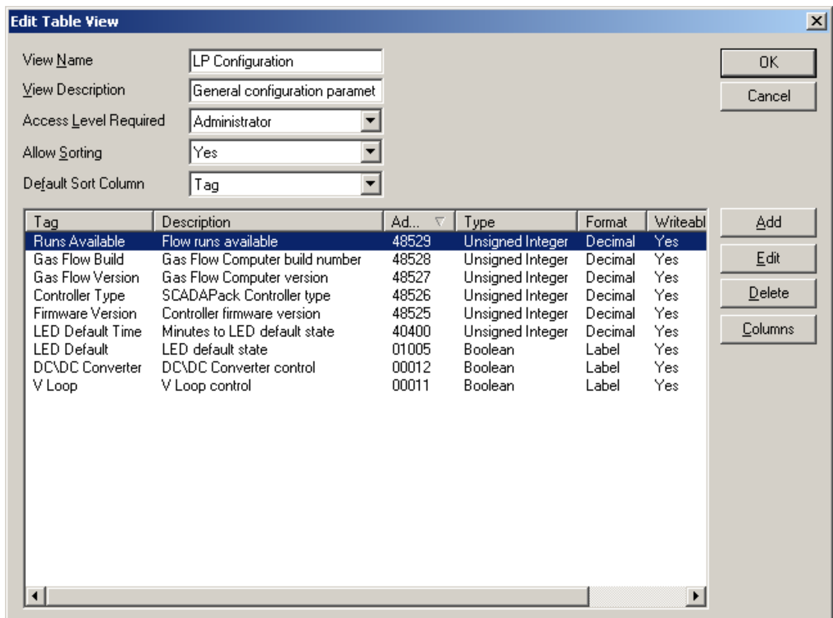
The **Update Rate** edit box sets the rate, in seconds that data is polled from the flow computer to refresh the Custom Views. Valid values are 1 to 65535 seconds. The default value is 1 second.

The **OK** button saves changes to the Custom Views and closes the dialog.

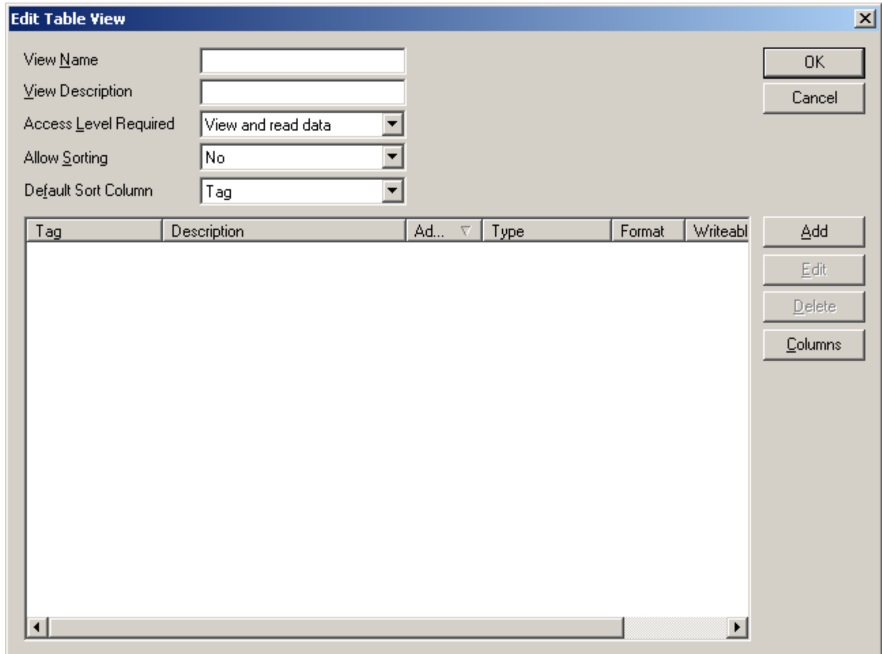
The **Cancel** button closes the dialog without saving any changes to the Custom Views.

Edit Table View Dialog

When the **Edit** button is selected, or a view is double clicked, in the Edit Custom Views dialog the **Edit Table View** dialog is opened as shown below. The dialog contains information about the selected Custom Views. The dialog contents are described below.



When the **Add** button is selected in the Edit Custom Views dialog the **Edit Table View** dialog is opened as shown below. The dialog contents are described below.



The **View Name** entry box contains the name of the Custom View. The View Name may be any character string up to 16 characters in length. A view name needs to be entered and it needs to be unique.

The **View Description** entry box contains a description of the Custom View. The View Description may be any character string up to 64 characters in length.

The **Access Level Required** dropdown menu selects the user account access level required to display the Custom Views. See the **Accounts** section for details on creating Realflo user account. Users with a lower access level than selected will not be able to see the view on menus. The menu selections are:

- View and read data.
- View, read and write data.
- Administrator.

Access levels that are greater than the current user's access level are not available. This prevents a user from creating a view that he will not be able to edit because his access level is too low. The default value is View and read data.

The **Allow Sorting** dropdown menu selects whether the user can change the sort order on the Custom View. The menu selections are:

- Yes
- No

The default value is Yes.

The **Default Sort Column** dropdown menu selects the default column by which the Custom View is sorted. The menu selections are:

- Tag
- Description

- Address
- Value
- Forced
- Type
- Format
- Writeable
- Initial Value

The default value is Tag.

The **Edit Table View** list control displays the register data that will be included in the custom view. The register data is for each entry is displayed as a row in the list with column headings across the top of the list.

- Click on the column headings to sort the data by the heading. Clicking once sorts the data in ascending order. Clicking again sorts the data in descending order.
- The address and initial value columns are sorted numerically. The tag, description, type, format, and writeable columns are sorted alphanumerically.
- The list is sorted by address in ascending order when the dialog is opened.
- Click on a row in the list to select it.
- Double-click on a row in the list to open the **Edit Register on View** dialog.
- Use Ctrl-click or Shift-click to select multiple rows.

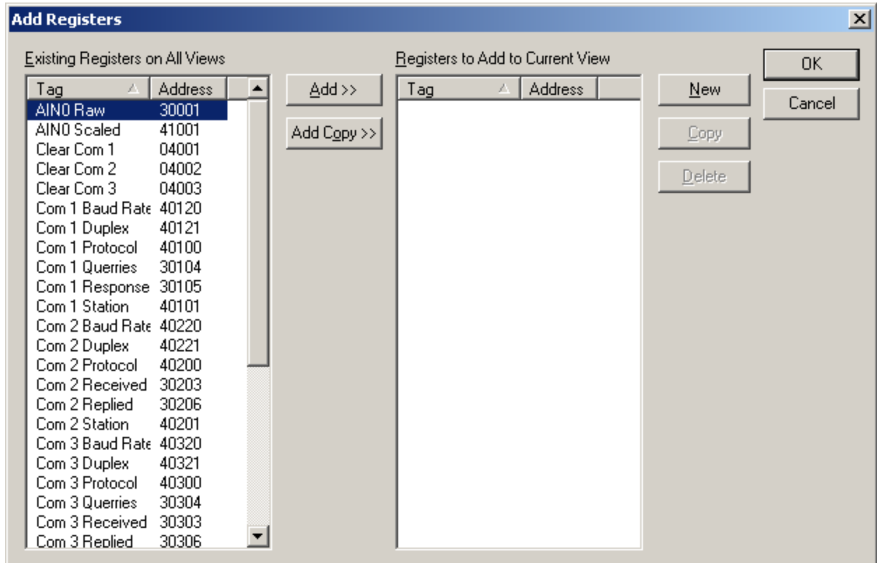
The **OK** button saves the changes to the Custom View and closes the dialog.

The **Cancel** button closes the dialog without saving any changes to the Custom View.

- Click the **Add** button to open the **Add Registers** dialog. This dialog is used to add registers to the Custom View.
- Click the **Edit** button to open the **Edit Registers On View** dialog. This button is disabled if no register is selected or multiple registers are selected.
- Click the **Delete** button to delete the selected register or registers. The button is disabled if no register is selected. After deletion the next register in the list is selected, or the last register in the list is selected.
- Click the **Columns** button to open the **Columns** dialog. This dialog is used to select the columns that will be displayed on the Custom View. This command does not affect the columns displayed in the **Edit Table View** dialog.

Add Registers Dialog

When the **Add** button is clicked in the **Edit Table View** dialog the **Add Registers** dialog is opened. The dialog contents are described below.



The **Existing Registers on All Views** list displays all registers that are defined in all views. The list displays all registers, even if they are already in the view. This allows adding them more than once with different format.

- Click on the column headings to sort the data. Clicking once sorts the data in ascending order. Clicking again sorts the data in descending order. The register column is sorted numerically. The tag column is sorted alphanumerically.
- The list is sorted by register in ascending order when the dialog is opened.

The **Registers to Add to Current View** list displays registers that are to be added to the current view. Registers in the Registers to Add to Current View list are added to the current view when the OK button is clicked.

- Click on the column headings to sort the data. Clicking once sorts the data in ascending order. Clicking again sorts the data in descending order. The register column is sorted numerically. The tag column is sorted alphanumerically.
- The list is sorted by register in ascending order when the dialog is opened.
- Registers in both lists may be selected by clicking on a row in the list or by holding down the Ctrl button and clicking on a row to select or deselect multiple rows.

The **Add>>** button will add the selected registers from the Existing Registers on All Views list to the Registers to Add to Current View list. This button is disabled if no registers are selected in the Existing Registers on All Views list.

The **Add Copy>>** button is used to add a copy of the selected register from the Existing Registers on All Views list to the Registers to Add to Current View list. When selected this button opens the **Register Properties** dialog.

The button is disabled if no register is selected in the Existing Registers on All Views list.

The **New** button adds a new register to the Registers to Add to Current View list. When the button is pressed the **Register Properties** dialog is opened.

The **Copy** button adds a copy of the selected registers from the Existing Registers on All Views list to the Registers to Add to Current View list. When the button is pressed the Register Properties dialog is opened. This button is disabled if no registers are selected in the Existing Registers on All Views list.

The **Delete** button deletes the selected registers from the Registers to Add to Current View list. The button is disabled if no registers are selected in the Registers to Add to Current View list. After deletion the next register in the list is selected, or the last register in the list is selected.

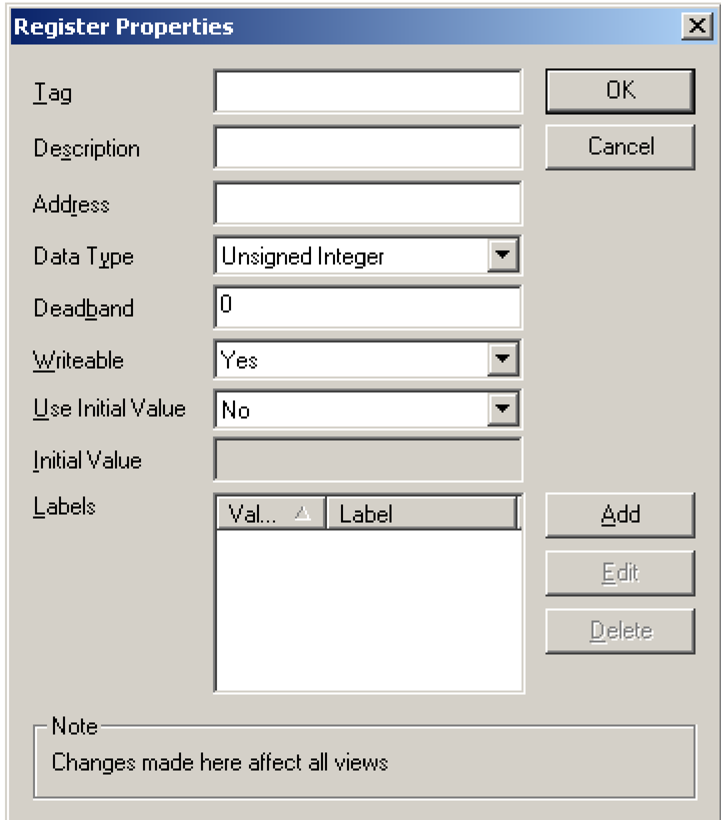
The **OK** button adds the registers to the view and closes the dialog. Registers of type Boolean are added using the Boolean format. All other register types are added using the decimal format.

The **Cancel** button closes the dialog without saving any changes.

Register Properties Dialog

The **Register Properties** dialog is used to edit the properties of a register object. Register objects are shared by all views. Editing these properties will affect all views that use the object. For example, if the register number is changed here, then all views that used the object will show the data from the new register.

When the Add Copy>> button or the New button are selected in the Add Registers dialog the Register Properties dialog is opened.



The **Tag** entry box contains the tag name of the register. The Tag name may be any character string up to 16 characters in length. A tag name needs to be entered and it needs to be unique.

The **Description** entry box contains a description of the register. The Description may be any character string up to 64 characters in length.

The Address entry box contains the address of the register to be displayed. Valid entries are:

- 00001 to 09999;
- 10001 to 19999;
- 30001 to 39999;
- 40001 to 49999.

The **Data Type** dropdown menu selects the type of register. Valid selections are:

- Boolean for address from 00001 to 09999 and from 10001 to 19999
- Signed Integer for address from 30001 to 39999 and from 40001 to 49999
- Unsigned Integer for address from 30001 to 39999 and from 40001 to 49999
- Signed Double for address from 30001 to 39999 and from 40001 to 49999
- Unsigned Double for address from 30001 to 39999 and from 40001 to 49999

- Floating Point for address from 30001 to 39999 and from 40001 to 49999
- ISaGRAF Integer for address from 30001 to 39999 and from 40001 to 49999

The default value is Unsigned Integer.

The **Deadband** entry is the amount by which the register needs to change value before Custom Views are updated. Valid entries depend on the register type selected. This control is disabled if Data Type is set to boolean. The following table shows the minimum and maximum values for each type of register.

Type	Minimum Value	Maximum Value
Signed Integer	-32768	32767
Unsigned Integer	0	65535
Signed Double	-2147483648	2147483647
Unsigned Double	0	4294967295
Floating Point	Any	Any
ISaGRAF Integer	-2147483648	2147483647

The **Writeable** dropdown menu selects whether the user can write to the register. Valid selections are Yes and No.

The **Use Initial Value** dropdown menu selects whether an initial value is defined for the register. Valid selections are Yes and No. This control is disabled if *Writeable* is set to no.

The **Initial Value** entry is the initial value for the register. Valid values depend on the register type as shown in the table below. This control is disabled if Use Initial Value is set to No or if Writeable is set to No.

Type	Minimum Value	Maximum Value
Boolean	OFF	ON
Signed Integer	-32768	32767
Unsigned Integer	0	65535
Signed Double	-2147483648	2147483647
Unsigned Double	0	4294967295
Floating Point	Any	Any
ISaGRAF Integer	-2147483648	2147483647

The **Labels** section displays the defined labels for a register. Labels are used in Custom Views to display text in place of values. For example a label could be used for the On / Off status of a motor. When the status is On the label could display Running and when the status is Off the label could display Stopped. When labels are defined there needs to be at least two labels.

The **Value** column displays the register value for which a label will be displayed.

The **Label** column displays the text that will be displayed for a value.

- Click on a row in the list to select it.
- Double-click on a row in the list to open the **Edit Label** dialog.
- Hold down Ctrl and click on a row to select or deselect multiple rows.

The **Add** button is used to add a label to the list. When selected the **Edit Label** dialog is opened.

The **Edit** button is used to edit the selected label in the list. When selected the **Edit Label** dialog is opened. This button is disabled if no label or more than one label is selected.

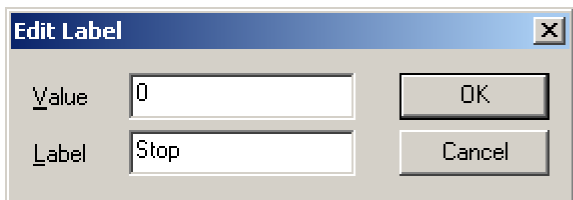
The **Delete** button deletes the selected labels. The button is disabled if no label is selected. After deletion the next label in the list is selected, or the last label in the list is selected.

The **OK** button saves the changes and closes the dialog.

The **Cancel** button closes the dialog without saving any changes.

Edit Label Dialog

When the Add or Edit button is selected in the Register Properties dialog the Edit Label dialog is opened.



The **Value** entry is the register value for which a label will be displayed. Valid entries depend on the register type as shown in the table below. The value needs to be unique for each label.

Type	Minimum Value	Maximum Value
Boolean	OFF	ON
Signed Integer	-32768	32767
Unsigned Integer	0	65535
Signed Double	-2147483648	2147483647
Unsigned Double	0	4294967295
Floating Point	Any	Any
ISaGRAF Integer	-2147483648	2147483647

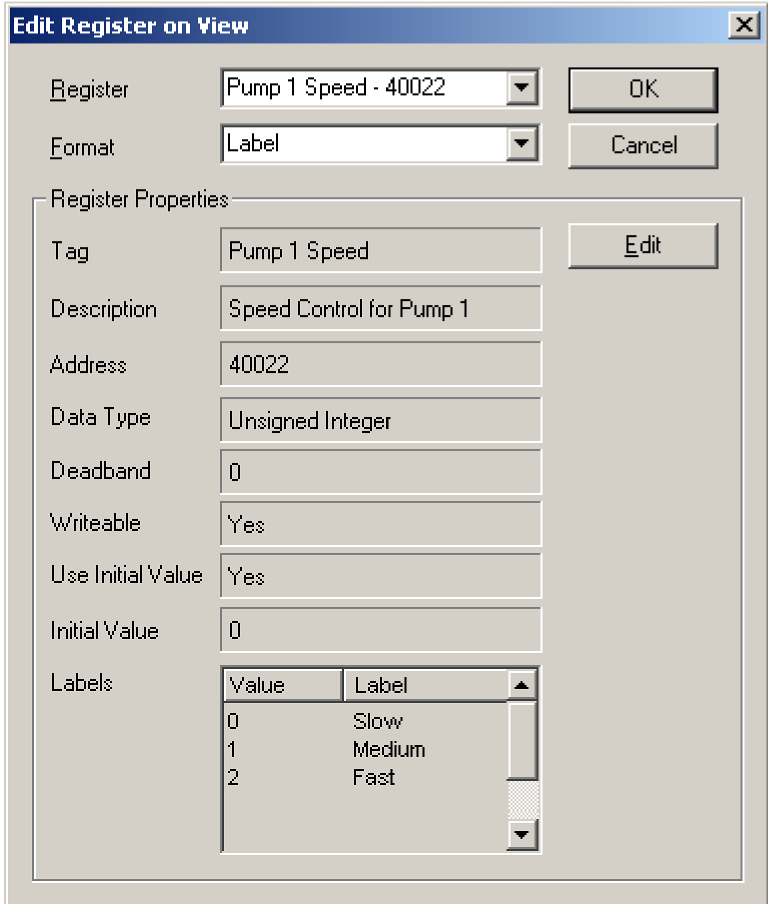
The **Label** entry is the text that will be displayed for a register value. The Label may be any character string up to 8 characters in length and needs to be unique.

The **OK** button saves the changes and closes the dialog.

The **Cancel** button closes the dialog without saving any changes

Edit Register on View Dialog

The **Edit Register on View** dialog is used to modify a register on a Custom View. This dialog is displayed when the Edit button in the Edit Table View is selected.



The **Register** dropdown menu selects the register object that is displayed on the view. The dropdown list displays defined registers by tag and register number.

The Format dropdown menu selects how the register object will be displayed on the view. Valid selections are listed below.

- **Boolean** - displays the register value as a Boolean. If the value is 0 then OFF is displayed. If the value is non-zero then ON is displayed.
- **Decimal** - displays the register value in decimal (base 10).
- **Hexadecimal** - displays the register value in hexadecimal (base 16).
- **Binary** - displays the register value in binary (base 2).
- **ASCII** - displays bytes of the register value as ASCII characters. The number of characters displayed depends on the register Type.
- **Label** - displays labels in place of the register value. The labels are defined in the register properties. This selection is not available if labels are not defined for the register.
- **Bit 00, Bit 01, … , Bit 31** - displays the selected bit from the register as a Boolean. If the bit is 0 then OFF is displayed. If the bit is non-zero then ON is displayed. I the register cannot be edited from the Table View if this format is selected. Valid values are Bit 00 to Bit 31 for 32-bit data types, and Bit 00 to Bit 15 for 16-bit data types.

The default selection value is Decimal. Changing selection doesn't affect the display of Register Properties. The selection will be changed to Decimal if the previous selection is no longer valid after changing register or editing register properties.

The **Register Properties** displays the properties of the selected register. The properties are updated when the **Register** is changed.

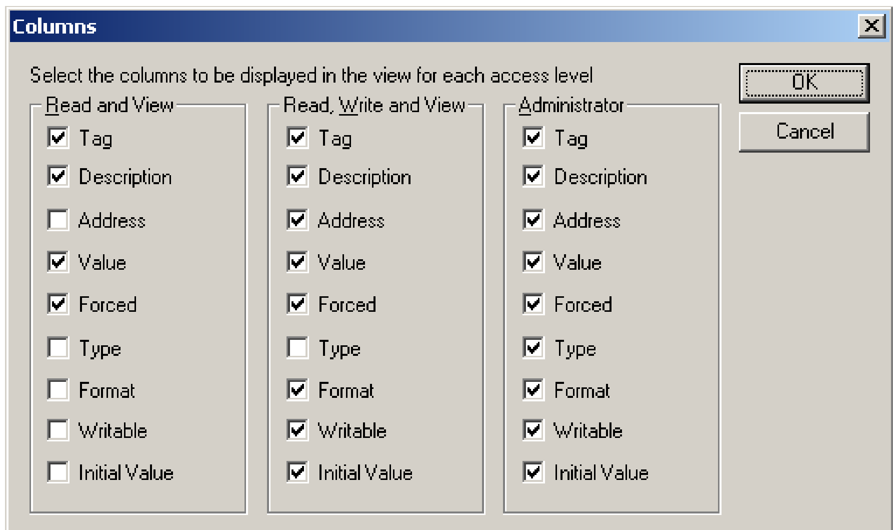
The **OK** button saves the changes and closes the dialog.

The **Cancel** button closes the dialog without saving any changes.

The **Edit** button is used to edit the register object properties. When selected the **Register Properties** dialog is opened.

Columns Dialog

The **Columns** dialog is used to define the columns displayed on the Table view and the Edit Register dialog. This does not affect the columns shown in the Edit Table View dialog.

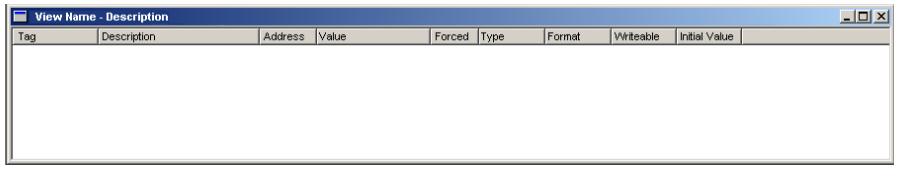


The columns to be displayed can be defined for each Access Level so different users see different information. Select the column to show it on in the Table view. Columns are enabled by default when a view is created.

- **Tag** - selects if the register tag is shown.
- **Description** - selects if the description is shown.
- **Address** - selects if the register address is shown.
- **Value** - selects if the register value is shown.
- **Forced** - selects if the force status is shown.
- **Type** - selects if the register type is shown.
- **Format** - selects if the display format is shown.
- **Writeable** - selects if the writeable status is shown.
- **Initial Value** - selects if the initial value is shown.

Custom View Window

The Custom View window displays the registers for a custom view in a tabular format. Each row in the table displays one register.



The Custom View window displays the following columns. Some columns may not appear if they are not enabled on the view.

- The **Tag** column displays the name of the register.
- The **Description** column displays the description of the register.
- The **Address** column displays the register address.
- The **Value** column displays the value of the register in the format defined for the view. If the Label format is selected and the value is not in the label list then *Invalid (value)* is displayed. If data is not available value shows ----.
- The **Forced** column displays if the register value is forced. If data is not available forced shows ----.
- The **Type** column displays the type of register.
- The **Format** column displays the format of the value.
- The **Writeable** column displays if the user can write to the register. A register is not writeable if the Format is set to Bit.
- The **Initial Value** column displays the initial value for the register if one is defined, or ---- if a value is not defined.

Clicking on the column headings will sort the table, in ascending order, according to the column selected. Clicking subsequent times on the same column toggles the sort order between descending and ascending order.

Click on any row to select it. Hold down Shift and click on any row to select the range from the currently selected row to the new row. Hold down Ctrl key and click on any row to toggle the selection of that row.

To change the column width, position the cursor over the line separating the columns in the heading. The cursor changes to a vertical bar with arrows pointing left and right. Click on the line and slide the mouse left or right. Release the mouse button when the column is the desired width.

Use the Flow Computer menu commands **Update Readings** or **Update Readings Once** to poll the flow computer for the value and force status of registers.

Editing Data

There are several ways to edit registers and data in a Custom View.

- Select a row and, from the *Edit* menu, choose the *Register* command to open the **Edit Register Value** dialog.
- Double-click on a row open the **Edit Register Value** dialog.

- Select a row and press the Enter key to open the **Edit Register Value** dialog.

The above commands are disabled if the **Writeable** parameter of the register is set to No, if the display format is set to Bit or if the Update Readings is not enabled.

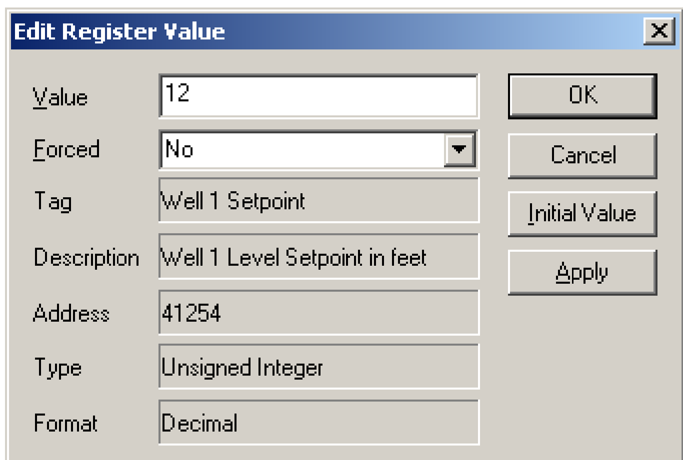
Printing and Exporting Data

To print or export part of the data in the Custom View, select the desired rows then use the Print or Export function.

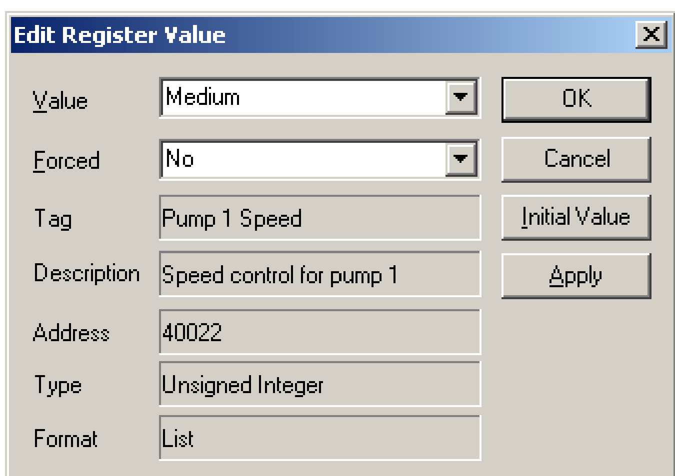
Register Command

The Register command is used to modify the value or force status of a selected register in a Custom View. This command is disabled if the Update Readings command is turned off. When this command is selected the **Edit Register Value** dialog is opened.

The dialog appears as follows for the decimal, ASCII, hexadecimal, binary and BIT formats.



The dialog appears as follows for the Boolean, and Label formats.



The **Value** field is the register value for decimal, ASCII, hexadecimal, binary and BIT formats. For Boolean and Label formats a dropdown menu is used to select the Value.

Valid values depend on the register type as shown in the table below. Value initially shows the current value of the register in the format defined for the view. If the Label format is selected and the value is not in the label list then *Invalid (value)* is displayed.

Type	Minimum Value	Maximum Value
Boolean	OFF	ON
Signed Integer	-32768	32767
Unsigned Integer	0	65535
Signed Double	-2147483648	2147483647
Unsigned Double	0	4294967295
Floating Point	Any	Any
ISaGRAF Integer	-2147483648	2147483647

Double register variables like counters use the Unsigned Double type with Telepace firmware and use the ISaGRAF integer type with ISaGRAF firmware.

The **Forced** dropdown menu selects if the register value is forced. The selections are Yes or No.

The **Register**, **Tag**, **Description**, **Type**, and **Format** fields display information about the register. These fields cannot be changed. Data is displayed only if the corresponding column appears in the Table View; otherwise the field is blank.

The **OK** button writes the value and force status to the flow computer and closes the dialog.

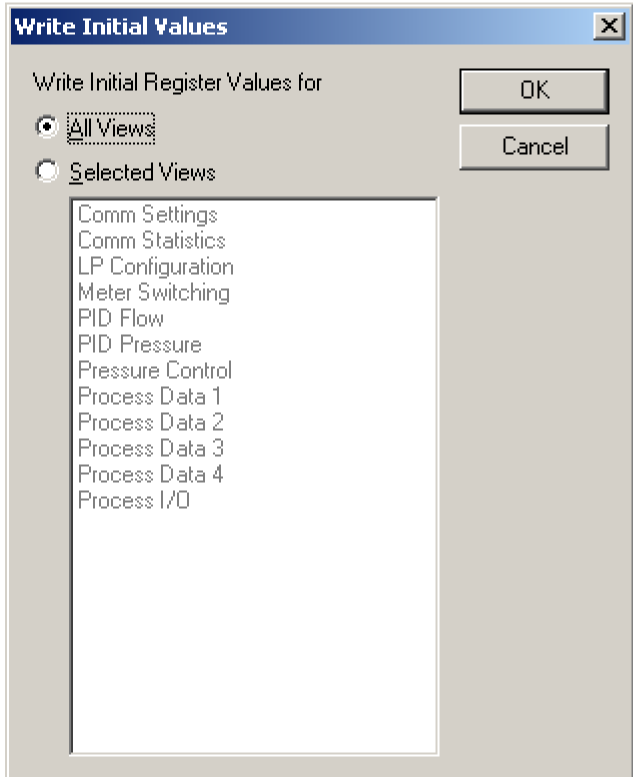
The **Cancel** button closes the dialog without any changes.

The **Initial Value** button sets Value to the initial value defined for the register. This button is disabled if no initial value is defined.

The **Apply** button writes the value and force status to the flow computer.

Write Initial Values Command

The **Write Initial Values** command is used to write initial values for all Custom Views or for selected Custom Views. This command is disabled if the Update Readings command is turned off. When this command is selected the Write Initial Values dialog is opened.



The **All Views** selection will write initial values to registers for all defined views. Registers with an initial value are written.

The **Selected Views** writes initial values to registers on the selected views only. All registers with an initial value on the selected views are written.

- Click on a row in the list to select it.
- Hold down Ctrl and click on a row to select or deselect multiple rows.
- Hold down Shift and click on a row to select a range of rows.

The **OK** button writes the initial values and closes the dialog.

The **Cancel** button closes the dialog with no changes.

Template Steps

This command is available only when a template file is opened in Realflo. A template is used to create a new flow computer from a pre-set configuration. The template specifies what data is pre-set and what needs to be entered when the template is used.

History, event, or alarm logs are not stored in templates. A history view can be opened in a template file, but it will be empty. This allows views to be arranged when the template is edited. The view arrangement is stored in the template.

Creating a Template File

Realflo can save a configuration as a template file for new flow computers. New flow computer files can then be created from a template using the New File wizard.

To create a template file:

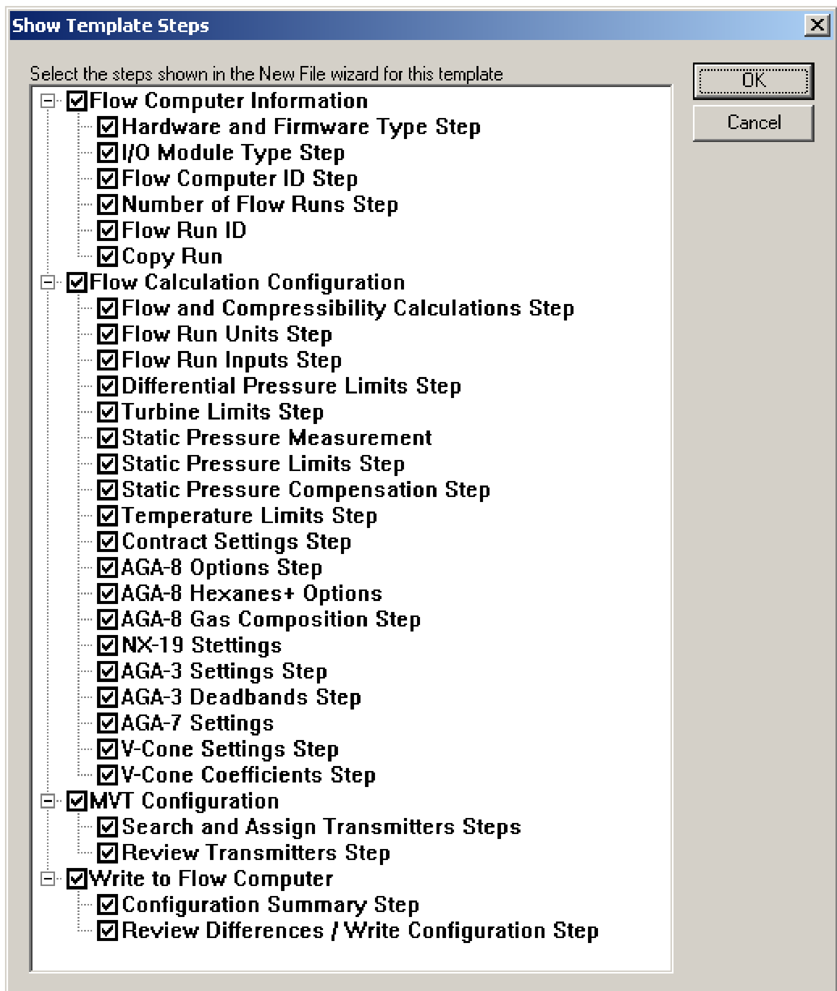
- Open a Realflo configuration file (TFC) and use the Save As command to save the file as a Realflo Template (RTC).

Selecting Template Steps

When the Template Steps command is selected the Show Template Steps dialog is displayed as shown below. A template provides default data for many of the steps in a new file wizard. To make it easier to use a template, some steps in the New File wizard may be skipped. These steps can be configured for each flow computer template.

All template steps are selected by default. To configure the steps shown for a template:

- Check the steps that should be displayed. Checking or a node automatically selects all the steps within that node.
- Click **OK**.



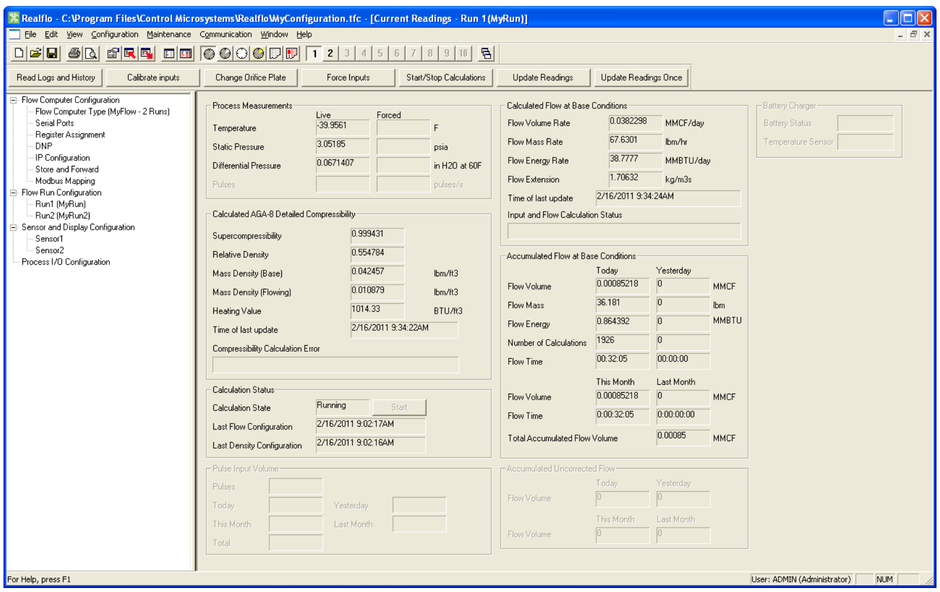
View Menu

The view menu commands select the data that is displayed in the active window. This data includes current readings, hourly history, daily history, event and alarm Logs. Each record in the displayed data file is generated in response to a predefined trigger. Refer to the section for each data file for details on the list of triggers.

The visibility of the Toolbar and Status Bar is controlled from the view menu.

Current Readings Command

Use this command to display the Current Readings view for the selected run. This view displays current measured and calculated values from the flow computer. The current readings view will appear differently depending on the run configuration. The dialog is a property sheet with tabs for each flow run configured in the flow computer. Click the Run1 tab to display run 1, Run 2 to display run2, and so on.



The view is divided into five sections that are described below:

Process Measurements

This section displays the live and forced values for the flow calculation process inputs. The live values show the value read from the sensor. The forced values show the inputs to the flow calculation when they are forced. The forced values are disabled when the input is live. The forced values are shown in red when the value is forced.

The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types. Process measurements not used by the flow calculation are disabled.

Forced values are not displayed for Flow Computers older than 6.0.

Calculated Compressibility

This section displays the results of the compressibility calculation selected in the ***Input Configuration*** property page. The time of the last compressibility calculation update and any compressibility calculation errors are also displayed in this section. The units of measurement displayed are those in effect when the readings were made (see **Measurement Units** for a full description of the unit types).

Calculation Status

The **Calculation Status** section displays the Calculation State of the flow computer calculations for the run. Refer to the Calculation Control command in the Flow Computer menu for further information on flow calculation control.

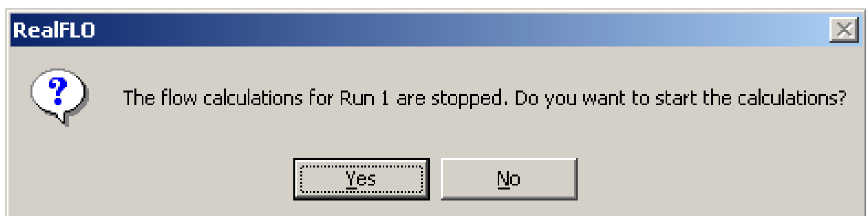
The Calculation State Start and Stop button is disabled for users who have a **read and view** privileges account.

The Calculation State can be changed using the start or stop button beside the Calculation State display.

- When the Current Readings are being updated and the calculation is **stopped** or **not set** then the button is labeled **Start**.
- When the Current Readings are being updated and the calculation is **running** then the button is labeled **Stop**.
- When the Current Readings are not being updated the button is disabled and no text is displayed on it.

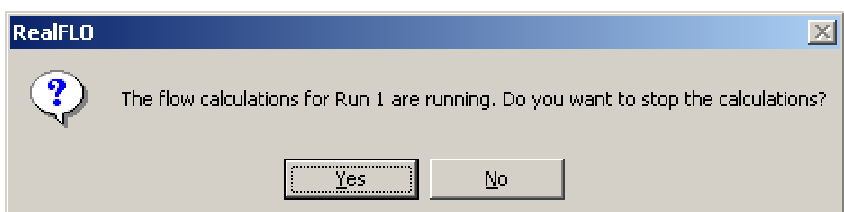
Click on the button to change the Calculation State.

If the calculations are stopped the following message box is displayed.



- If **Yes** is selected the flow calculations for the run are started.
- If **No** is selected the message box is closed and no further action is taken.

If the calculations are running the following message box is displayed.



- If **Yes** is selected the flow calculations for the run are stopped.
- If **No** is selected the message box is closed and no further action is taken.

The **Last Flow Configuration** displays the time stamp of the last time the flow configuration was changed.

The **Last Density Configuration** displays the time stamp of the last time the compressibility configuration was changed.

The Last Flow Configuration and Last Density Configuration values are not displayed for flow computers older than 6.0.

Pulse Input Volume

This section displays pulse and accumulated flow volumes for the onboard counter of a SolarPack 410. This section applies only to the SolarPack 410 system.

Data displayed is as follows:

- Pulses: Raw instantaneous pulse count
- Today: An accumulation of today's total.
- Yesterday: An accumulation of yesterday's total.
- This Month: An accumulation of the totals for this month.
- Last Month: An accumulation of the totals for last month.
- Total: A running total volume since the beginning of this operation.

Volumes are listed in the unit selected when configuring the Pulse Input.

Calculated Flow at Base Condition

The **Calculated Flow** displays the instantaneous Flow Mass Rate, Standard Flow Volume Rate, Flow Energy Rate, Flow Product, Time of last update, and Input and Flow Calculation Status. The Flow Extension is displayed when the run is configured for AGA-3 (1990) calculations. The Flow Product is displayed when the run is configured for AGA-3 (1990) calculations. The time of the last flow calculation and input and flow calculation status are also displayed. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

Calculated Flow (PEMEX)

The **Calculated Flow** displays the instantaneous Flow Volume Rate, Standard Flow Volume Rate, Flow Energy Rate, Flow Product, Time of last update, and Input and Flow Calculation Status. The Flow Extension is displayed when the run is configured for AGA-3 (1990) calculations. The Flow Product is displayed when the run is configured for AGA-3 (1990) calculations. The time of the last flow calculation and input and flow calculation status are also displayed. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

Accumulated Flow Base Conditions

The **Accumulated Flow** section displays the flow volume for the current contract day (Today) and the previous contract day (Yesterday). Data is copied from the current contract day (Today) to the previous contract day (Yesterday) at the end of the contract day, as measured by the real time clock. Data is not copied when a new day is started for other reasons. It also displays the standard flow volume, flow energy, the number of flow calculations. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

This section also displays the accumulated flow volume and flow time for the current month and the previous month. Data is copied from the current month (This Month) to the previous month (Last Month) at the end of the contract day at the end of the month, as measured by the real time clock.

Accumulated Flow (PEMEX)

The **Accumulated Flow** section displays the PEMEX flow volume for the current contract day (Today) and the previous contract day (Yesterday). Data is copied from the current contract day (Today) to the previous contract day (Yesterday) at the end of the contract day, as measured by the real time clock. Data is not copied when a new day is started for other reasons. It also displays the standard flow volume, flow energy, the number of flow calculations. The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a full description of the unit types.

This section also displays the accumulated flow volume and flow time for the current month and the previous month. Data is copied from the current month (This Month) to the previous month (Last Month) at the end of the contract day at the end of the month, as measured by the real time clock.

Accumulated Uncorrected Flow

The **Accumulated Uncorrected Flow** section displays the total calculated uncorrected flow volume (AGA-7 only) for the current contract day, the previous contract day, the current month and the last month.

The view is updated according to the status of the **Update Readings** selection in the **Maintenance** menu.

Battery Charger

This section applies only to the SolarPack 410.

The **Battery Status** indicates the current state of the solar panel charger.

The **Temperature Sensor** indicates the status of the battery charger temperature sensor.

Hourly History Command

Use this command to display the Hourly History view or the Hourly Gas Quality History view for the selected run.

Hourly History View

- Select **Hourly History** from the **View** menu to view the Hourly History table.

This view shows a table of flow measurements. Each row in the table represents one period (nominally one hour) of flow history.

Data in this view is updated when **Hourly History** is read from the controller when you click **Read Logs and History.**

The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a description of the unit types.

New Hour Triggers

A break in the hourly log is made when new hour is triggered. When a new hour is triggered the current hourly record is closed and a new hourly record is created.

A **new record** is created and added to the hourly history when any of the following triggers occur:

- Power on.
- At the end of each hour.
- When the clock is changed to a new time that is within the current day.
- AGA-3 (1985 or 1992) configuration change.
- V-Cone configuration change.
- AGA-8 configuration change. An AGA-8 configuration change does not start a new hour if the flow computer is set to ***ignore*** gas quality changes.
- NX-19 configuration change.
- Flow calculation stopped. (Stopping calculations ends the current hour. Starting calculations starts the new hour).
- Any of the items marked with an asterisk under the Input Configuration is changed.
- Contract configuration change, all parameters except the Wet Gas Meter factor for versions 6.21 and newer.

Realflo Standard and GOST Modes Hourly History Views

The columns in the tables are listed below. Some columns are not used for some types of flow calculation.

The **Start Time** column displays the date and time of the start of the period.

For flow computers using earlier versions of Realflo, Realflo will display ``---`` in the **Start** Time column. For flow computers using Realflo 6.70 or higher, Realflo will display the start time for the period.

The **End Time** column displays the date and time of the end of the period.

The **Flow Time** column displays the time of flow, in seconds, for the period.

The **Volume** column displays the corrected flow volume at standard conditions for the period.

The **Mass** column displays the calculated flow mass for the period.

The **Energy** column displays the calculated flow energy for the period based on real heating value.

The **Temperature** column displays the average temperature in the period. When the Flow Time is zero, the value will be the average temperature for the entire hour or hour fragment.

The **Pressure** column displays the average pressure in the period. When the Flow Time is zero, the value will be the average pressure for the entire hour or hour fragment.

The **Differential Pressure** column displays the average differential pressure in the period.

The **Meter Pulses** column displays the number of meter pulses in the period (AGA-7 only).

The **Relative Density** column displays the average relative density value for the period.

The **Flow Extension** column displays the average flow extension value for the period. The flow extension is calculated based on the AGA-3 calculation being used:

For AGA-3 (1985)

Flow Extension = square root of the Flow Product

Where

Flow Product = Upstream Static Pressure * Differential Pressure

For AGA-3 (1992)

Flow Extension = square root of the Flow Product

Where

Flow Product = Density of the fluid at flowing conditions * Differential Pressure

The **Uncorrected Volume** column displays the calculated uncorrected flow volume for the period (AGA-7 only).

The **Events** column displays the number of *Events* if there are events in the Event Log within the period. *Zero* is displayed if there are no Events within the period.

The **Alarms** column displays the number of *Alarms* if there are Alarms in the Alarm Log within the period. Zero is displayed if there are no Alarms within the period.

For flow computers earlier than version 6.70, the events and alarms displayed will be calculated the number of events based on the event log. For flow computers version 6.70 or higher, Realflo will read the value from the flow computer.

Realflo PEMEX Mode Hourly History View

The columns for PEMEX are listed below.

The **Start Time** column displays the date and time of the start of the period.

See section ***Historic Record Format*** for information on the units used in the Daily History table.

For flow computers using earlier versions of Realflo, Realflo will display ``---`` in the **Start** Time column. For flow computers using Realflo 6.70 or higher, Realflo will display the start time for the period.

The **End Time** column displays the date and time of the end of the period.

The **Flow Time** column displays the time of flow, in seconds, for the period.

The **Volume** column displays the corrected flow volume at standard conditions for the period.

The **Volume PEMEX** column displays the corrected flow volume at secondary conditions for the period.

The **Energy** column displays the calculated flow energy for the period based on real heating value.

The **Temperature** column displays the average temperature in the period. When the Flow Time is zero, the value will be the average temperature for the entire hour or hour fragment.

The **Pressure** column displays the average pressure in the period. When the Flow Time is zero, the value will be the average pressure for the entire hour or hour fragment.

The **Differential Pressure** column displays the average differential pressure in the period.

The **Meter Pulses** column displays the number of meter pulses in the period (AGA-7 only).

The **Relative Density** column displays the average relative density value for the period.

The **Flow Extension** column displays the average flow extension value for the period. The flow extension is calculated based on the AGA-3 calculation being used:

For AGA-3 (1985)

Flow Extension = square root of the Flow Product

Where

Flow Product = Upstream Static Pressure * Differential Pressure

For AGA-3 (1992)

Flow Extension = square root of the Flow Product

Where

Flow Product = Density of the fluid at flowing conditions * Differential Pressure

The **Uncorrected Volume** column displays the calculated uncorrected flow volume (for the period (AGA-7 only).

The **Events** column displays *Events* if there are events in the Event Log within the period. *None* is displayed if there are no Events within the period.

The **Alarms** column displays *Alarms* if there are Alarms in the Alarm Log within the period. *None* is displayed if there are no Alarms within the period.

For flow computers earlier than version 6.70, the events and alarms displayed will be calculated the number of events based on the event log. For flow computers version 6.70 or higher, Realflo will read the value from the flow computer.

The **Up Time** column displays the time of flow in minutes for the day.

The **Heating value** column displays average heating value for the period.

The **Quality** column indicates if there are alarms during the period. It shows 1 if alarms occurred and 0 if no alarms occurred.

Daily History Command

- Select **Daily History** from the **View** menu to view the Daily History table.

Use this command to display the Daily History view for the selected run. This view shows a table of flow measurements. Each row in the table represents one period (nominally one day) of flow history.

Data in this view is updated when **Daily History** is read from the flow computer with the **Read Logs and History** command.

The units of measurement displayed are those in effect when the readings were made. See **Measurement Units** for a full description of the unit types.

New Day Triggers

A **new record** is added to the daily history when any of the following triggers occur:

- Power on (when contract hour passed while power was off);
- Time passed contract hour;
- Real time clock changed outside contract day;
- Change in input configuration of these parameters:
    - Flow calculation type
    - Compressibility calculation type
- Contract configuration change
- All parameters except the Wet Gas Meter factor for versions 6.21 and newer.

Realflo Standard and GOST Modes Daily History Views

The Daily History table contains the following information, divided into columns in the table. The columns in the table are listed below. Some columns are not used for some types of flow calculation.

The **Start Time** column displays the date and time of the start of the period.

For flow computers using earlier versions of Realflo, Realflo will display ``--- `` in the **Start** Time column. For flow computers using Realflo 6.70 or higher, Realflo will display the start time for the period.

The **End Time** column displays the date and time of the end of the period.

The **Flow Time** column displays the time of flow, in seconds, in the period.

The **Volume** column displays the corrected flow volume at standard conditions for the period.

The **Mass** column displays the calculated flow mass for the period.

The **Energy** column displays the calculated flow energy for the period based on real heating value.

The **Temperature** column displays the average temperature in the period.

The **Pressure** column displays the average pressure in the period.

The **Differential Pressure** column displays the average differential pressure in the period.

The **Meter Pulses** column displays the number of meter pulses in the period (AGA-7 only).

The **Relative Density** column displays the average relative density value for the period.

The **Flow Extension** column displays the average flow extension value for the period. The flow extension is calculated based on the AGA-3 calculation being used:

For AGA-3 (1985)

Flow Extension = square root of the Flow Product

Where

Flow Product = Upstream Static Pressure * Differential Pressure

For AGA-3 (1992)

Flow Extension = square root of the Flow Product

Where

Flow Product = Density of the fluid at flowing conditions * Differential Pressure

The **Uncorrected Volume** column displays the calculated uncorrected flow volume for the period (AGA-7 only).

The **Events** column displays the number of *Events* if there are events in the Event Log within the period. *Zero* is displayed if there are no Events within the period.

The **Alarms** column displays number of *Alarms* if there are Alarms in the Alarm Log within the period. *Zero* is displayed if there are no Alarms within the period.

For flow computers earlier than version 6.70, the events and alarms displayed will be calculated the number of events based on the event log. For flow computers version 6.70 or higher, Realflo will read the value from the flow computer.

Realflo PEMEX Mode Daily History View

The PEMEX mode Daily History table contains the following information, divided into columns in the table. The columns in the table are listed below. Not all columns are used for all types of flow calculation.

See section ***Historic Record Format*** for information on the units used in the Daily History table.

The **Start Time** column displays the date and time of the start of the period.

For flow computers using earlier versions of Realflo, Realflo will display ``---`` in the **Start** Time column. For flow computers using Realflo 6.70 or higher, Realflo will display the start time for the period.

The **End Time** column displays the date and time of the end of the period.

The **Flow Time** column displays the time of flow, in seconds, in the period.

The **Volume** column displays the corrected flow volume at standard conditions for the period.

The **Volume PEMEX** column displays the corrected flow volume at secondary conditions for the period.

The **Energy** column displays the calculated flow energy for the period based on real heating value.

The **Temperature** column displays the average temperature in the period.

The **Pressure** column displays the average pressure in the period.

The **Differential Pressure** column displays the average differential pressure in the period.

The **Meter Pulses** column displays the number of meter pulses in the period (AGA-7 only).

The **Relative Density** column displays the average relative density value for the period.

The **Flow Extension** column displays the average flow extension value for the period. The flow extension is calculated based on the AGA-3 calculation being used:

For AGA-3 (1985)

Flow Extension = square root of the Flow Product

Where

Flow Product = Upstream Static Pressure * Differential Pressure

For AGA-3 (1992)

Flow Extension = square root of the Flow Product

Where

Flow Product = Density of the fluid at flowing conditions * Differential Pressure

The **Uncorrected Volume** column displays the calculated uncorrected flow volume for the period (AGA-7 only).

The **Heating value** column displays average heating value for the period.

The **Events** column displays the number of *Events* if there are events in the Event Log within the period. *Zero* is displayed if there are no Events within the period.

The **Alarms** column displays number of *Alarms* if there are Alarms in the Alarm Log within the period. *Zero* is displayed if there are no Alarms within the period.

For flow computers earlier than version 6.70, the events and alarms displayed will be calculated the number of events based on the event log. For flow computers version 6.70 or higher, Realflo will read the value from the flow computer.

The **Quality** column indicates if there are alarms during the period. It shows 1 if alarms occurred and 0 if no alarms occurred.

The **Up Time** column displays the time of flow in minutes for the day.

Hourly Gas Quality History Command

Use this command to display the accumulated gas component values for the period since the previous gas composition message or the beginning of the hourly record (whichever has the later time stamp). At the end of the period, a maximum one hour, the average gas component values are calculated.

- Select **Hourly Gas Quality History** from the **View** menu to view the Hourly Gas Quality History table.

This view shows a table of gas quality average values. Each row in the table represents one period (nominally one hour) of gas quality history.

Data in this view is updated when **Hourly Gas Quality History** is read from the controller when you click **Read Logs and History.**

New Hour Triggers

A break in the hourly log is made when new hour is triggered. When a new hour is triggered the current hourly record is closed and a new hourly record is created.

A **new record** is added to the hourly gas quality history when any of the following triggers occur:

- Power on.
- Time passed end of hour.
- When the clock is changed to a new time that is within the current day.
- V-Cone configuration change.
- AGA-8 configuration change. An AGA-8 configuration change does not start a new hour if the flow computer is set to ***ignore*** gas quality changes.
- AGA-7 configuration change.
- AGA-385 configuration change.
- AGA-392 configuration change.
- Flow calculation stopped. (Stopping calculations ends the current hour. Starting calculations starts the new hour.)
- Change to input configuration.
- Change to contract configuration.
- Start calculations (stopping calculations ends the current hour, starting calculations starts the new hour).

Hourly Gas Quality History View

The columns in the table are listed below.

Gas Quality History Columns

The **Start Time** column displays the date and time of the start of the period.

The **End Time** column displays the date and time of the end of the period.

The **Operational Time** column displays the value, in seconds, how long the meter run was running during the period.

The **Methane** column displays the average percentage of methane in the gas composition for the period.

The **Nitrogen** column displays the percentage of nitrogen in the gas composition for the period.

The **Carbon Dioxide** column displays the average percentage of carbon dioxide in the gas composition for the period.

The **Ethane** column displays the average percentage of ethane in the gas composition for the period.

The **Propane** column displays the average percentage of propane in the gas composition for the period.

The **Water** column displays the average percentage of water in gas composition for the period.

The **Hydrogen Sulphide** column displays the average percentage of hydrogen sulphide in the gas composition for the period.

The **Hydrogen** column displays the average percentage of hydrogen in the gas composition for the period.

The **Carbon Monoxide** column displays the average percentage of carbon monoxide in the gas composition for the period.

The **Oxygen** column displays the average percentage of oxygene in the gas composition for the period.

The **i-Butane** column displays the average percentage of i-Butane in the gas composition for the period.

The **n-Butane** column displays the average percentage of n-Butane in the gas composition for the period.

The **i-Petane** column displays the average percentage of i-Petane in the gas composition for the period.

The **n-Petane** column displays the average percentage of n-Petane in the gas composition for the period.

The **n-Hexane** column displays the average percentage of n-Hexane in the gas composition for the period.

The **n-Heptane** column displays the average percentage of n-Heptane in the gas composition for the period.

The **n-Octane** column displays the average percentage of n-Octane in the gas composition e for the period.

The **n-Nonane** column displays the average percentage of n-Nonane in the gas composition for the period.

The **n-Decane** column displays the average percentage of n-Decane in the gas composition for the period.

The **Helium** column displays the average percentage of helium in gas composition for the period.

The **Argon** column displays the average percentage of argon in the gas composition for the period.

The **Relative Density** column displays the average relative density value for the period.

The **Heating Value** column displays the average heating value in BTU(60)/ft^3 of the gas composition for the period.

The **HexanesPlus** column displays the average percentage of hexaneplus in gas composition for the period.

Event Log Command

Use this command to display the Event Log view for the selected run. This view displays the event log from the flow computer. The view is a table, with each row in the table representing one event, that being, a Realflo configuration change.

Events are numbered sequentially from 1 to 65535, with automatic rollover allowing for verification that events have been duly recorded when reviewing event history.

Data in this view is updated when **Event Log** is read from the flow computer with the **Read Logs/History** from Controller command. Data in this view is also updated when hourly history is read from the controller with the **Read Logs/History** command from the **Flow Computer** menu. To delete the events read from the log in the flow computer, select **Just Read New Events**.

If the events in the log are not purged and the event log fills with 700 events, the oldest events are lost and the lost event counter is incremented. Events are numbered sequentially from 1 to 65535, with automatic rollover allowing for verification that events have been duly recorded when reviewing alarm history.

Each event in the log contains the following information, divided into columns in the table.

- The **Time** column displays the date and time of the event in the short format defined from the Windows Control Panel.
- The **Event Number** column displays the unique event number for the event (module 65536) as read from the flow computer.
- The **Event ID** column displays the code identifying the event.
- The **Event Type** column displays the description of the Event ID code.
- The **New Value** column displays the new data associated with the event. If a configuration parameter was changed, for example, the new value of the parameter is displayed.
- The **Previous Value** column displays the previous data associated with the event. If a configuration parameter was changed, for example, the previous value of the parameter is displayed. Some events don't record a previous value. In that case a value of 0 is displayed.
- The **userID** column displays the code identifying the user that caused the event.
- The **User Name** column displays the account name of the user that caused the event.

Alarm Log Command

Use this command to display the Alarm Log view for the selected run. This view displays the alarm log from the flow computer. The view is a table, with each row in the table representing one alarm, that being, a dynamic change that affects the outcome of the calculations, for example, if communications are lost between the flow computer and sensor.

Alarms are numbered sequentially from 1 to 65535, with automatic rollover allowing for verification that alarms have been duly recorded when reviewing alarm history.

Data in this view is updated when **Alarm Log** is read from the flow computer with the **Read Logs/History** from Controller command. Data in this view is also updated when hourly history is read from the flow computer with the

Read Logs/History command. To delete the alarms read from the log in the flow computer, select **Just Read New Alarms**.

If the alarms in the log are not acknowledged and the alarm log fills with 300 alarms, the oldest alarms are lost and the lost alarm counter is incremented. Alarms are numbered sequentially from 1 to 65535, with automatic rollover allowing for verification that all alarms have been duly recorded when reviewing alarm history.

Each alarm in the log contains the following information, divided into columns in the table.

- The **Time** column displays the date and time of the alarm in the short format defined from the Windows Control Panel.
- The **Alarm Number** column displays the unique alarm number for the event (module 65536) as read from the flow computer.
- The **Alarm ID** column displays the code identifying the alarm.
- The **Alarm Type** column displays the description of alarm.
- The **New Value** column displays the new data associated with the alarm.
- The **Previous Value** column displays the previous data associated with the alarm. Some alarms don’t include a previous value. In that case a value of 0 is displayed.
- The **userID** column displays the code identifying the user that caused the alarm.
- The **User Name** column displays the account name of the user that caused the alarm.

More Views Command

Use these commands to change the Custom View. The view type is not changed. If the *Change All Views* option is selected, opened views are changed to the selected Custom View. Otherwise, only the current view is changed. When more than nine custom views are available the **More Views** command is enabled.

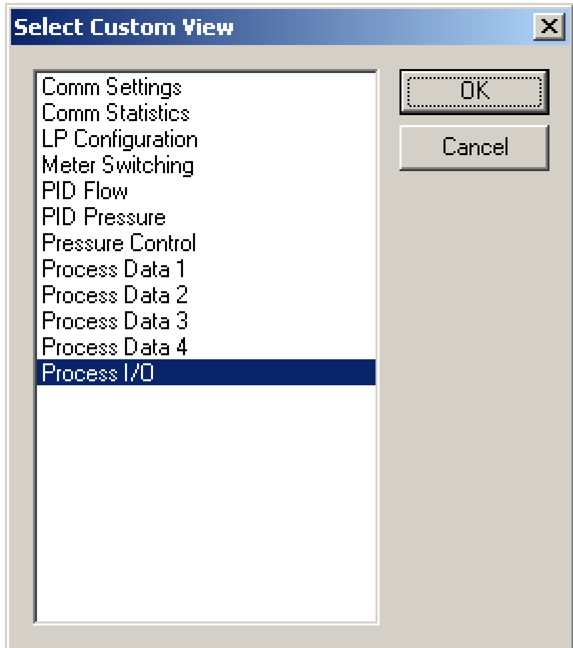
The Custom Views displayed will depend on the number of custom views created. The Custom Views displayed will have the format:

1 Custom View
2 Custom View
3 Custom View
4 Custom View
5 Custom View
6 Custom View
7 Custom View
8 Custom View
9 Custom View
More Views

When the More Views command is selected the **Select Custom View** dialog is opened.

The **Select Custom View** dialog displays a list of custom views. The list shows the views that are available to the current user. Views that require a higher access level are not shown. Refer to the Accounts section for more information on Access Levels.

The views are sorted in alphabetical order.



Click on a view in the list to select it. Double click on a view in the list to show the selected view in the current window and close the dialog.

The **OK** button shows the selected view in the current window and closes the dialog.

The **Cancel** button closes the dialog

Run 1 . . . Run 10 Commands

Use these commands to change the run being viewed to the selected run. The view type is not changed. If the *Change All Views* option is selected, opened views are changed to the selected run. Otherwise, only the current view is changed.

The Runs displayed are:

Run 1
Run 2
Run 3
Run 4
Run 5
Run 6
Run 7
Run 8
Run 9
Run 10

Commands for runs that are not enabled in the current file are grayed.

Change All Views Command

Use this command to select if all views are affected by the **Run** commands, or if only the current view is affected. A checkmark appears to the left of the item if all views are selected.

Modifying History and Log Views

The history and log view tables may be modified using the following options.

Sorting Data

Clicking on the column headings will sort the table, in ascending order, according to the column selected. Click on the same column heading again to toggle the sort order from ascending to descending order.

Sizing Columns

Positioning the cursor over the line separating the columns in the heading can change the column widths. The cursor changes to a vertical bar with arrows pointing left and right. Click on the line then slide the mouse left or right. Release the mouse button when the column is the desired width.

Selecting Data

Click on any row to select it. Hold down Shift and click on any row to select the range from the currently selected row to the new row. Hold down Ctrl and click on any row to toggle the selection of that row.

Printing and Exporting Data

To print or export part of the data, select the desired rows then use the Print or Export function.

Toolbar Command

Use this command to display and hide the toolbars, which includes buttons for some of the common commands in Realflo. A check mark appears next to the menu item when the toolbar is displayed. See the ***Standard Toolbar*** section for help on using the toolbar.

Status Bar Command

Use this command to display and hide the Status Bar. The Status bar appears at the bottom of the main window. It displays information about the command selected and other status information. A check mark appears next to the menu item when the Status Bar is displayed. See **Status Bar** section for help on using the status bar.

Maintenance Mode

Use this command to switch to the Maintenance Mode screen in Realflo.

- Click the **Maintenance Mode** command to switch to Maintenance Mode.

Start in Expert Mode

Realflo starts in maintenance mode by default. Advanced users can select to have Realflo start in expert mode.

- Click the **Start in Expert Mode** command to have Realflo start with the Expert Mode window opened.

A check mark is displayed beside the Start in Expert Mode command indicating the selection.

Configuration Menu

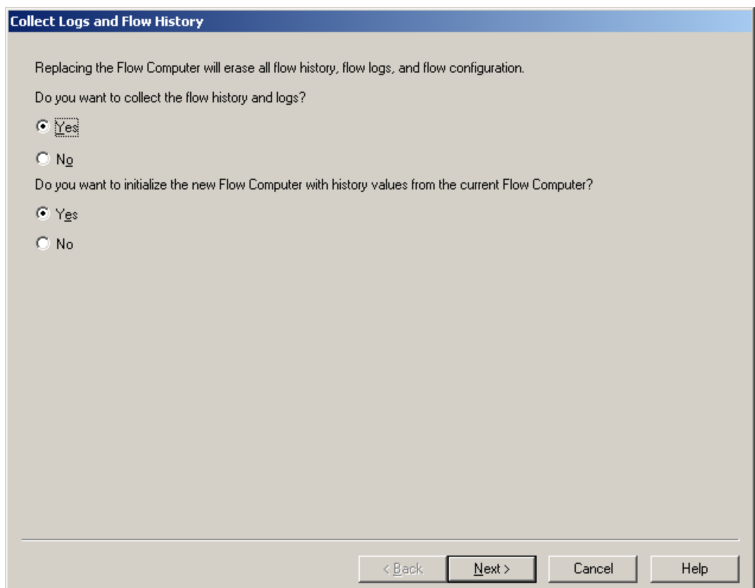
Replace Flow Computer

The Replace Flow Computer command enables users to replace the flow computer. This is typically required only when a new version of flow computer is available.

When selected, the command starts the Replace Flow Computer wizard to guide you through the steps to replace the flow computer (see the **Replace** Flow Computer Wizard section).

Collect Logs and Flow History

This step selects whether the logs and flow history are read before replacing the flow computer program and if the new flow computer is initialized with the logs and flow history from the current flow computer.



The first question, **Do you want to collect the flow history and logs?** Determines if the flow history and logs are to be read from the current flow computer before it is replaced.

Select **Yes** to collect the logs and flow history. This is the default selection.

- Select **No** to discard the uncollected logs and flow history.

The second question, **Do you want to initialize new Flow Computer with history values from the current Flow Computer?** Selects whether the new flow computer will be initialized with the flow history and logs are read from the current flow computer once the new flow computer is written.

- Select Yes to initialize the new flow computer with history values. This is the default selection.
- Select **No** to discard the history values of the current Flow Computer.

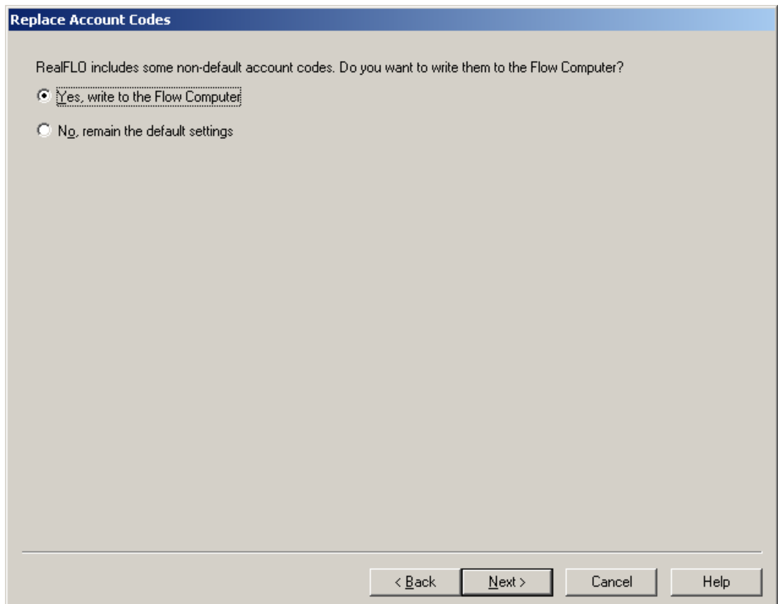
The **Next** button moves to the next step. The next step is Replace Account Codes if the current account includes some non-default account, otherwise the next step is Read Configurations if **collect the logs and flow history option** is selected, otherwise the next step is Replace Flow Computer.

The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Replace Account Codes

The Replace Account Codes dialog is be displayed if the current Realflo file includes some non-default account codes. Selections allow for the account codes to be written to the flow computer or to have the account codes set for the default settings.



Select **Yes, write to the Flow Computer** to write the account codes. This is the default selection. The writing account codes will be done after writing the accumulated history in the Replace Flow Computer step.

Select **No, remain the default settings** to not write the account codes.

The **Back** button returns to the previous step.

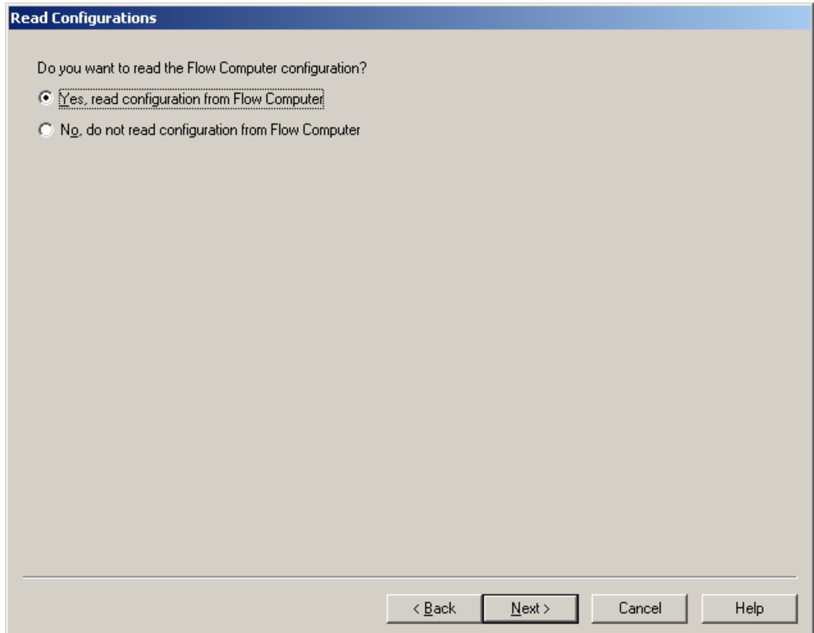
The **Next** button moves to the next step.

The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Read Configuration

This step selects whether the current configuration is read from the flow computer. Selections provide for reading configurations from the flow computer or to not read configurations. See the **Power Management Configuration** section of this manual for further information on what information is read.



Select **Yes, read configuration from Flow Computer** to read the configurations from flow computer. This is a default option.

Select **No, do not read configuration from Flow Computer** to skip reading configurations.

The **Back** button returns to the previous step.

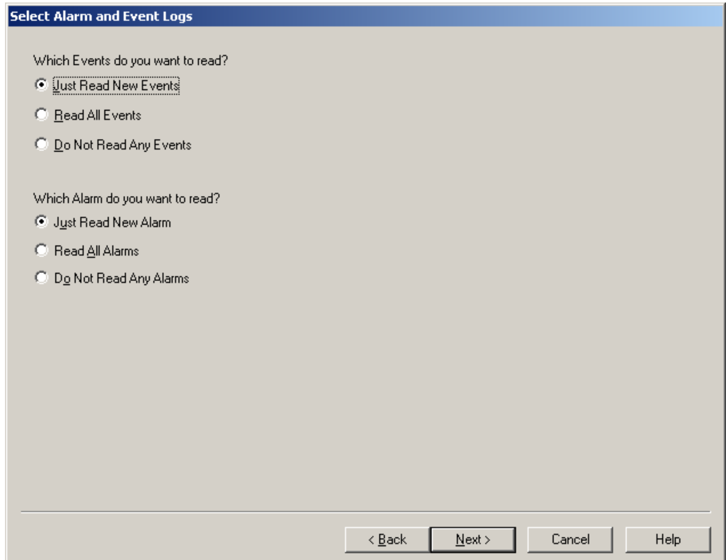
The **Next** button reads the flow computer configuration, if selected, and moves to the next step, Select Alarms and Events.

The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Select Event and Alarm Logs

This step selects whether the alarms and events in the flow computer are read.



The **Which Events do you want to read?** selection determines which events to read from the flow computer.

- Select **Just Read New Events** to read unacknowledged events in the flow computer. If the operator has **View, Read and Write Data** or **Administrator** authorization then the events will be acknowledged after reading the new events. If the events in the log are not acknowledged, the event log will fill with 700 events. Operator activity will be prevented until the events are read and acknowledged. The control is grayed under the following conditions:
    - The event log is not selected.
    - The user has **Read and View** account privileges.
    - The **Restrict Realflo users to reading all alarms and events** option is selected in the Expert Mode Options menu.
- Select **Read All Events** to read all events in the flow computer. This control is grayed if the Event Log control is not selected.
- Select **Do Not Read Any Events** to skip reading of events from the flow computer.

The **Which Alarms to you want to read?** selection determines which alarm logs to read from the flow computer.

- Select **Just Read New Alarms** to read unacknowledged alarms in the flow computer. If the operator has **View, Read and Write Data** or **Administrator** authorization then the alarms will be acknowledged after reading the new events. If the events in the log are not acknowledged, the alarm log will fill with 300 events. Operator activity will be prevented until the alarms are read and acknowledged. The control is grayed under the following conditions:
- The alarm log is not selected.

- The user has **Read and View** account privileges.
- The **Restrict Realflo users to reading all alarms and events** option is selected in the Expert Mode Options menu.
- The **Read All Alarms** radio button selects the reading of all alarms in the controller. The control is grayed if the Alarm control is not selected.
- The **Do Not Read Any Alarms** button selects not to read alarms from the flow computer.
- Click the **Next>** button to move to the next step in the wizard.

The **Which Events do you want to read?** section has the following selections.

- Select **Just Read New Events** to read unacknowledged events in the flow computer. If the operator has Write authorization then the events will be acknowledged after reading the new events. If the events in the log are not acknowledged, the event log will fill with 700 events. Operator activity will be stopped until the events are read and acknowledged. This is the default selection.
- Select **Read All Events** to read all events in the flow computer. Do not acknowledge the events.
- Select **Do Not Read Any Events** to skip reading events.

The **Back** button returns to the previous step.

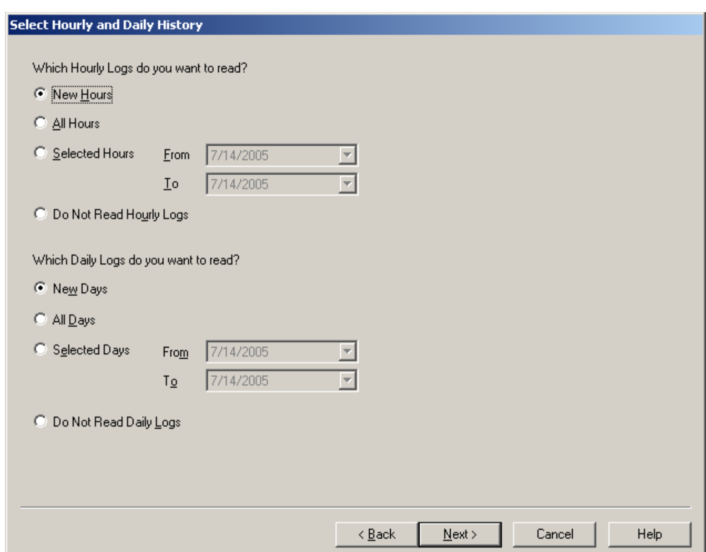
The **Next** button reads the selected alarms and events and moves to the next step, Select Hourly History.

The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Select Hourly and Daily History

This step selects which hourly and daily history logs are read from the flow computer.



The **Which Hourly Logs do you want to read?** section has the following selections.

- Select **New Hours** to read hourly history for days after those in the file. If the file is empty then Realflo will read all hourly history stored in the flow computer. This is the default selection.
- Select **All Hours** to read hourly history for all days stored in the flow computer.
- Select **Selected Hours** to read hourly history for the range of days selected with the From and To drop-down lists. Records are read for the contract days whose first hour is within the date range. Records for the contract day are read, regardless of their calendar date. This may result in records with calendar days outside the range being added to the log. For example, if the contract day is configured to start at 7:00 AM. Reading hourly history for September 23 would return the records where the first record in a day was between 7:00 on the 23rd to 6:59:59 AM on the 24th.
- Select **Do Not Read Hourly Logs** to skip the reading of hourly history.

The **Which Daily Logs do you want to read?** section has the following selections.

- Select **New Days** to read daily history for days after those in the file. If the file is empty then Realflo will read daily history stored in the flow computer. This is the default selection.
- Select **All Days** to read daily history for all days stored in the flow computer.
- Select **Selected Days** to read daily history for the range of days selected with the From and To drop-down lists. Records are read for the contract days whose first record is within the date range. Records for the contract day are read, regardless of their calendar date. This may result in records with calendar days outside the range being added to the log. For example, if the contract day is configured to start at 7:00 AM. Reading daily history for September 23 would return the daily records whose end time is in the range 7:00 on the 23rd to 6:59:59 AM on the 24th.
- Select **Do Not Read Daily Logs** to skip the reading of daily history.

The **From** controls contain the oldest previous day for which the hourly or daily history is to be read. The initial value is 35 days before the current day. The control is enabled when the **Selected Hours** or **Selected Days** is selected. Change this date to avoid reading data that has previously been read into the log.

The **To** controls contain the recent previous day for which the hourly or daily history is to be read. The initial value is the current day. The allowed range is the same or greater than the value in the **From** control. The control is enabled when the **Selected Hours** or **Selected Days** is selected. Change this date when wanting to read older data only. Leaving this date at its default will result in the recent data being read.

The **Back** button returns to the previous step.

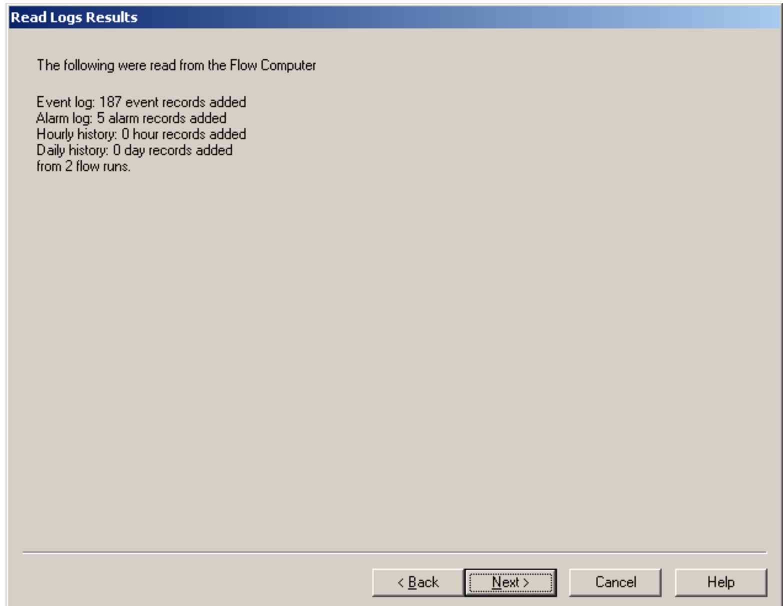
The **Next** button reads the selected logs and then moves to the next step, Read Log Results.

The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Read Log Results

This step displays the results of the Read Logs and History steps.



The **Back** button returns to the previous step.

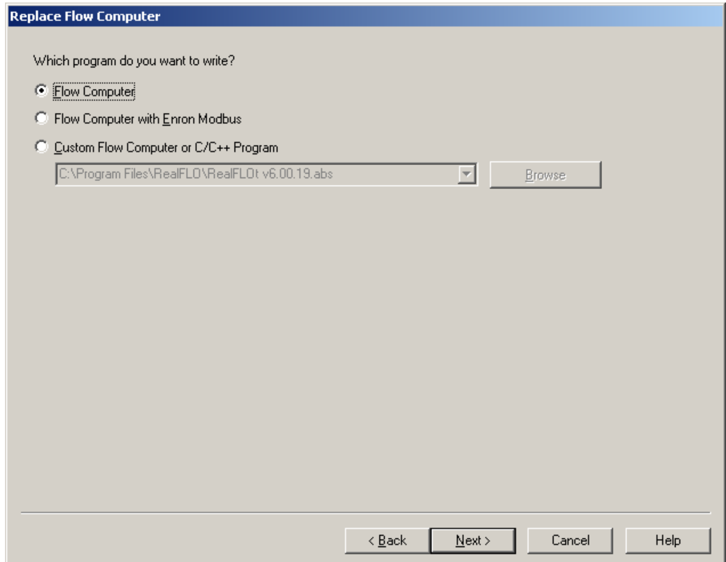
The **Next** button moves to the next step, Replace Flow Computer.

The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Replace Flow Computer Wizard

This step selects the flow computer file to write and writes the file to the flow computer.



Use the Replace Flow Computer dialog to select the flow computer program to write to the flow computer.

Select **Flow Computer** to write a basic flow computer program. Realflo selects the correct program file for the flow computer from the folder Realflo was started from, typically **C:\Program Files\Control Microsystems\Realflo**.

- The file selected will be **Realflot v#.##.#.abs** for Telepace firmware and **Realfloi v#.##.#.abs** for ISaGRAF firmware on 16-bit SCADAPack controllers, where #.##.# is the flow computer version number.

This option is disabled if the controller type is a SCADAPack 32, SCADAPack 314/330/334, SCADAPack 350, SCADAPack 4203 and SolarPack 410.

Select **Flow Computer with Enron Modbus** to write a flow computer program with Enron Modbus support. Realflo selects the correct program file for the flow computer from the folder Realflo was started from, typically **C:\Program Files\Control Microsystems\Realflo**.

Flow computer files available will depend on the Realflo operating mode and the controller type.

Standard Flow Computer Files

- RFEnront v#.##.#.abs for Telepace firmware and RFEnroni v#.##.#.abs for ISaGRAF firmware for 16-bit SCADAPack controllers.
- Realflot v#.##.#.out for Telepace SCADAPack 350 firmware and Realfloi v#.##.#.out for ISaGRAF SCADAPack 350 firmware.
- Realflo33xt v#.##.#.out for Telepace SCADAPack 330/334 firmware and Realflo33xi v#.##.#.out for ISaGRAF SCADAPack 330/334 firmware.
- Realflo31xt v#.##.#.out for Telepace SCADAPack 314 firmware and Realflo31xi v#.##.#.out for ISaGRAF SCADAPack 314 firmware.

- Realflo4203t v#.##.#.out for Telepace SCADAPack 4203 firmware and Realflo4203i v#.##.#.out for ISaGRAF SCADAPack 4203 firmware.
- Realflo410t v#.##.#.out for SolarPack 410 firmware.
- Realflot v#.##.#.mot for Telepace SCADAPack 32 firmware and Realfloi v#.##.#.mot for ISaGRAF SCADAPack 32 firmware.

GOST Flow Computer Files

- Realflo_GOST_t v#.##.#.abs for Telepace firmware and Realflo_GOST_i v#.##.#.abs for ISaGRAF firmware for 16-bit SCADAPack controllers.
- Realflo_GOST_33xt v#.##.#.out for Telepace SCADAPack 330/334 firmware and Realflo_GOST_33xi v#.##.#.out for ISaGRAF SCADAPack 330/334 firmware.
- Realflo_GOST_31xt v#.##.#.out for Telepace SCADAPack 314 firmware and Realflo_GOST_31xi v#.##.#.out for ISaGRAF SCADAPack 314 firmware.
- Realflo_GOST_4203t v#.##.#.out for Telepace SCADAPack 4203 firmware and Realflo_GOST_4203i v#.##.#.out for ISaGRAF SCADAPack 4203 firmware.
- Realflo_GOST_410t v#.##.#.out for SolarPack 410 firmware.
- Realflot v#.##.#.mot for Telepace SCADAPack 32 firmware and Realfloi v#.##.#.mot for ISaGRAF SCADAPack 32 firmware.

PEMEX Flow Computer Files

- Realflo_PEMEX_t v#.##.#.abs for Telepace firmware and Realflo_PEMEX_i v#.##.#.abs for ISaGRAF firmware for 16-bit SCADAPack controllers.
- Realflo_PEMEX_33xt v#.##.#.out for Telepace SCADAPack 330/334 firmware and Realflo_PEMEX_33xi v#.##.#.out for ISaGRAF SCADAPack 330/334 firmware.
- Realflo_PEMEX_31xt v#.##.#.out for Telepace SCADAPack 314 firmware and Realflo_PEMEX_31xi v#.##.#.out for ISaGRAF SCADAPack 314 firmware.
- Realflo_PEMEX_4203t v#.##.#.out for Telepace SCADAPack 4203 firmware and Realflo_PEMEX_4203i v#.##.#.out for ISaGRAF SCADAPack 4203 firmware.
- Realflo_PEMEX_410t v#.##.#.out for SolarPack 410 firmware.
- Realflot v#.##.#.mot for Telepace SCADAPack 32 firmware and Realfloi v#.##.#.mot for ISaGRAF SCADAPack 32 firmware.

Select **Customer Flow Computer or C/C++ Program** to write any C/C++ program to the flow computer. Select the file to write by:

- Entering the file name in the edit box.
- Selecting a recently used file by clicking the down arrow.
- Using the Browse button to select a file. The Browse button opens a file open dialog. The dialog shows files of type ABS if the flow computer is a SCADAPack. OUT, if the flow computer is a SCADAPack 314/330/334,

SCADAPack 350 or SCADAPack 4203, or MOT if the flow computer is a SCADAPack 32.

The **Back** button returns to the previous step.

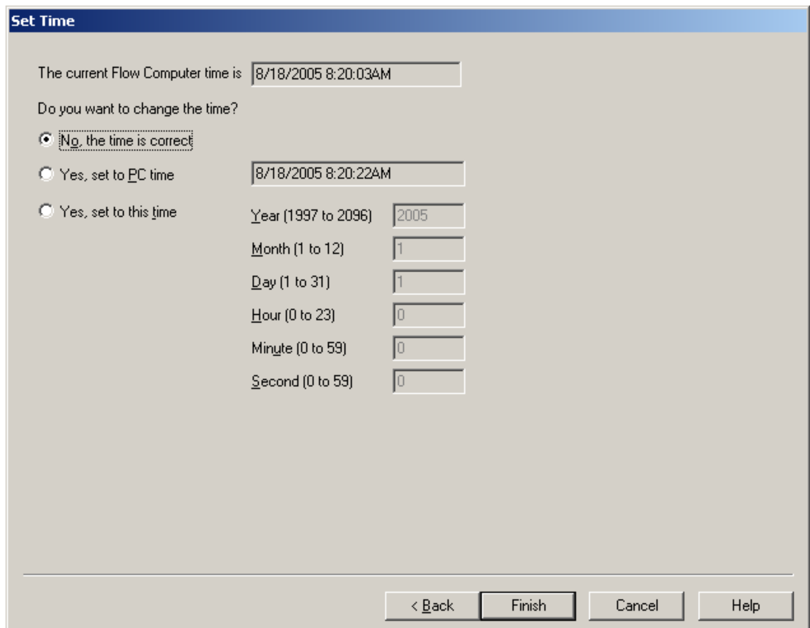
The **Next** button writes the flow computer file and moves to the next step, Set Time.

The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Set Time

This step sets the time in the flow computer.



The following controls are available from the Real Time Clock dialog.

The current Flow Computer Time shows the current time and date in the flow computer. It is updated continuously while the dialog is open. The time and date are displayed in the short time format as defined in the Windows Control Panel.

The **Yes, set to PC Time** radio button selects setting the controller time to match the PC time. The current PC time and date are shown to the right of the button. The time and date are displayed in the short format as defined in the Windows Control Panel.

The **Yes, set to this time** radio button selects setting the time and date to the values specified by the user in the **Year**, **Month**, **Day**, **Hour**, **Minute** and **Second** controls. If the Set to User Entered Time radio button is not selected these controls are grayed.

The **Back** button returns to the previous step.

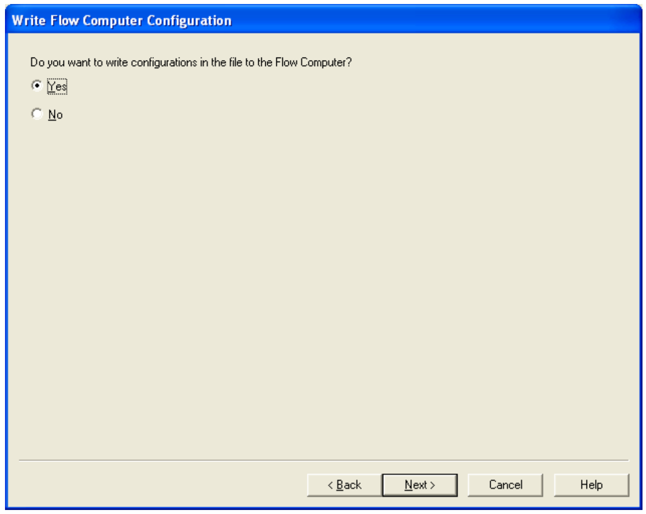
The **Finish** button writes the time and ends the wizard.

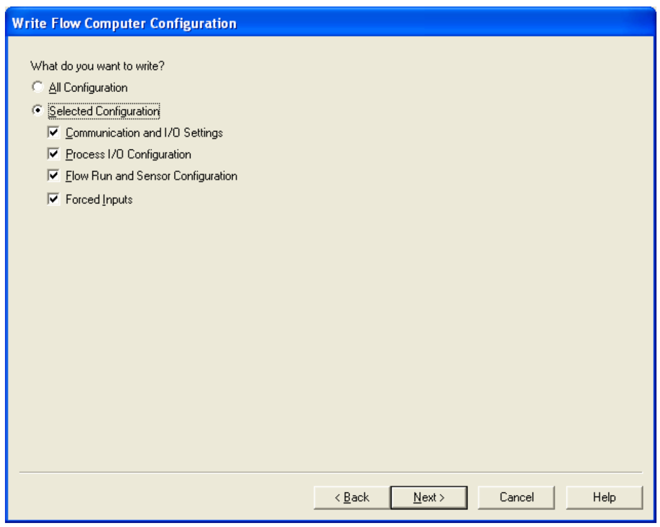
The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Write Flow Computer Configuration

The Write Configuration command is used to write all or selected parts of the Flow Computer Configuration. When selected the command displays the Write Flow Computer Configuration dialog as shown below.





The **All Configuration** radio button, when selected, results in the writing of all configuration data from the flow computer.

The **Selected Configuration** radio button enables specific configuration data to be written to the flow computer.

- Select **Communication and I/O Settings** to write the serial port, register assignment configuration information and mapping table.
- Select **Flow Run and MVT Configuration** to write the flow run configuration and the MVT transmitter configuration.
- Select **Process I/O Configuration** to write the Process I/O configuration.
- Select **Force Inputs** to write the force status of any forced flow run inputs before the flow computer was updated.

Click on the **OK** button to write the selected items to the flow computer.

Click the **Cancel** button to cancel the operation and close the dialog.

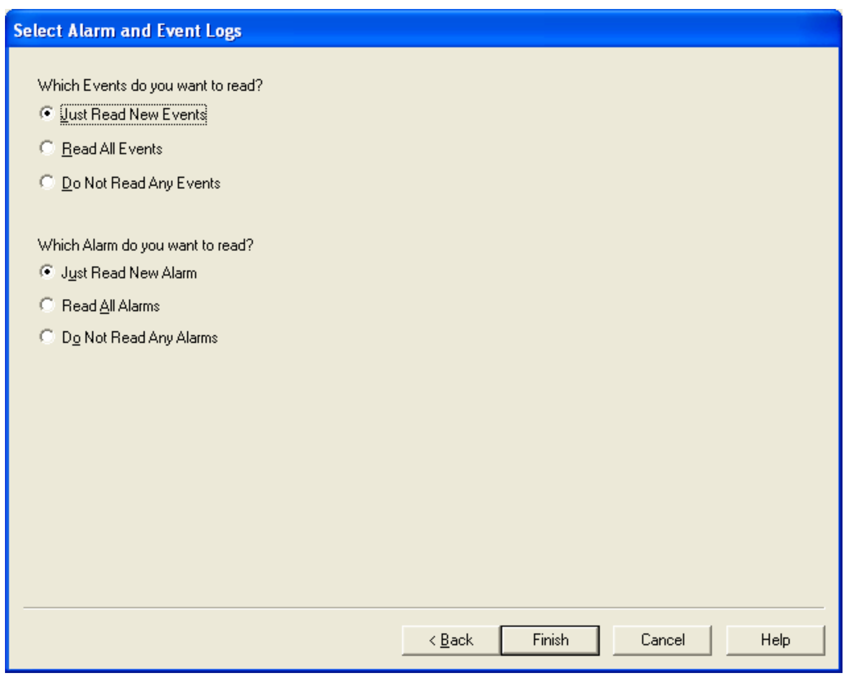
- The Flow Computer ID is checked before writing. If the Flow Computer ID does not match the ID in the dialog Realflo displays an error message.
- An error occurs if Controller Configuration is selected and the flow computer type is different from the flow computer type selected in the Controller Type dialog. An error message is displayed.

In Flow Computer versions 6.73 and older, when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers. The Actual registers are not updated until a new Density calculation is started with the new values. The new values are not available to SCADA host software reading the Actual registers until a until a new Density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers and in the Actual registers. This allows a SCADA host to immediately confirm the new values were written to the flow computer. The new gas values are not used by the flow computer until a new density calculation is started.

Read Alarm and Event Logs

This step selects whether the alarms and events in the flow computer are read.



The **Which Events do you want to read?** section has the following selections.

- Select **Just Read New Events** to read unacknowledged events in the flow computer. If the operator has Write authorization then the events will be acknowledged after reading the new events. If the events in the log are not acknowledged, the event log will fill with 700 events.

Operator activity will be stopped until the events are read and acknowledged. This is the default selection.

- Select **Read All Events** to read all events in the flow computer. Do not acknowledge the events.
- Select **Do Not Read Any Events** to skip reading events.

The **Back** button returns to the previous step.

The **Next** button reads the selected alarms and events and moves to the next step, Select Hourly History.

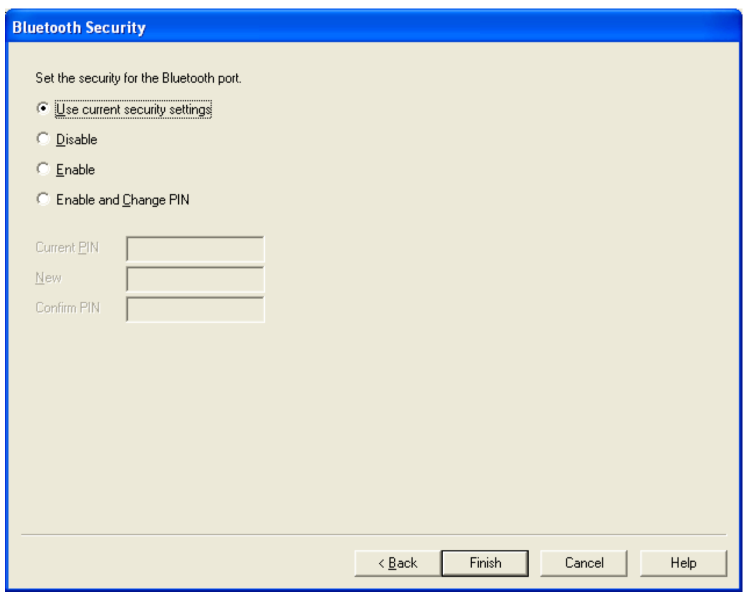
The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Bluetooth Security

If a *Bluetooth* connection was used to replace the flow computer in a SolarPack 410 the last step is setting the *Bluetooth* security.

The *Bluetooth* Security Settings dialog specifies how *Bluetooth* security is configured in the SolarPack 410 controller. Opening the dialog reads the current settings from the controller. The dialog does not open if the settings can’t be read.



***Bluetooth* Security** selects if security is enabled or not. Select **Use current security settings** to maintain the security settings that have already been established. Select **Disable** to operate the *Bluetooth* radio without security. Select **Enable** to use authentication and encryption. Select **Enable and Change PIN** to use authentication and encryption with a new PIN.

Current PIN specifies the current value of the PIN. Valid values are up to 10 alphanumeric characters (a to z, A to Z, and 0 to 9). The PIN is case sensitive. Characters entered are masked. Copy and paste are disabled (so the user needs to type the PIN). The factory default PIN is **default**.

New PIN specifies the new value of the PIN. This control is enabled if **Enable and Change PIN** is selected. Valid values are up to 10 alphanumeric characters (a to z, A to Z, and 0 to 9). The PIN is case sensitive. Characters entered are masked. Copy and paste are disabled (so the user needs to type the PIN).

Confirm New PIN specifies the new value of the PIN. This control is enabled if **Enable and Change PIN** is selected. Valid values are up to 10 alphanumeric characters (a to z, A to Z, and 0 to 9). The PIN is case sensitive. Characters entered are masked. Copy and paste are disabled (so the user needs to type the PIN).

The two values of the new PIN needs to match before any settings are written to the controller.

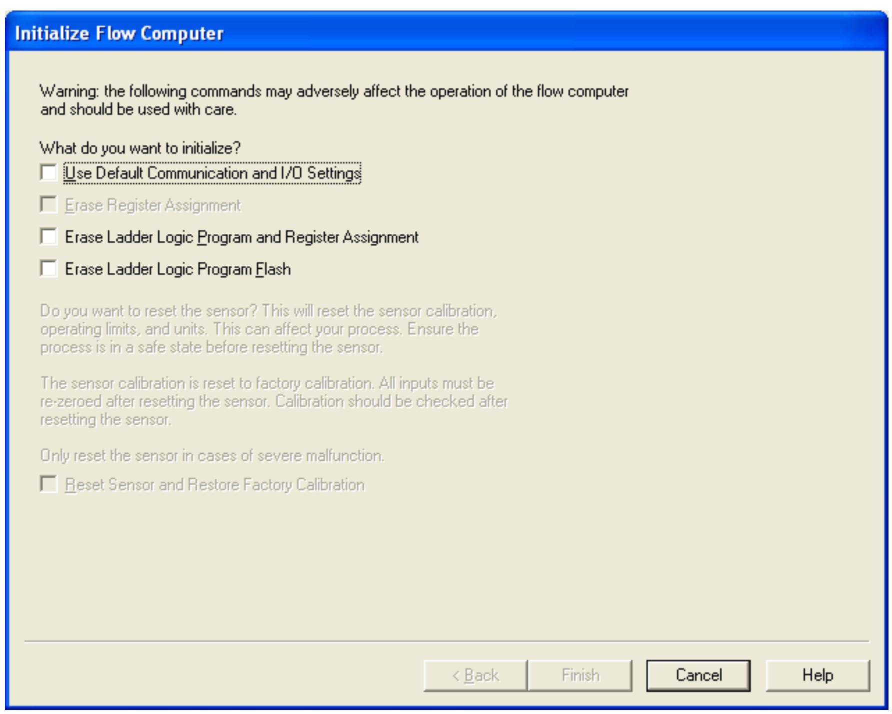
Click **Finish** to write the new settings to the controller. A message is displayed if the settings cannot be written to the controller and the dialog remains open.

Click **Cancel** to close the dialog without making any changes.

Initialize Command

The Initialize command erases programs in the flow computer and sets the flow computer to default settings. This command is typically used when starting a new project with a flow computer. This command is disabled if the Update Readings command is enabled. The command opens the **Initialize Flow Computer** dialog. The dialog displayed will depend on whether Telepace or ISaGRAF firmware is used in the flow computer.

Initialize Telepace Flow Computer



Check **Use Default Communication and I/O Settings** to reset flow computer settings to default values and clear all registers in the I/O database. This includes the serial port settings. If you are communicating using settings other than the default, the **PC Communications Settings Command** will have to be changed once the command is complete.

Check **Erase Register Assignment** to erase the register assignments. This command applies only if Telepace firmware is loaded in the flow computer. The command is disabled if SCADAPack 314, SCADAPack 330, SCADAPack 334 or SCADAPack 350 is selected as the hardware type.

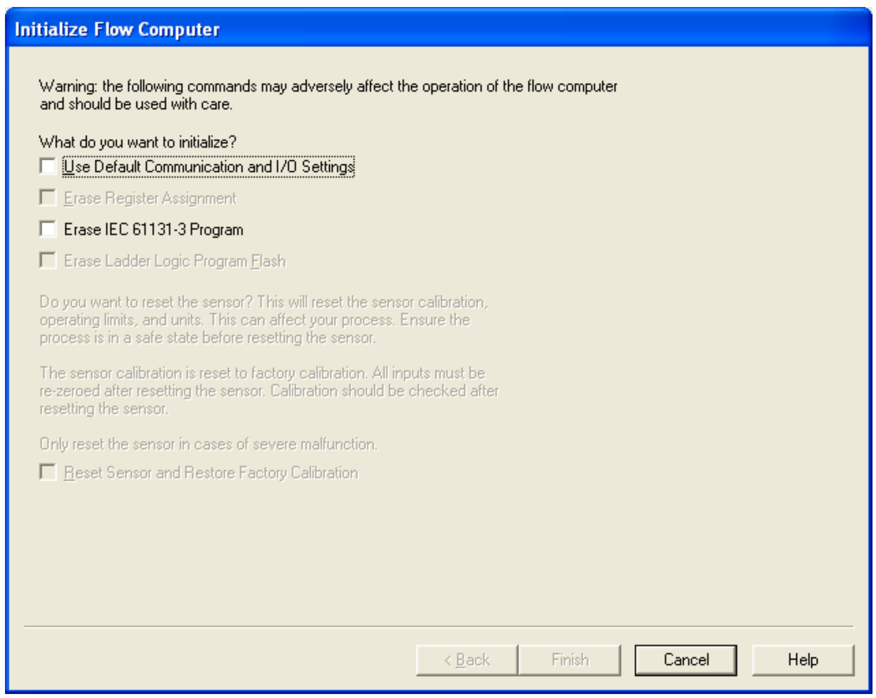
Check **Erase Ladder Logic** to erase the Telepace Ladder Logic application in the flow computer.

Check **Erase Ladder Logic Program Flash** to erase the Telepace Ladder Logic application in flash memory in the flow computer. This command applies only if Telepace firmware is loaded in the controller.

Click on the **Finish** button to perform the requested initializations.

Click on the **Cancel** button to exit without performing any action.

Initialize IEC 61131-3 Flow Computer



Check **Use Default Communication and I/O Settings** to reset flow computer settings to default values and clear registers in the I/O database. This includes the serial port settings. If you are communicating using settings other than the default, the **PC Communications Settings Command** will have to be changed once the command is complete.

Check **Erase Register Assignment** to erase the register assignments. The command is disabled if ISaGRAF firmware is loaded.

Check **IEC 61131-3 Program** to erase the IEC 61131-3 Logic application in the flow computer.

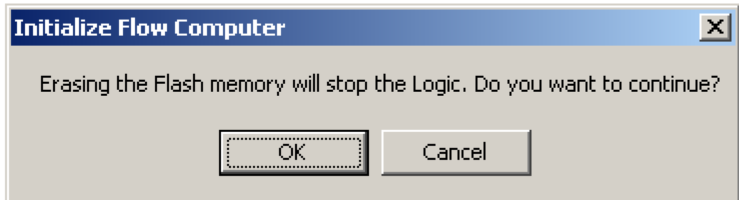
Check **Erase Ladder Logic Program Flash** to erase the Telepace Ladder Logic application in flash memory in the flow computer. This command applies only if Telepace firmware is loaded in the controller. The command is disabled if ISaGRAF firmware is loaded.

Click on the **Finish** button to perform the requested initializations.

Click on the **Cancel** button to exit without performing any action.

Erasing Programs in Flash

Erasing the flash memory requires stopping the Logic and C programs. If either flash erase command is selected the following message is displayed.

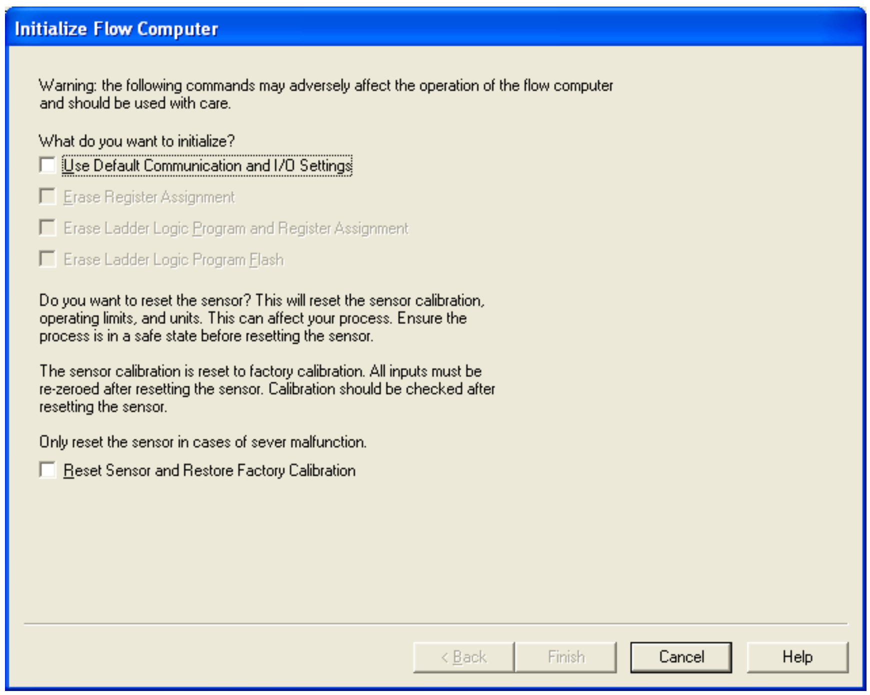


Select **OK** to stop the Logic program and erase the flash memory.

Select **Cancel** to abort the initialization of flash memory. Other selected initializations will still be performed.

Initialize SCADAPack 4203 and SolarPack 410 Flow Computer

When a SolarPack 410 is the controller type the following dialog is displayed when the Initialize command is selected.



Check **Use Default Communication and I/O Settings** to reset flow computer settings to default values and clear registers in the I/O database. This includes the serial port settings. If you are communicating using settings other than the default, the **PC Communications Settings Command** will have to be changed once the command is complete.

The **Reset Sensor and Restore Factory Calibration** check box will return the sensor to factory calibration. Note that the sensor calibration, operating limits and measurement units are reset to factory calibration.

Real Time Clock

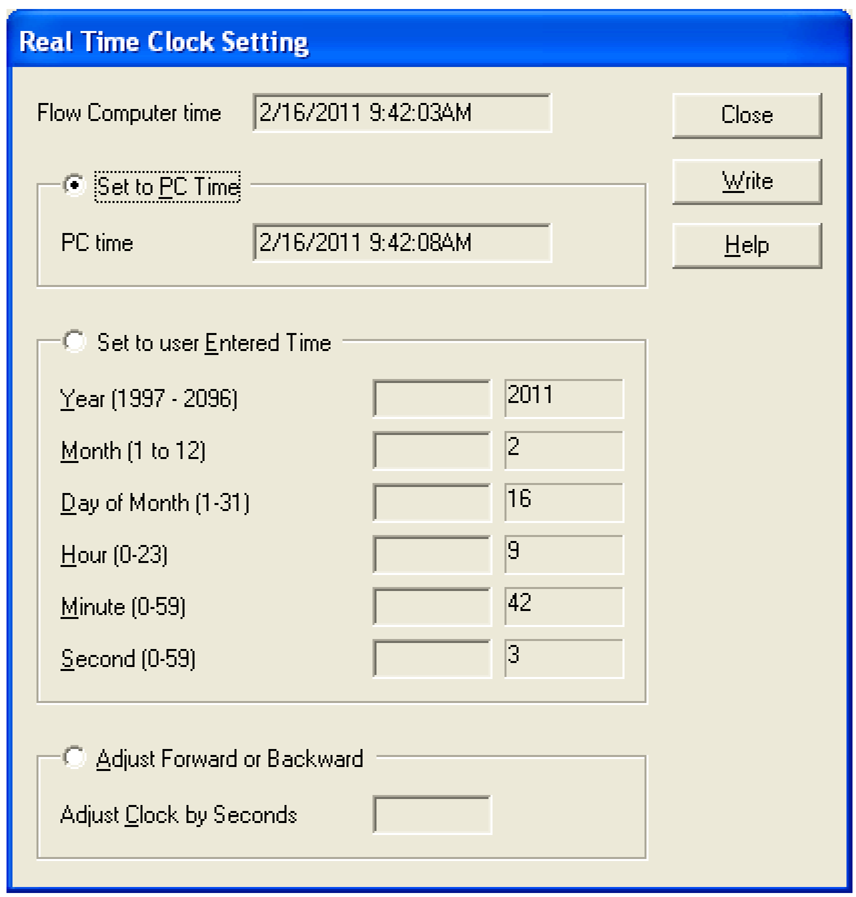
The Real Time Clock dialog sets the real time clock in the flow computer. This command is disabled if the Update Readings command is enabled. The user may set the clock to the PC time, to a user specified time or adjust the clock forward or back by a number of seconds.

The following methods cannot to set the real time clock when using the flow computer.

- The ***CNFG Real Time Clock and Alarm*** register assignment in Telepace.
- The ***setclock*** function in IEC 61131-3.
- The ***Real Time Clock*** dialog in Telepace or IEC 61131-3.

Using any of these methods to set the Real Time Clock may result in the flow computer logging data incorrectly.

The Flow Computer clock was set at the factory. However, it may be set to the wrong time zone for your location. Set the clock before configuring the flow computer so that configuiration events are stored at the correct time.



The following controls are available from the Real Time Clock dialog.

Controller Time shows the current time and date in the controller. It is updated continuously while the dialog is open. The time and date are displayed in the short time format as defined in the Windows Control Panel.

The **Set to PC Time** radio button selects setting the controller time to match the PC time. The current PC time and date are shown to the right of the button. The time and date are displayed in the short format as defined in the Windows Control Panel.

The **Set to User Entered Time** radio button selects setting the time and date to the values specified by the user in the **Year**, **Month**, **Day**, **Hour**, **Minute** and **Second** controls. If the Set to User Entered Time radio button is not selected these controls are grayed.

The **Adjust Forward or Backward** radio button selects adjusting the time by the number of seconds specified in the **Adjust Clock by Seconds** edit box. The value can be negative or positive. The edit box is grayed if the *Adjust by* radio button is not selected.

This option is useful if your communication network introduces a delay between the time the command is sent and when the flow computer receives it.

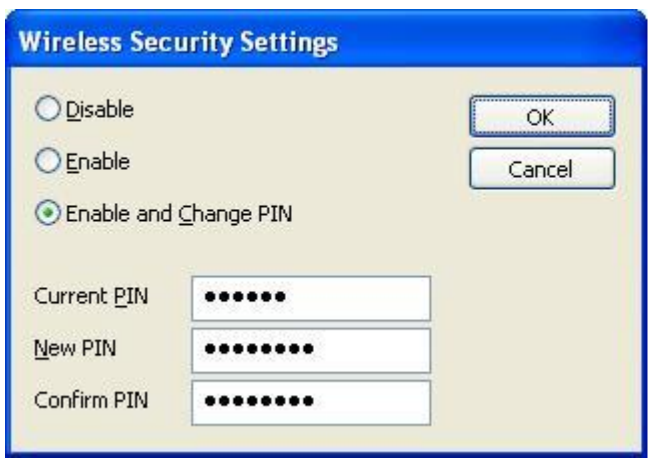
The **Close** button closes the dialog.

The **Write** button writes the selected time to the flow computer.

The **Help** button displays the help for this dialog.

Wireless Security Settings

The Wireless Security Settings dialog specifies how wireless security is configured in the SolarPack 410 controller. Opening the dialog reads the current settings from the controller. The dialog does not open if the settings can't be read. The pictorial representation of the dialog and description of each field is given below. This command is available on the SolarPack 410 controllers only.



Select **Disable** to operate the wireless radio without security. Select **Enable** to use authentication and encryption. Select **Enable and Change PIN** to use authentication and encryption with a new PIN.

Current PIN specifies the current value of the PIN. Valid values are up to 10 alphanumeric characters (a to z, A to Z, and 0 to 9). The PIN is case sensitive. Characters entered are masked. Copy and paste are disabled (so the user needs to type the PIN).

New PIN specifies the new value of the PIN. This control is enabled if **Enable and Change PIN** is selected. Valid values are up to 10 alphanumeric characters (a to z, A to Z, and 0 to 9). The PIN is case sensitive. Characters entered are masked. Copy and paste are disabled (so the user needs to type the PIN).

Confirm New PIN specifies the new value of the PIN. This control is enabled if **Enable and Change PIN** is selected. Valid values are up to 10 alphanumeric characters (a to z, A to Z, and 0 to 9). The PIN is case sensitive. Characters entered are masked. Copy and paste are disabled (so the user needs to type the PIN).

The two values of the new PIN needs to match before any settings are written to the controller.

Click **OK** to write the new settings to the controller. An error message is displayed if the settings cannot be written to the controller and the dialog remains open.

Click **Cancel** to close the dialog without making any changes.

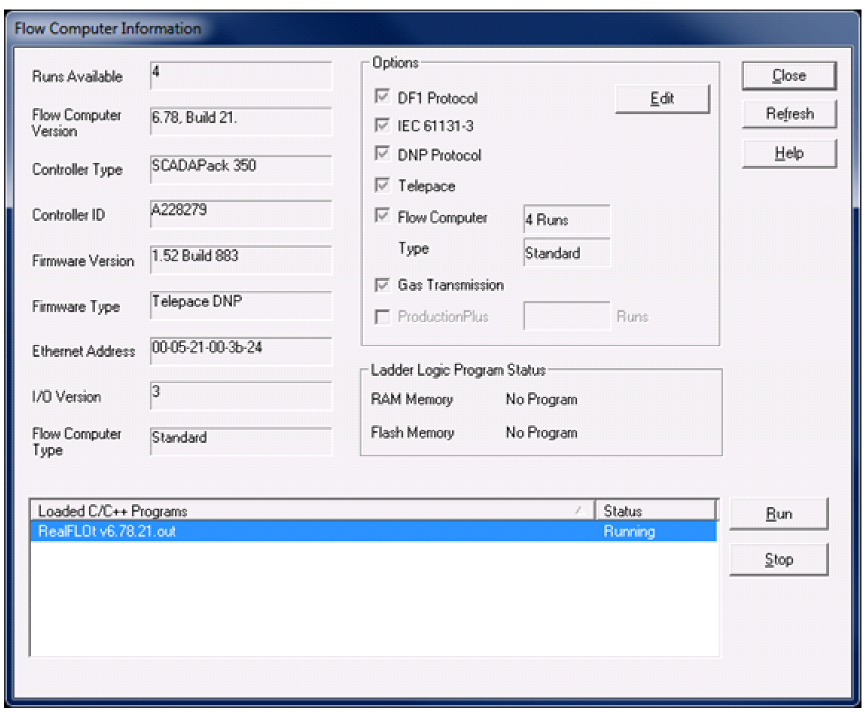
Flow Computer Information

The Flow Computer Information command is used to display information about the firmware, options, and programs installed in the flow computer. When selected, the command opens the Flow Computer Information dialog.

The Flow Computer dialog displayed depends on the Firmware Type and Hardware Type that is running the flow computer.

Telepace Flow Computer Information

For SCADAPack 32, SCADAPack, SCADAPack 4202 and Micro16 controllers the following dialog is displayed. The Telepace firmware Program Status is shown in the following dialog.



Runs Available is the maximum number of runs supported by the flow computer. The runs available may differ from the number of runs licensed in options section. This is typically due to other C applications and consuming memory in the controller. For SCADAPack 32 controllers the maximum number of runs is 4 when the Gas Transmission option is enabled.

Flow Computer Version is the version of the flow computer program.

Controller Type is the type of controller hardware.

Controller ID is the unique ID assigned to the controller at the factory.

Firmware Version is the version of the firmware in the controller.

Firmware Type is the type of firmware in the controller. It is one of Telepace, Telepace DNP, or ISaGRAF, or ISaGRAF DNP.

Ethernet Address is the Ethernet address of the controller, if an Ethernet port is available.

I/O Version is the version number of the internal I/O controller.

Flow Computer Type is the type of flow computer licensed. You can select one of the following values for this field from the dropdown list:

- None
- Standard
- PEMEX
- GOST

If you select an unlicensed flow computer type, an error message displays telling you to purchase the appropriate license.

- The Options area shows the current options enabled in the controller.
- The DF1 Protocol option enables communication using the Allen-Bradley full duplex and half-duplex protocols.
- The IEC 61131-3 option enables the IEC 61131-3 run-time engine.
- The DNP Protocol option enables communication using the DNP Protocol.
- The Telepace option enables communication using Telepace.
- The Flow Computer option enables support for the Realflo natural gas flow computer. The valid options from the dropdown list are:
    - Standard
    - PEMEX
    - GOST
- The Runs option displays the number of runs available for the flow computer.
- The Gas Transmission checkbox enables or disables calculating hourly gas quality history.

If the Flow Computer option is set to **None,** the **Runs Available** and th**e Gas Transmission** options are disabled**.**

The **Edit** button opens the ***Edit Options Dialog***.

The **Ladder Logic Program Status** section indicates the state of the Ladder Logic program. A program can be loaded in RAM memory and in

Flash memory. Only one of the programs can be running. The state will be one of No Program, Stopped, or Running.

The **C/C++ Program (Flow Computer) Status** section indicates the state of the C/C++ program. Usually this is the flow computer program, but it could be another program. The state will be one of No Program, Stopped, or Running.

- On a SCADAPack controller with Telepace firmware 1.65 or newer, a program can be loaded in RAM memory. The controller has operating system code in the C Program section of Flash.
- On a SCADAPack controller with Telepace firmware 1.64 or older, a program can be loaded in RAM memory and in Flash memory. Only one of the programs can be running.
- On a SCADAPack 32 controller a program is executed from RAM memory and saved in Flash memory.

Click **Run** to run the C/C++ program (flow computer). If there is a program in both RAM and Flash, the program in RAM will run.

Click **Stop** o stop the C/C++ program (flow computer).

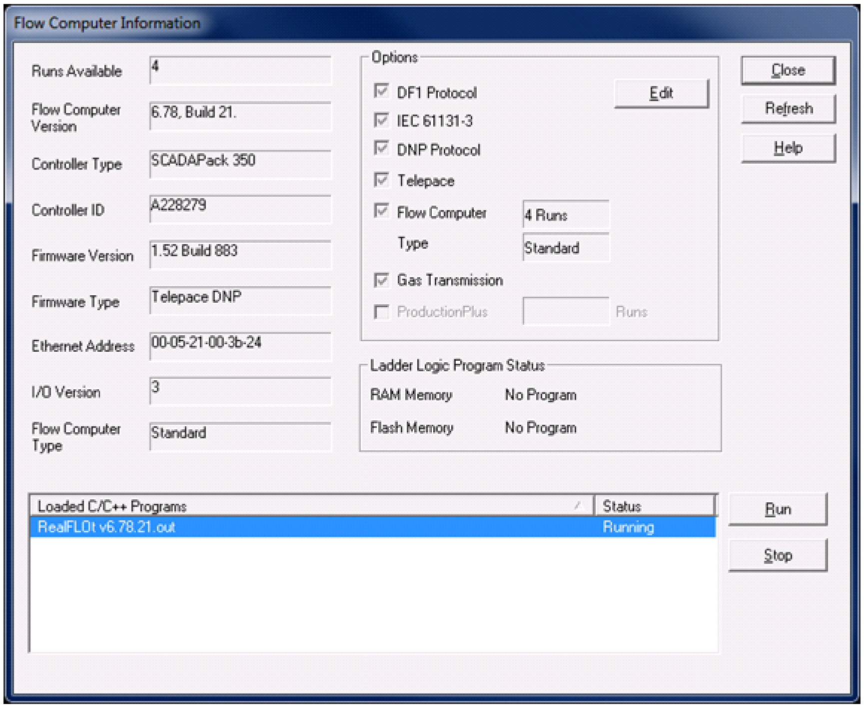
Close closes the dialog.

Refresh button reads information from the flow computer.

Help button opens the user manual.

Telepace SCADAPack 314/330/334, SCADAPack 350, SCADAPack 4203 and SolarPack 410 Flow Computer Information

For SCADAPack 314/330/334, SCADAPack 350, SCADAPack 4202 and SolarPack 410 controllers the following dialog is displayed. The SCADAPack 314/330/334, SCADAPack 350 and SCADAPack 4203 controllers support multiple C/C++ applications. When this controller is used the Flow Computer Information dialog allows for the stopping and running of each C/C++ application independently.



Runs Available is the maximum number of runs supported by the flow computer. The runs available may differ from the number of runs licensed in options section. This is typically due to other C applications or IEC 61131-3 applications running and consuming memory in the controller.

Flow Computer Version is the version of the flow computer program.

Controller Type is the type of controller hardware.

Controller ID is the unique ID assigned to the controller at the factory.

Firmware Version is the version of the firmware in the controller.

Firmware Type is the type of firmware in the controller. It is one of Telepace, Telepace DNP, or ISaGRAF, or ISaGRAF DNP.

Ethernet Address is the Ethernet address of the controller, if an Ethernet port is available.

I/O Version is the version number of the internal I/O controller.

Flow Computer Type is the type of flow computer licensed. This will be one of the following types:

- None
- Standard

- PEMEX
- GOST

If you select an unlicensed flow computer type, an error message displays telling you to purchase the appropriate license.

The **Options** area shows the current options enabled in the controller.

- The **DF1 Protocol** option enables communication using the Allen-Bradley full duplex and half-duplex protocols.
- The **IEC 61131-3** option enables the IEC 61131-3 run-time engine.
- The **DNP Protocol** option enables communication using the DNP Protocol.
- The **Flow Computer** option enables support for the Realflo natural gas flow computer. The valid options from the dropdown list are:
    - Standard
    - PEMEX
    - GOST
- The **Runs** option displays the number of runs available for the flow computer.
- The **Gas Transmission** checkbox enables or disables calculating hourly gas quality history.

If the Flow Computer option is not set the Runs Available and the Gas Transmission options are disabled.

The **Edit** button opens the ***Edit Options Dialog***.

The **Ladder Logic Program Status** section indicates the state of the Ladder Logic program. A program can be loaded in RAM memory and in Flash memory. Only one of the programs can be running. The state will be one of No Program, Stopped, or Running.

The dialog displays the C/C++ Programs that are loaded in the controller. The status of each program is indicated as **Running** or **Stopped**.

The **Close** button closes the dialog.

The **Refresh** button reads information from the flow computer.

The **Help** button opens the user manual.

The **Loaded C/C++ Programs** section indicates the state of the C/C++ programs currently loaded in the controllers. Usually this is the flow computer program, but it could be another program. The state will be one of No Program, Stopped, or Running.

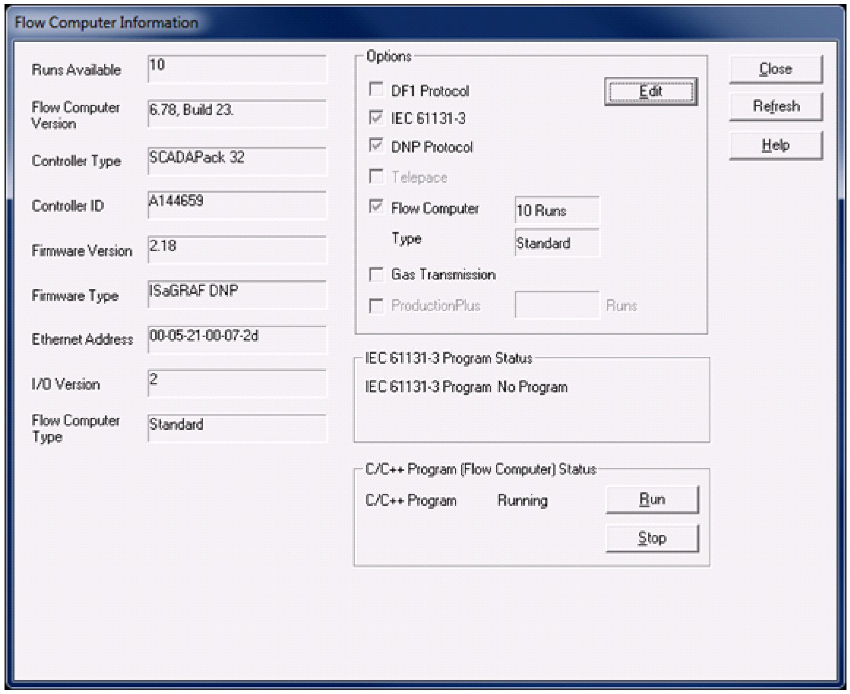
The **Run** and **Stop** buttons apply to the C/C++ Program selected from the list of loaded C/C++ programs. Only one C/C++ Program may be selected from the list at one time. These buttons are disabled when there are no C/C++ Programs loaded.

The **Run** button stops and restarts the selected C/C++ program in the controller.

The **Stop** button stops the selected C/C++ program in the controller.

IEC 61131-3 Flow Computer Information

The Flow Computer Information dialog is different for ISaGRAF firmware. The program status section appears as follows in the Flow Computer Information dialog.



Runs Available is the maximum number of runs supported by the flow computer. The runs available may differ from the number of runs licensed in options section. This is typically due to other C applications or IEC 61131-3 applications running and consuming memory in the controller. For SCADAPack 32 controllers the maximum number of runs is 4 when the Gas Transmission option is enabled.

Flow Computer Version is the version of the flow computer program.

Controller Type is the type of controller hardware.

Controller ID is the unique ID assigned to the controller at the factory.

Firmware Version is the version of the firmware in the controller.

Firmware Type is the type of firmware in the controller. It is one of Telepace, Telepace DNP, or ISaGRAF, or ISaGRAF DNP.

Ethernet Address is the Ethernet address of the controller, if an Ethernet port is available.

I/O Version is the version number of the internal I/O controller.

Flow Computer Type is the type of flow computer licensed. This will be one of the following types:

- Standard
- PEMEX
- GOST

If the Flow Computer option is not set the Runs Available and the Gas Transmission options are disabled.

The **Options** area shows the current options enabled in the controller.

- The DF1 Protocol option enables communication using the Allen-Bradley full duplex and half-duplex protocols.
- The Flow Computer option enables support for the Realflo natural gas flow computer. The Runs window displays the number of runs available for the flow computer.
- The IEC 61131-3 option enables the IEC 61131-3 run-time engine.
- The DNP Protocol option enables communication using the DNP Protocol.
- The **Flow Computer** option enables support for the Realflo natural gas flow computer. The valid options from the dropdown list are:
    - None
    - Standard
    - PEMEX
    - GOST
- The **Runs** option displays the number of runs available for the flow computer.
- The **Gas Transmission** checkbox enables or disables calculating hourly gas quality history.

If the Flow Computer option is not set the Runs Available and the Gas Transmission options are disabled.

The **Edit** button opens the ***Edit Options Dialog***.

The **Program Status** portion of the dialog depends on the controller type and the firmware. See the sections below for details.

The **IEC 61131-3 Program Status** section indicates the state of the IEC 61131-3 program. The state will be one of No Program, Stopped, or Running.

The **C/C++ Program (Flow Computer) Status** section indicates the state of the C/C++ program. Usually this is the flow computer program, but it could be another program. The state will be one of No Program, Stopped, or Running.

Click on the **Run** button to run the C/C++ program (flow computer).

Click on the **Stop** button to stop the C/C++ program (flow computer).

The **Close** button closes the dialog.

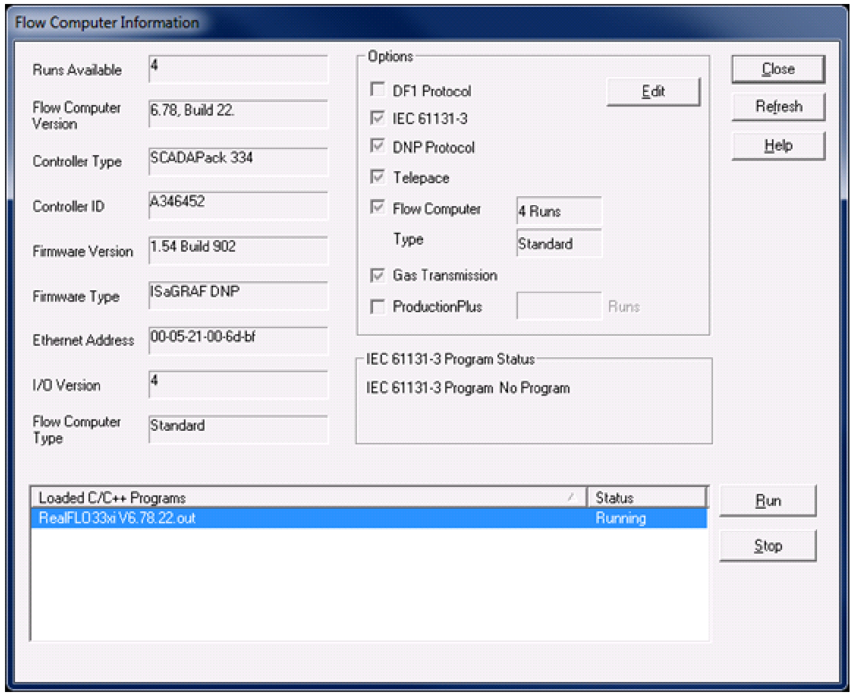
The **Refresh** button reads information from the flow computer.

The **Help** button opens the user manual.

IEC 61131-3 SCADAPack 314/330/334, SCADAPack 350 and SCADAPack 4203 Flow Computer Information

For SCADAPack 314/330/334, SCADAPack 350 and SCADAPack 4203 controllers the following dialog is displayed. When this controller is used the

Flow Computer Information dialog allows for the stopping and running of each C/C++ application independently.



Runs Available is the maximum number of runs supported by the flow computer. The runs available may differ from the number of runs licensed in options section. This is typically due to other C applications or IEC 61131-3 applications running and consuming memory in the controller.

Flow Computer Version is the version of the Flow Computer program.

Controller Type is the type of controller hardware.

Controller ID is the unique ID assigned to the controller at the factory.

Firmware Version is the version of the firmware in the controller.

Firmware Type is the type of firmware in the controller. It is one of Telepace, Telepace DNP, or ISaGRAF, or ISaGRAF DNP.

Ethernet Address is the Ethernet address of the controller, if an Ethernet port is available.

I/O Version is the version number of the internal I/O controller.

Flow Computer Type is the type of flow computer licensed. This will be one of the following types:

- Standard
- PEMEX
- GOST

If the Flow Computer option is not set the Runs Available and the Gas Transmission options are disabled.

The **Options** area shows the current options enabled in the controller.

- The **DF1 Protocol** option enables communication using the Allen-Bradley full duplex and half-duplex protocols.

- The **IEC 61131-3** option enables the IEC 61131-3 run-time engine.
- The **DNP Protocol** option enables communication using the DNP Protocol.
- The **Flow Computer** option enables support for the Realflo natural gas flow computer. The valid options from the dropdown list are:
  - None
  - Standard
  - PEMEX
  - GOST
- The **Runs** option displays the number of runs available for the flow computer.
- The **Gas Transmission** checkbox enables or disables calculating hourly gas quality history.

If the Flow Computer option is not set the Runs Available and the Gas Transmission options are disabled.

The **Edit** button opens the ***Edit Options Dialog***.

The **Program Status** portion of the dialog depends on the controller type and the firmware. See the sections below for details.

The **Close** button closes the dialog.

The **Refresh** button reads information from the flow computer.

The **Help** button opens the user manual.

The **Loaded C/C++ Programs** section indicates the state of the C/C++ programs currently loaded in the SCADAPack 314/330/334 or SCADAPack 350. Usually this is the flow computer program, but it could be another program. The state will be one of No Program, Stopped, or Running.

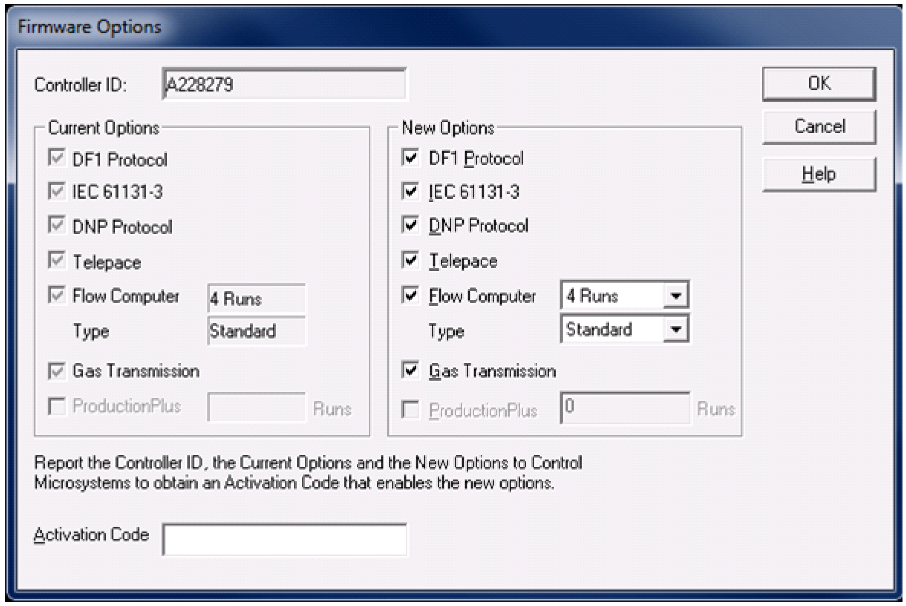
The **Run** and **Stop** buttons apply to the C/C++ Program selected from the list of loaded C/C++ programs. Only one C/C++ Program may be selected from the list at one time. These buttons are disabled when there are no C/C++ Programs loaded.

The **Run** button stops and restarts the selected C/C++ program in the controller.

The **Stop** button stops the selected C/C++ program in the controller.

Edit Options Dialog

The Edit Options dialog modifies the firmware options. An activation code is required to change the options. See the *Obtaining an Activation Code* section below for details on obtaining an activation code. See the *Applying an Activation Code* section below for details on applying the activation code.



The **Controller ID** is shown at the top of the dialog. This is a unique ID for the controller and is set at the factory. It cannot be changed.

The controllers **Current Options** are shown on the left. These are read from the controller when the Change Options command selected.

The **New Options** available for the controller are shown on the right. Select the new options based on the Activation Code obtained from Control Microsystems. See the *Obtaining an Activation Code* section below for details on obtaining an activation code.

The **Activation Code** edit box contains the activation code for the currently selected options. If you leave the activation code edit box blank, an error message displays.

The **OK** button accepts the options and writes them to the controller. If the activation code is correct, the options are enabled. Otherwise the current options remain in effect.

The **Cancel** button closes the dialog without making any changes.

The **Help** button opens the user manual.

Obtaining an Activation Code

The activation code needs to be obtained from Control Microsystems. To obtain activation codes:

- Record the Controller ID, Current Options and New Options for each controller you wish to update.
- Contact Control Microsystems sales department, or your local representative, and report the information gathered in step 1.
- The sales representative will inform you of the cost of the options and arrange for payment.
- The activation codes will be sent to you upon receipt of payment.

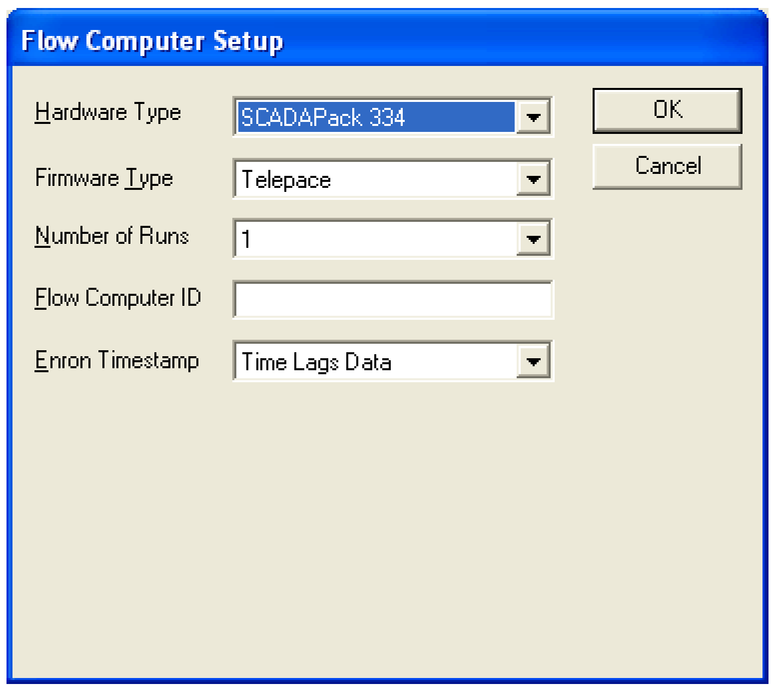
Applying an Activation Code

- Enter the same New Options as in item 1 of the *Obtaining an Activation Code* section.

- Enter the Activation Code received from Control Microsystems and click OK. The options will be written to the flow computer.
- Stop flow runs using the Maintenance | Calculation Control menu item.
- Read logs and history using the Maintenance | Read Logs/History menu item.
- Replace the flow computer using the Configuration | Replace Flow Computer menu item.
- Replace the configuration using the Configuration | Write Configuration menu item. Flow runs will be started.

Setup

The Setup command is used to display and configure basic flow computer parameters. The hardware type, firmware type, number of flow runs enables and the flow computer ID are configurable.



The **Hardware Type** selection sets the type hardware that the flow computer is executing on. Valid selections are Micro16, SCADAPack, SCADAPack Plus, SCADAPack Light, SCADAPack LP, SCADAPack 100: 1024K, SCADAPack 32, SCADAPack 32P, SCADAPack 4202 DR, SCADAPack 4202 DS, SCADAPack 4203 DR, SCADAPack 4203 DS, SCADAPack 314, SCADAPack 330, SCADAPack 334, SCADAPack 350 and SolarPack 410.

The **Firmware Type** selection sets the firmware type for the flow computer. Valid sel;ections are Telepace and ISaGRAF. The default value is Telepace for step-by-step, or the value in the template.

The **Number of Runs** selection sets the number of runs in the file. The number of runs available depends on the type of flow computer used.

- For Micro 16, SCADAPack, SCADAPack Light and SCADAPack Plus flow computers the maximum number of runs is three.

The selection of three meter runs is available for older flow computers that could be enabled for three meter runs.

- For SCADAPack LP and SCADAPack 4202 of flow computers the maximum number of meter runs is two.
- For SCADAPack 100: 1024K and SolarPack 410 Flow Computers the maximum number of meter runs is one.
- For SCADAPack 314/330/334 and SCADAPack 350 Flow Computers the maximum number of meter runs is four.
- For SCADAPack 32 and SCADAPack 32P the maximum number of runs available is ten without the gas transmission option enabled and four with the gas transmission option enabled.

The **Flow Computer ID** entry is a unique ID for the flow computer. It stops accidental mixing of data from different flow computers. The Flow Computer ID is stored in the flow computer. Realflo will not perform operations if the ID in the flow computer and that in the configuration file are not the same. Enter a string of up to 8 characters for the Flow Computer ID. Any character is valid and the ID may be left blank.

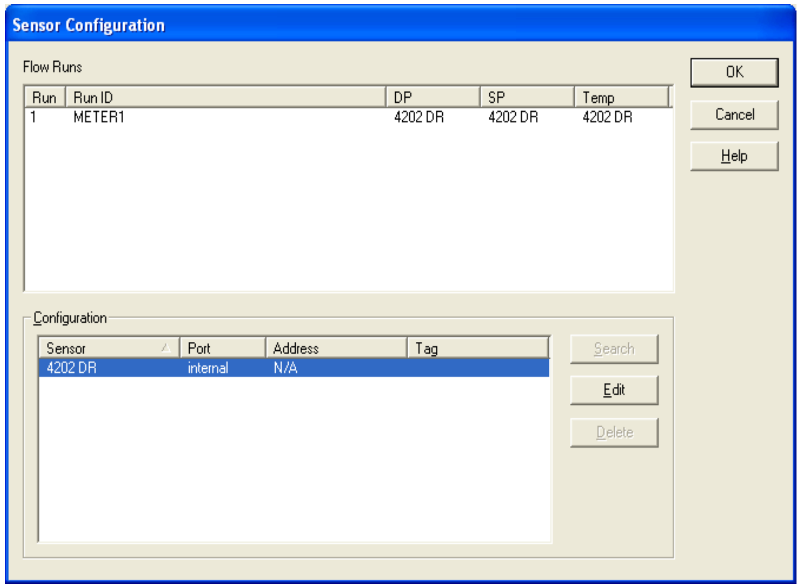
The **Enron Timestamp** selects the type of timestamp for Enron flow history logs. Realflo and flow computer versions 6.77 and higher support the selection of **time leads data** or **time lags data** for the timestamp.

- Time leads data selection time stamps the data for the period at the beginning of the period.
- Time lags data selection time stamps the data for the period at the end of the period.

The configuration is valid for runs of the flow computer and is applied on the Enron Modbus enabled ports only. This control is hidden in PEMEX or GOST application modes.

Sensor and Display

Use this command to configure the sensor parameters of external transmitters. This command is disabled if the Update Readings command is enabled and opens the ***Transmitter Configuration*** dialog as shown below, when selected.



The **Flow Runs** list displays each of the configured flow runs. The list displays the Run number, Run ID and the transmitter that is used for the differential pressure (DP), static pressure (SP) and temperature sensors. The Run values are numbered 1 to N, in order.

The **Configuration** list shows the transmitters that can be configured. Up to 10 transmitters can be configured, depending on number of flow runs available. The number of transmitters in the list is equal to the number of flow runs. Use the ***Setup*** dialog on the ***Flow Computer*** menu to set the number of flow runs.

The configuration list displays the transmitter; the serial port the transmitter is connected to, the transmitter Modbus address, and the transmitter tag name.

When a transmitter is used the first position in the dialog is reserved for the internal transmitter. In this case the following dialog is displayed.

The list may be sorted by clicking on the column headings. Click on the column headings once to sort the list in ascending order. Click on the column a second time to sort the list in descending order.

The **Search** button opens the **Sensor Search Dialog**. The search button is disabled for SCADAPack 4202 or 4203 transmitters if only one meter run is enabled.

The **Edit** button opens the **Edit Sensor Settings Dialog** to edit the selected transmitter configuration. The button is disabled if no transmitter is selected or if more than one transmitter is selected.

The **Delete** button deletes the configuration for selected transmitters in the list box. The button is disabled if no transmitter is selected.

The **OK** button saves the settings and closes the dialog.

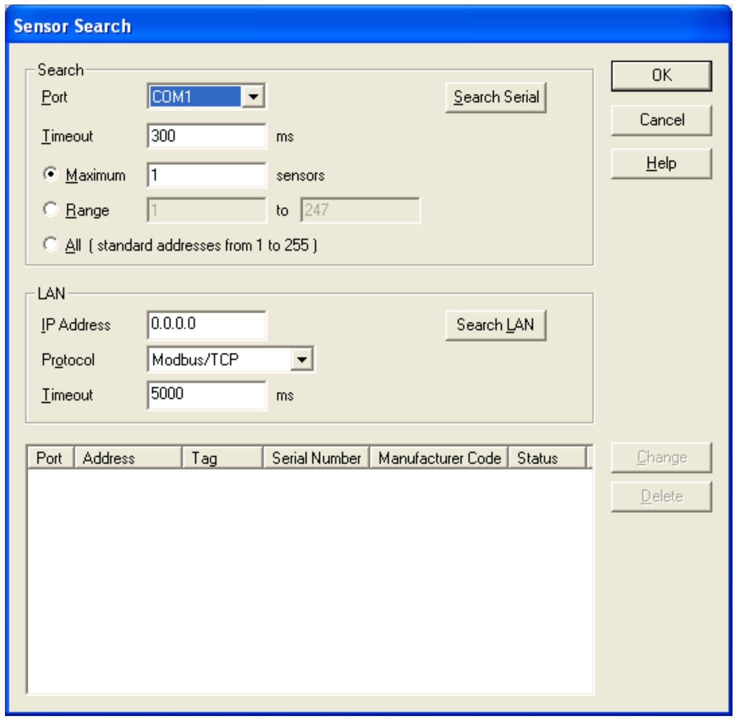
The **Cancel** button closes the dialog without saving.

The **Help** button opens the on-line manual.

Sensor Search Dialog

The Sensor Search dialog allows searches for Multi-Variable Transmitters connected to the flow computer. Searches can be made using a serial connection and if the flow computer supports it using a LAN connection.

The Search dialog cannot remove or replace a transmitter when the controller type is a SCADAPack.



Search Serial

The Search Serial area of the search dialog is highlighted in the picture above. The LAN Search is described in ***Search LAN*** section below. The following paragraphs describe the parameters of the Serial Search.

The **Port** drop-down list box selects the controller serial port that will communicate with the transmitter. The valid ports are COM1, COM2, COM3 and COM4 for serial connections and LAN for LAN connections.

The **Timeout** edit box specifies the length of time the flow computer will wait for a response from a transmitter. The valid range is from 100 ms to 10000 ms. The default is 300 ms.

The radio buttons determine for which transmitters to search.

Use the **Maximum** radio button to search for the specified number of transmitters. The search operation will stop after finding the specified number of transmitters. The valid value is from 1 to 247. The default is 1.

Use the **Range** radio button to search the addresses in specified range. The range to search for is entered in the edit boxes to the right of the radio button. The value in *To* edit control needs to be equal or great than the value in the first edit control. The maximum search range that can be entered is for 255 transmitters. The default range is 1 to 247.

- Valid values are any range between 1 and 247 for the SCADAPack 4101 and 3095MVT.

- 4000 transmitters support addresses 1 to 255 in standard Modbus mode, and 1 to 65534 in extended address mode. The address mode of the flow computer serial port needs to be set to extended to search for transmitters with extended addresses.
- The SCADAPack 4202 or 4203 transmitter support 1 to 255 addresses in the standard addressing mode and 1 to 65534 addresses in the extended addressing mode. The address mode of the SCADAPack 4202 or 4203 port needs to be set to extended in order to search for transmitters with extended addresses.

Select the **All** radio button to search the addresses of transmitters connected with the serial port selected in *Port*. A maximum of 255 addresses are searched.

The **Serial Search** button starts the search for MVT transmitters. A search process dialog is displayed so that the search operation can be cancelled at any time. The results of the search are added to the list box at the bottom of the dialog.

The search result list box shows the transmitters that were found by the search. Additional searches may add to the list box. The list may be sorted by clicking on the column headings. Click on the column headings once to sort the list in ascending order. Click on the column a second time to sort the list in descending order.

The list box displays the following columns:

The **Port** column displays the serial or LAN port the controller is using to communicate with the transmitter.

The **Address** column displays the Modbus station address of the transmitter.

The **Tag** column displays the Tag Name assigned to the transmitter. This column may be blank if a Tag Name has not been assigned to the transmitter.

The **Serial Number** column displays the transmitter factory serial number.

The **Manufacturer Code** column displays the transmitter factory manufacturer code.

The **Status** column indicates if configuration data for the transmitter exists.

- ***Configured*** indicates a transmitter with the same port, address, serial number, and factory code is in the list in the **Sensor and Display *Configuration*** dialog.
- ***Different*** means a transmitter with the same port and address is in the list in the ***Sensor and Display Configuration*** dialog. The tag, serial number, or factory code of the transmitter is different.
- ***New*** means that the transmitter is not in the list of configured transmitters.

The **Change** button opens the ***Change Address Dialog*** to change the Modbus station address of the serial port on the remote transmitter. This action will change the Modbus station number of the serial port on the MVT connected to a SCADAPack controller. The button is grayed if the list is empty or if more than one transmitter is selected.

The **Delete** button removes the selected items from the list. The button is grayed if the list empty or no transmitter is selected.

The **OK** button saves the settings and closes the dialog. Transmitters in the result list are added to the transmitter configuration in the ***Sensor and Display Configuration*** Dialog.

- If the transmitter status is configured the list is not changed.
- If the transmitter status is different the tag, serial number, and factory code in the list is updated with the new information from the transmitter.
- If the transmitter status is new the transmitter is added to the list in the first available position. If there are more new transmitters than there are free positions in the list an error dialog is displayed with the message *"There are too many new transmitters. Please delete some new transmitters from the list."*

The ***Cancel*** button closes the dialog without saving.

The ***Help*** button opens the on-line manual.

Search LAN

The Search LAN area of the search dialog is highlighted in the picture below. The following paragraphs describe the parameters of the Search LAN function.

The **IP Address** edit box specifies the known IP address of the 4000 transmitter. Valid entries are IP addresses in the format nnn.nnn.nnn.nnn where nnn are values between 0 and 255.

The **Protocol** drop-down list box selects the type of IP protocol that will be used to query the transmitter. Valid IP protocol selections are Modbus/TCP and Modbus RTU in UDP.

The IP port (for example port 502) for the selected protocol needs to be the same in the flow computer and the 4000 transmitter.

The LAN **Timeout** edit box specifies the length of time the flow computer will wait for a response from a 4000 transmitter. The valid range is from 100 to 10000 milliseconds. The default is 5000 ms.

The **Search LAN** button starts the search for the 4000 transmitters. A search progress dialog is displayed and the search operation can be cancelled at any time. The result of the search is added to the search results list box at the bottom of the MVT Search dialog.

The search result list box shows the transmitters that were found by the search. Additional searches may add to the list box. The list may be sorted by clicking on the column headings. Click on the column headings once to sort the list in ascending order. Click on the column a second time to sort the list in descending order.

The **Port** column displays the serial or LAN port the controller is using to communicate with the transmitter.

The **Address** column displays the Modbus station address of the transmitter.

The **Tag** column displays the Tag Name assigned to the transmitter. This column may be blank if a Tag Name has not been assigned to the transmitter.

The **Serial Number** column displays the transmitter factory serial number.

The **Manufacturer Code** column displays the transmitter factory manufacturer code.

The **Status** column indicates if configuration data for the transmitter exists.

- Configured indicates a transmitter with the same port, address, serial number, and factory code is in the list in the Sensor and Display Configuration dialog.
- Different means a transmitter with the same port and address is in the list in the Sensor and Display Configuration dialog. The tag, serial number, or factory code of the transmitter is different.
- New means that the transmitter is not in the list of configured transmitters.

The **Delete** button removes the selected items from the list. The button is grayed if the list empty or no transmitter is selected.

The **OK** button saves the settings and closes the dialog. Transmitters in the result list are added to the transmitter configuration in the ***Sensor and Display Configuration*** Dialog.

- If the transmitter status is configured the list is not changed.
- If the transmitter status is different the tag, serial number, and factory code in the list is updated with the new information from the transmitter.
- If the transmitter status is new the transmitter is added to the list in the first available position. If there are more new transmitters than there are free positions in the list the following message is displayed “There are too many new transmitters. Please delete some new transmitters from the list.”

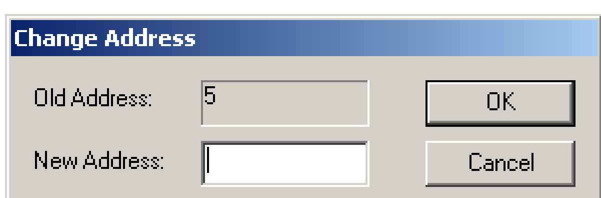
The ***Cancel*** button closes the dialog without saving.

The ***Help*** button opens the on-line manual.

Change Address Dialog

The **Change** button opens the ***Change Address Dialog*** to change the Modbus station address of the serial port on the remote transmitter. This action will change the Modbus station number of the serial port on the MVT connected to a SCADAPack controller. The button is grayed if the list is empty or if more than one transmitter is selected.

New SCADAPack 4101 transmitters have a default address of 99. It is recommended that transmitters be assigned an address other than 99. This will allow adding a new transmitter at any time. If a transmitter is left at address 99, then it will have to be disconnected to install a new transmitter.



The **Old Address** window displays the current address of the transmitter.

The **New Address** entry specifies the new address for the transmitter. The new address needs to be different from any existing addresses in the results list of ***Sensor Search*** dialog. Valid values are any range between 1 and 247 for the SCADAPack 4101and 3095MVT. The SCADAPack 4202 or 4203 transmitters support 1 to 255 addresses in the standard addressing mode and 1 to 65534 addresses in the extended addressing mode.

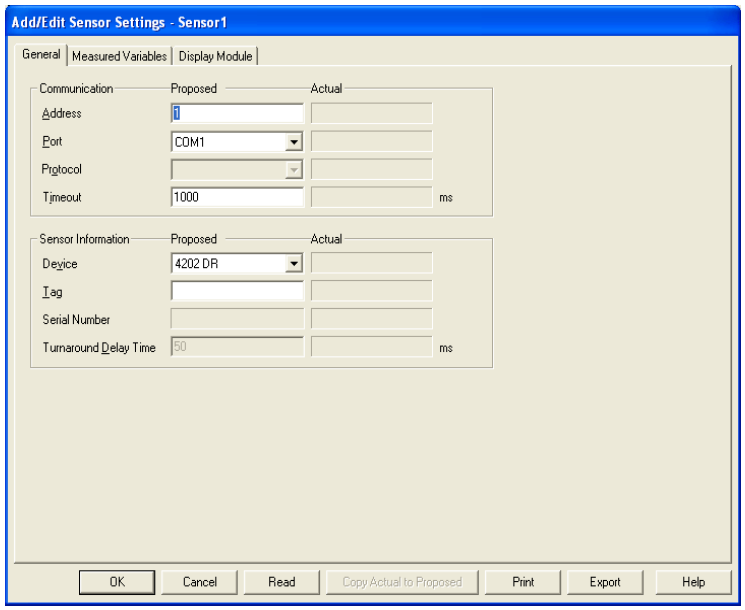
The **OK** button changes the transmitter address. A communication progress dialog opens while the information is written to the transmitter. Click on the *Cancel* button on the progress dialog to attempt to abort the command. This will close the progress dialog, bit the address of the transmitter already may be changed.

The **Cancel** button closes the dialog without changing the transmitter address.

Edit Sensor Settings Dialog

This dialog allows the editing of settings for transmitters connected to the flow computer.

There are three selection tabs, shown at the top left corner of the dialog. When selected, each tab will display a page of configuration parameters in the dialog. The General Page contains sets communication and transmitter information for a transmitter. The Measured Variables page configures the three process measurements, and the Display Module Page configures the display on the transmitter.



There are two columns of data on each page. The **Proposed** column contains the values that will be written to the controller. The **Actual** column contains the values that were in the controller the last time data was read from the controller. Values in the Proposed column are colored blue if they differ from the values in the Actual column; this enables the easy location of any differences.

The **OK** button closes the dialog and saves the settings.

The **Read** button reads the transmitter settings from the flow computer into the Actual column on all pages. If there is no transmitter configured in the flow computer then the flow computer will attempt to read the configuration from the Address in the Proposed column. A communication progress dialog is displayed while reading from the flow computer.

The **Copy Actual to Proposed** button copies settings from the Actual column to the Proposed column on both pages. The button is disabled if the Actual column is empty.

The **Print** button prints the current page display settings.

The **Export** button exports the settings to a specified CSV file.

The **Help** button opens the on-line manual.

The flow computer ID is checked when the Read command is used. If the flow computer ID does not match the ID Realflo displays the message " The

Flow Computer ID from the flow computer does not match the Flow Computer ID from the file." The read is not performed.

General Page

The ***General*** page sets communication and generic information for a transmitter.

The **Address** edit-box specifies the Modbus address of the transmitter for serial connections and the IP address of the transmitter for LAN connections. Transmitters on the same serial port need to have a unique Modbus address. Transmitters on the LAN port need to have a unique IP address. This edit box is disabled if the controller type is set to a SCADAPack 4202 or 4203 transmitter.

- Valid addresses are between 1 and 247 for the SCADAPack 4101and 3095MVT.
- 4000 transmitters support addresses 1 to 255 in standard Modbus mode, and 1 to 65534 in extended address mode.
- The SCADAPack 4202 or 4203 transmitters support 1 to 255 addresses in the standard addressing mode and 1 to 65534 addresses in the extended addressing mode.

New SCADAPack 4101 transmitters have a default address of 99. It is recommended that transmitters be assigned an address other than 99. This will allow adding a new transmitter at any time. If a transmitter is left at address 99, then it will have to be disconnected to install a new transmitter.

The **Port** drop-down list box specifies the flow computer serial port where the MVT is connected. The valid port selections are com1, com2, com3, and com4 for serial connections and LAN for LAN connections. This edit box is disabled if the controller type is set to a member of the SCADAPack 4202 or 4203 of controllers.

Polling Sensors for SCADAPack 32 10 Runs

The SCADAPack 32 supports 10 flow runs but can poll a maximum of 6 sensors in 1 second. So that all sensors and Coriolis meters are polled for all runs in 1 second the flow computer manages the polling using multiple serial communication ports.

When using more than 5 runs on a SCADAPack 32 flow computer users need to distribute the communication for sensor and Coriolis meter data over multiple serial ports. For example if 10 runs are to be used poll for 5 sensors on one serial port and 5 sensors on another serial port.

The **Timeout** edit-box specifies the time the flow computer waits for a response from the transmitter before the command is unsuccessful. The valid range is from 0 to 10000 ms. The default is 1000 ms. This edit box is disabled if the controller type is set to a member of the SCADAPack 4202 or 4203 of controllers.

The flow computer polls each configured transmitter in turn. It waits for a response or timeout. If the transmitter does not respond it will take longer to poll it, than if it responded. The flow computer does not retry the transmitter. It moves on to the next transmitter. The transmitter will be polled again in the regular cycle.

The communication failure alarm is raised if the transmitter does not respond for 3 consecutive polls.

The **Device** dropdown list specifies the type of transmitter connected to the flow computer. Valid values are 3095FB, SCADAPack 4101, SCADAPack 4102 or a SCADAPack 4202 or 4203 transmitter.   The default value is 4202 DR.

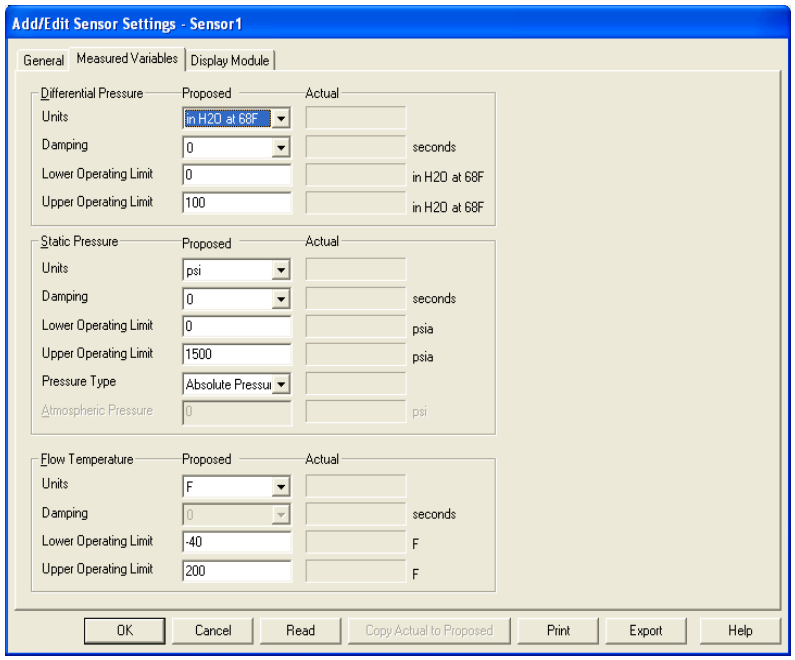
The **Tag** edit-box specifies the transmitter tag. Up to 8 characters can be entered. The default is no tag.

The **Serial Number** displays the serial number of the MVT transmitter. It cannot be edited. It is set when the transmitter is found using the Search feature.

The **Turnaround Delay Time** edit-box specifies the turnaround delay time. The transmitter will wait this long before responding to the flow computer. The valid range is 0 to 200 ms. The default is 50 ms.

Measured Variables Page

The *Measured Variables* page configures the transmitter measurements.



The MVT transmitter measures differential pressure, static pressure, and temperature. The configuration parameters for each measurement are the same.

The **Units** drop-down list boxes select the units used by the transmitter for the measurement. Values read from the transmitter are in these units. If the transmitter has a local display it uses these units.

- For ***Differential Pressure*** the valid units displayed will depend on the transmitter used. For SCADAPack 4202, 4203 or 4000 transmitters, valid units are: inches H2O at 68 F, Pascal (Pa) and kiloPascal (kPa). The default is inches H2O at 68°F. For the 3095 MVT valid units are: inches H2O at 60°F, Pascal (Pa), kiloPascal (kPa) and inches H2O at 60 F. The default is inches H2O at 60°F.
- For Static Pressure the valid units are kiloPascal (kPa), MegaPascal (Mpa), and pounds per square inch (psi). The default is psi.

- For Temperature the valid units are degrees Celsius (C) and degrees Fahrenheit (F). The default is Fahrenheit (F).

The **Damping** edit boxes specify the response time of transmitter in order to smooth the process variable reading when there are rapid input variations. For the SCADAPack 4202, 4203 or 4000 transmitters the valid values are 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 seconds. The default value is 0 (damping off). Flow Temperature damping is disabled for the SCADAPack 4202, 4203 and 4000 transmitters.

For the 3095 MVT the valid values are 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824 and 27.648. The default is 0.864.

The **Lower Operating Limit** (LOL) and **Upper Operating Limit** (UOL) edit boxes specify the sensor operating values. These values are set in Realflo as a method to generate an alarm in the alarm log if the measured value is outside these limits The flow computer uses these values to record when the process value has transitioned into an unexpected value based on the predicted characteristics of the users application. The valid range depends upon the transmitter. The default is 0 for lower operating limit and 65534 for upper operating limit. The LOL and UOL needs to satisfy the following conditions. The user is responsible for selecting suitable values for LOL and UOL.

LRL <= LOL < (UOL – URL/100)

(LOL + URL/100) <= UOL <= URL

Where LRL (Lower Range Limit) and URL (Upper Range Limit) are the upper and lower calibrated measurements for the transmitter as it is shipped from the factory. These are fixed values and not adjustable by the user. Refer to the calibration plate on the MVT transmitter or your MVT User Manual for calibrated LRL and URL ranges.

Re-ranging is a concept that does not apply to the 4000 digital transmitters. The transmitters are shipped with a specific URL/LRL that defines the calibrated measurement range of the transmitter. The accuracy specifications of the transmitter are based on this calibrated range, and that range is not user adjustable.

Older analog transmitters had an analog output to indicate the pressure reading. For applications where the measurement was only expected to take place over a portion of the full transmitter measurement range, this analog output could be 're-ranged' so that the full output analog range (4-20mA) would cover only a portion of the factory calibrated range, and therefore reduce some of the error associated with the digital-to-analog (D/A) conversion.

Since there is no D/A conversion in the digital transmitters, the additional errors associated with the D/A conversion are not present and the concept of re-ranging that was done with analog transmitters no longer applies.

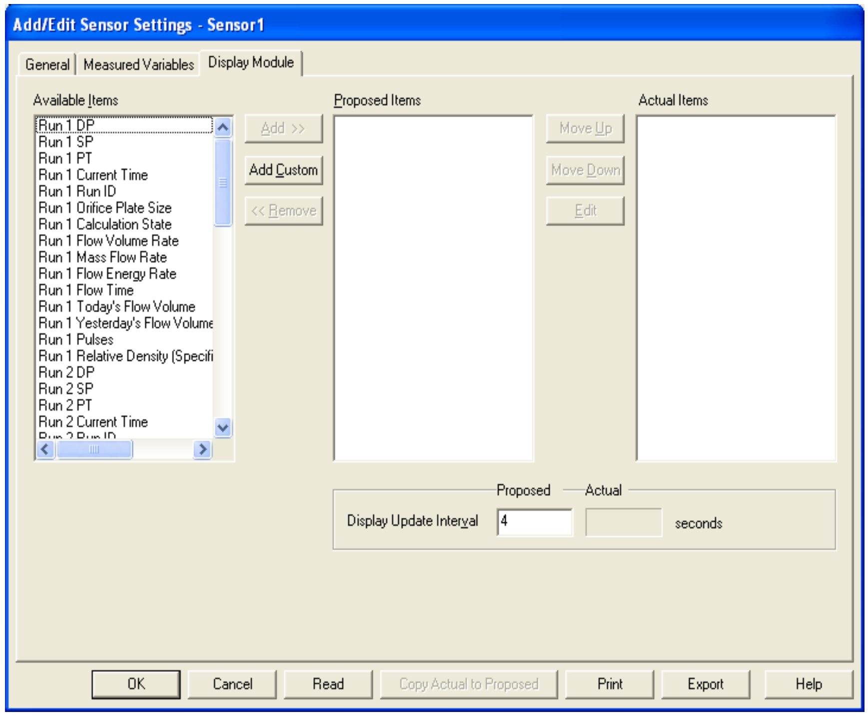
The **Pressure Type** edit box specifies whether the static pressure is measured as gage or absolute pressure. Valid values are Absolute and Gage. The default value is Absolute. The control is enabled for the SCADAPack 4202 or 4203 and 4102 transmitters, and is disabled for other transmitters.

The **Atmospheric Pressure** specifies the local atmospheric pressure. The atmospheric pressure is the weight of the atmosphere on the surface of the

Earth. Valid values are 0 to 30 psia, or equivalent values in other units. The default value is 0 psia. The control is disabled if the Pressure Type is Absolute. The control is enabled for the SCADAPack 4202, 4203 and 4102 transmitters, and is disabled for other transmitters.

Display Module Page

The ***Display Module*** page sets items that will be displayed on the MVT transmitter display.



The **Available Items** list will contain possible items that can be displayed. The number of available items will vary depending on how many flow runs are configured. The table below shows the available items.

Item	Notes
DP	One selection for each flow run is available
SP	One selection for each flow run is available
PT	One selection for each flow run is available
Current Time	One selection for each flow run is available
Run ID	One selection for each flow run is available
Orifice Plate Size	One selection for each flow run is available
Calculation State	One selection for each flow run is available
Flow Volume Rate	One selection for each flow run is available
Flow Mass Rate	One selection for each flow run is available
Flow Energy Rate	One selection for each flow run is available
Flow Time	One selection for each flow run is available
Today's Flow Volume	One selection for each flow run is available

Item	Notes
Yesterday's Flow Volume	One selection for each flow run is available
Pulses	One selection for each flow run is available
Relative Density	One selection for each flow run is available for flow computers with version 6.00 and higher.
Pipe Diameter	One selection for each flow run is available
Atmospheric pressure	One selection for each flow run is available
Battery Voltage	This item is available for SolarPack 410 controllers only.

The **Proposed Items** list contains the items are ready to be displayed. The order of the items in the list is the same as the order that the items will be shown on the display. A maximum of 12 items can be added to the **Proposed Items** list. A maximum of 5 custom display registers can be added to the list. It is permitted to have the same item in the list multiple times.

Clicking on the **Add** button will move selected items from the **Available Items** list to the **Configured Items** list. The **Add** button is disabled if there is not enough room in the **Configured Items** list to add the selected items, and when the **Configured Items** list is full. The **Add** button is also disabled if no items are selected in the **Available Items** list.

Click **Add Custom** to open the **Add/Edit Custom Item** dialog with default settings. The resulting item will be placed at the end of the **Proposed Items** list. The **Add Custom** button is disabled when the Proposed Items list is full. A maximum of 5 custom display registers can be added.

Clicking on the **Remove** button will remove selected items from the **Configured Items** list. Multiple items may be removed at once. The **Remove** button is disabled if no items are selected in the **Configured Items** list.

The **Display Update Interval** edit-box shows the length of time that each measurement from the **Configured Items** list will be displayed. The valid range is from 2 to 60 seconds inclusive. The default setting is 4 seconds.

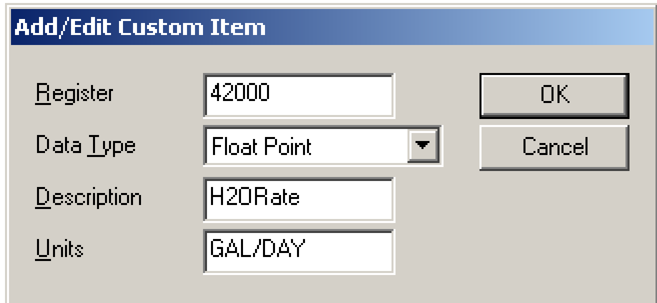
The **Move Up** button will move the selected item(s) in the **Configured Items** list up one position each time it is clicked. The **Move Up** button is disabled if no item is selected in the **Configured Items** list or if multiple items are selected in the **Configured Items** list.

The **Move Down** button will move the selected item(s) in the **Configured Items** list down one position each time it is clicked. The **Move Down** button is disabled if no item is selected in the **Configured Items** list or if multiple items are selected in the **Configured Items** list.

The **Actual Items** list contains the items that read from the controller and **Actual Display Update Rate** text-box contains the display update rate that read from the controller.

Custom Item Dialog

When the Add Custom button is used the Add/Edit Custom Item dialog is displayed as shown below. A maximum of 5 custom display registers can be added.



Type the **Register** number. Registers can be in the range 1 to 9999, 10001 to 19999, 30001 to 39999 and 40001 to 49999.

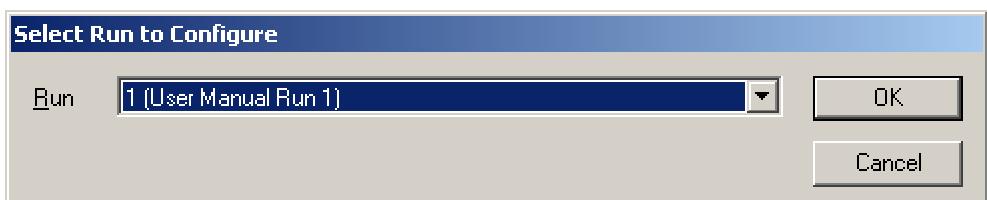
Select the **Data Type** format for the value in the register. Some data types will read two consecutive registers. The boolean data type reads a single bit. The types are: boolean, signed, unsigned, signed double, unsigned double, floating point and ISaGRAF integer.

Type the seven character string in the **Description** control. This string will be displayed below the value for the first half of the display period.

Type the seven character string in the **Units** control. This string will be displayed below the value for the second half of the display period. This string may be scrolled to allow a scaling exponent to be displayed.

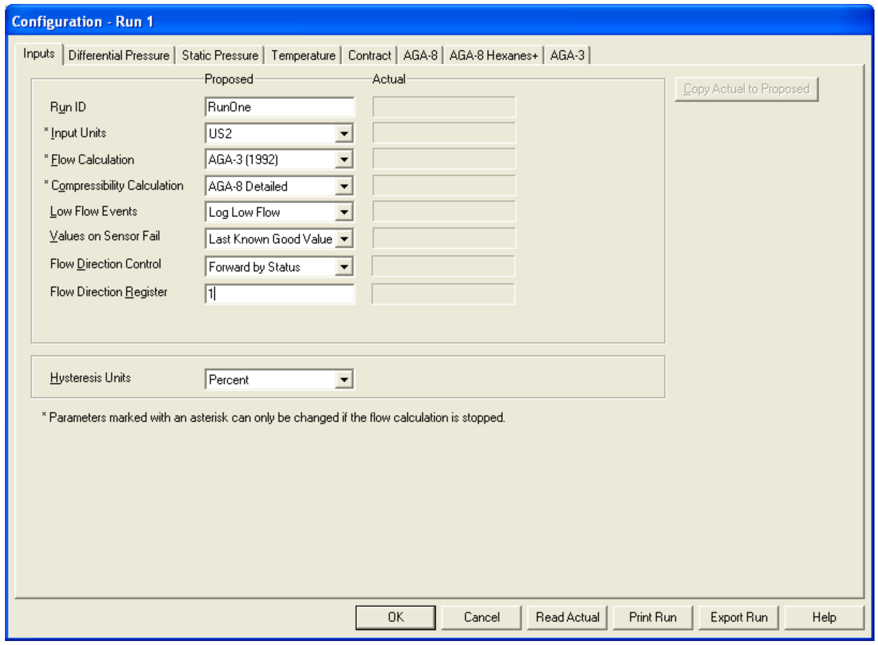
Flow Run

Use this command to configure the parameters for a selected meter run. This command is disabled if the Update Readings command is enabled. The Flow Run command opens the ***Select Run to Configure*** dialog. This dialog selects the run to be configured.



- The **R**un drop-down list box lists the runs available. The number of runs available is set in the Flow Computer Setup dialog.
- The **OK** button opens the ***Configuration - Run N*** dialog with the data for the selected run.

The ***Configuration - Run N*** dialog displays a maximum of eight selection tabs, depending on the flow calculation type, shown across the top of the dialog. When selected, each tab will display a page of configuration parameters in the dialog. This section provides an overview of the configuration parameters for each tab. Detailed explanations for the configuration parameters are found in the ***Inputs Tab*** section.



To select a tab move the pointer to the tab name and click the left mouse button. The seven tabs displayed will change depending on the type of flow calculation and type of compressibility calculation selected in the Input tab.

- The Inputs tab defines the type of flow calculation to be performed, the type of compressibility calculation to be performed, and the configuration of the sensor inputs.
- The Static Pressure tab defines the parameters for the static pressure sensor for the meter run.
- The Temperature tab defines the parameters for the temperature sensor for the meter run.
- The Differential Pressure tab defines the parameters for the differential pressure sensor for the meter run.
- The Contract tab defines parameters for the gas measurement contract. These parameters define the information operation of the flow computer.
- The AGA-3 tab defines parameters unique to the AGA-3 calculation. This tab is visible only if the AGA-3 calculation is selected on the Input configuration.
- The AGA-7 tab defines parameters unique to the AGA-7 calculation. This tab is visible only if the AGA-7 calculation is selected on the Input configuration.
- The V-Cone tab defines parameters unique to the V-Cone calculation. This tab is visible only if the V-Cone calculation is selected on the Input configuration.
- The AGA-11 tab defines parameters unique to the AGA-11 calculation. This tab is visible only if the AGA-11 calculation is selected on the Input configuration. This calculation type is not available for 16-bit controllers.
- The AGA-8 tab defines parameters unique to the AGA-8 Detailed calculation. This tab is visible only if the AGA-8 calculation is selected on the Input configuration.

- The AGA-8 Hexanes+ tab defines the composition of the heavier gas components being measured
- The NX-19 tab defines parameters unique to the NX-19 calculation. This tab is visible only if the NX-19 calculation is selected on the Input configuration.

Tabs work in the same manner. There are two columns of data on the page. The **Proposed** column contains the values that will be written to the controller. The **Actual** column contains the values that were in the controller the last time data was read from the controller. Values in the **Proposed** column are colored blue if they differ from the values in the **Actual** column; this lets you easily located differences.

The Run Configuration dialog has the following controls at the bottom of the dialog. These controls are available and are independent of the tab selected.

- The **OK** button saves the modified settings and closes the Run Configuration dialog.
- The **Cancel** button closes the Controller Configuration dialog and discards any changes. The **OK** button is disabled if the user is logged on with an account that is read and view only.
- The **Read Actual** button reads the run configuration from the flow computer. Data for all property pages is read and placed in the **Actual** columns on the property pages. If the flow computer ID does not match the ID in the file Realflo displays the message " The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file."

In SCADAPack 4202 and SCADAPack 16-bit Flow Computers with multiple flow runs, the latest AGA-8 ratios may not be read back for several minutes. In SCADAPack 4203 and SCADAPack 314/330/334, SCADAPack 350 or SCADAPack32 Flow Computers with multiple flow runs, the latest AGA-8 ratios may not be read back for up to a minute. New gas ratio configurations may be delayed until the other flow run has completed its current AGA-8 calculation.

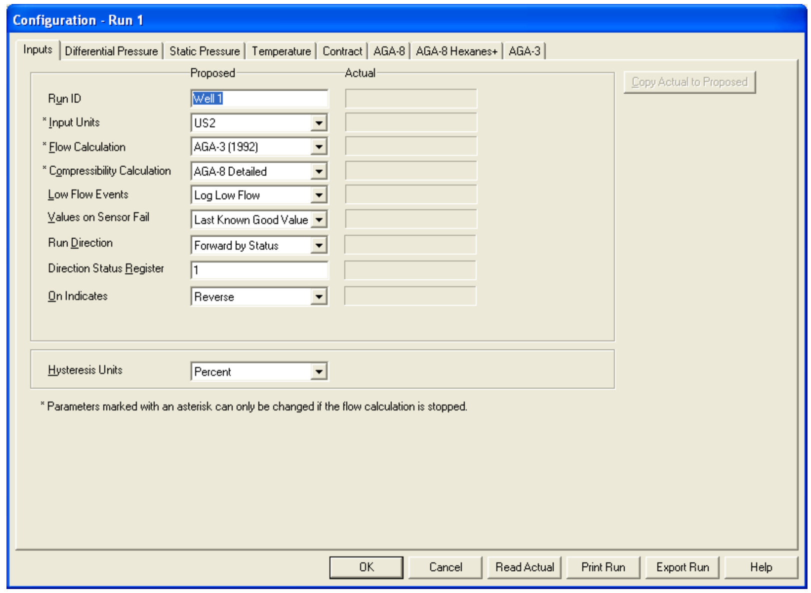
- The **Print Run** button prints the configuration data for the run.
- The **Export Run** button exports the configuration data, for the run, to a file. Refer to the *Exporting* section below.
- The **Help** button displays help for the currently open property page.

Inputs Tab

Inputs Tab defines the type of flow calculation to be performed, the type of compressibility calculation to be performed, and the configuration of the sensor inputs. The contents of the page will change depending on the selections made in the Flow Calculation and Compressibility Calculation selections.

The flow calculation needs to be stopped in order to write some of the parameters on this page to the controller. These parameters are noted with an asterisk (*) beside the parameter title. Refer to the **Calculation Control** section for information on stopping and starting flow calculations in the flow computer.

Realflo does not allow configuration changes if the Event Log in the flow computer is full. Use the **Maintenance Menu >> Read Logs/History** command to empty the Flow Computer Event Log.



The configuration of parameters for the **Inputs** page is done using entry fields or dropdown selections for each parameter. The following edit controls are displayed.

Run ID

The flow run identification string, Run ID, is used to identify the flow run. Enter a string up to 16 characters long in the ***Run ID*** edit box. For flow computer version 6.00 or higher, type a string up to 32 characters long.

The flow run ID is displayed in the title bar of each view window beside the run number. The flow run ID is printed on report headers beside the run number.

The run ID is not supported in older flow computers. Realflo will not read or write the run ID when an older flow computer is detected.

* Input Units

Select the units of measurement of input values for the meter run. Inputs may be measured in different units than the calculated results. This allows you to use units that are convenient to you for measuring inputs. The flow calculation needs to be stopped in order to write this parameter to the controller. A dropdown box allows the selection of the following unit types:

- US1
- US2
- US3
- IP
- Metric1
- Metric2
- Metric3

- SI
- US4
- US5
- US6
- US7
- US8
- PEMEX

Refer to the **Measurement Units** section for information on unit types and how they are displayed.

*** Flow Calculation**

Select the type of flow calculation for the meter run. Realflo supports the AGA-3 (1985 version) and AGA-3 (1992 version) for orifice meters the AGA-7 calculations for turbine meters and the V-Cone calculations for v-cone meters. A dropdown box allows the selection of:

- AGA-3 (1985)
- AGA-3 (1992)
- AGA-7
- AGA-11 (not available for 16-bit controllers)
- V-Cone

Notes:

- The SolarPack 410 does not support AGA-7 calculations.
- When a Realflo configuration file that is using AGA-11 flow calculation type is opened in a version of Realflo 6.75 or earlier the flow calculation type AGA-11 is not displayed and the window is blank. This is correct operation. When a new calculation type is entered, i.e. AGA-3(1992), the AGA-8 and AGA-8 Hexanes+ tabs are not displayed. To correct this select OK to close the Run Configuration dialog and then reopen it. The missing tabs are correctly displayed.

*** Compressibility Calculation**

Select the type of compressibility calculation for the meter run. AGA-8 Detailed and NX-19 compressibility calculations can be selected. AGA-8 Detailed is the recommended calculation for new systems as it has superior performance compared to NX-19. NX-19 is provided for legacy systems. The flow calculation needs to be stopped in order to write this parameter to the controller. A dropdown box allows the selection of:

- AGA-8
- NX-19 (Not supported for PEMEX flow computers)

When NX-19 calculation is used the Input Units type needs to be selected such that the Static Pressure is in psi (pounds per square inch).

Low Flow Events

Select whether to log or ignore flow events that occur for the meter run. Realflo can ignore all events or log low flow events. A dropdown box allows the selection of:

- Ignore
- Log Low Flow

Select **Ignore** if the measured flow experiences these events as part of normal operation. Ignoring these events will keep the Alarm Log from overflowing. Flow accumulation stops when this alarm occurs.

When selected the Low Flow events are added to the Alarm log.

Value on Sensor Fail

The Value on Sensor Fail configuration option uses the specified value in this field as the live input value when communicating with a sensor. A dropdown list lets you select:

- Use Last Known Good Value
- Use Default Value

When the **Use Default Value** option is selected the default value is entered in the Differential Pressure, Static Pressure and the Temperature tabs. The entry window Default Value is activated in each tab when this selection is made.

When you open a file using an older file format, Realflo sets the default value of the **Values on Sensor Fail** field to **Use Last Known Good.**

When the status to a sensor changes and you select the **Use Default Value** option, this is added to the Event Log.

- For flow computers 6.70 and later, when communication to a sensor fails and the configuration option “Use Last Known Good Value” is set to “Use Default Value,” the flow computer needs to use the specified default value in the configuration in place of a live input value.
- When communication to a sensor is restored and the configuration option for the **Value on Sensor Fail** field is set to use the default value, the flow computer uses the input value from the sensor as the live input value.
- For flow computers prior to 6.70, the value on sensor fail is “Use Last Known Good Value.”

Run Direction Control

The **Run Direction Control** option is used to indicate the direction of flow, forward or reverse, for a meter run. The flow computer calculates flow rates and accumulates flow volumes for one flow direction only for each flow run configured. In order to calculate flow rates and accumulate volume for another flow direction a second flow run needs to be configured, using the same run parameters but with an opposite flow direction setting.

Flow direction is indicated using either the value from a Differential Pressure sensor or Coriolis meter or a status register.

When using a value to indicate flow direction:

- Forward flow direction is indicated by a positive (plus) value from a differential pressure sensor for AGA-3 and V-Cone applications and a positive (plus) mass flow rate value from a Coriolis meter.
- Reverse flow direction is indicated by a negative (minus) value from a differential pressure sensor for AGA-3 and V-Cone applications and a negative (minus) mass flow rate value from a Coriolis meter.

When using status to indicate flow direction the flow direction is indicated by a status register and the On Indicates value for the status register.

- Forward flow direction is indicated by a status value of 1 or ON in the Flow Direction Register when the On Indication is set to Forward.
- Reverse flow direction is indicated by a status value of 1 or ON in the Flow Direction Register when the On Indication is set to Reverse.

In many applications the flow direction is forward but in some applications there is a need to calculate reverse flow under certain conditions. An example of this would be a gas storage facility.

The selections available for Flow Direction Control are:

The **Forward by Value** selection will indicate the flow direction is forward when the value from a differential pressure (DP) sensor is positive or the mass flow rate value from a Coriolis meter is positive. When the flow direction is forward the flow computer calculates flow rates and accumulates volumes for the flow run. Using this setting when the value from a differential pressure (DP) sensor is negative or the mass flow rate value from a Coriolis meter is negative the flow computer does not calculate flow rates or accumulate volumes for the flow run.

The **Reverse by Value** selection will indicate the flow direction is reverse when the value from a differential pressure (DP) sensor is negative or the mass flow rate value from a Coriolis meter is negative. When the flow direction is reverse the flow computer calculates flow rates and accumulates volumes for the flow run. Using this setting when the value from a differential pressure (DP) sensor is positive or the mass flow rate value from a Coriolis meter is positive the flow computer does not calculate flow rates or accumulate volumes for the flow run.

The **Forward by Status** selection will indicate the flow direction is forward when the Flow Direction Register has a value of 1 (ON) and the On Indication value is set to Forward. When the flow direction is forward the flow computer calculates flow rates and accumulates volumes for the flow run. Using this setting when the Flow Direction Register has a value of 0 (OFF) the flow computer does not calculate flow rates or accumulate volumes for the flow run.

The **Reverse by Status** selection will indicate the flow direction is reverse when the Flow Direction Register has a value of 1 (ON) and the On Indication value is set to Reverse. When the flow direction is reverse the flow computer calculates flow rates and accumulates volumes for the flow run. Using this setting when the Flow Direction Register has a value of 1 (ON) the flow computer does not calculate flow rates or accumulate volumes for the flow run.

Flow Direction Register

The **Flow Direction Register** edit-box specifies which register indicates the forward or reverse flow direction status. Valid registers for the flow computer controller can be used for this setting. The default register is 1. This edit control is disabled if **Flow Direction Control** selection is Value. This control is hidden in GOST mode flow computers.

When using the flow direction register consider the following points:

- When two configured runs are using the same status register one run is configured for forward direction and second run is configured for reverse direction.

- When more than two configured runs are using the same status register the configuration needs to be checked. There may be a logic application that uses a single status point for all runs.

On Indicates

The On Indicates drop-down selection list allows the selection of Forward or Reverse for the status register value. The default is Forward. The control does not show up in GOST mode. The control is disabled if Status Register control is disabled.

Gas Quality Sources

This parameter is available for PEMEX versions of Realflo only. The Gas Quality Sources control selects the source for the AGA-8 gas quality for PEMEX applications. A dropdown box allows the selection of Gas Quality Source as:

- Manual
- PEMEX Host

When **Manual** is selected AGA-8 gas quality can be written from the Realflo application to the flow computer. The Modbus Mapping table can also be written if the user has an Admin level account. The PEMEX interface (PEMEX Host) cannot write gas quality settings when the source is set to manual. An error is returned to the PEMEX host if an attempt is made to write the settings to the flow computer.

When **PEMEX Host** is selected AGA-8 gas quality cannot be written from the Realflo application to the flow computer. Writing the Modbus Mapping table will return an error code if an attempt is made to write the AGA-8 settings to the flow computer. The PEMEX interface (PEMEX Host) is able to write gas quality settings when the source is set to PEMEX Host.

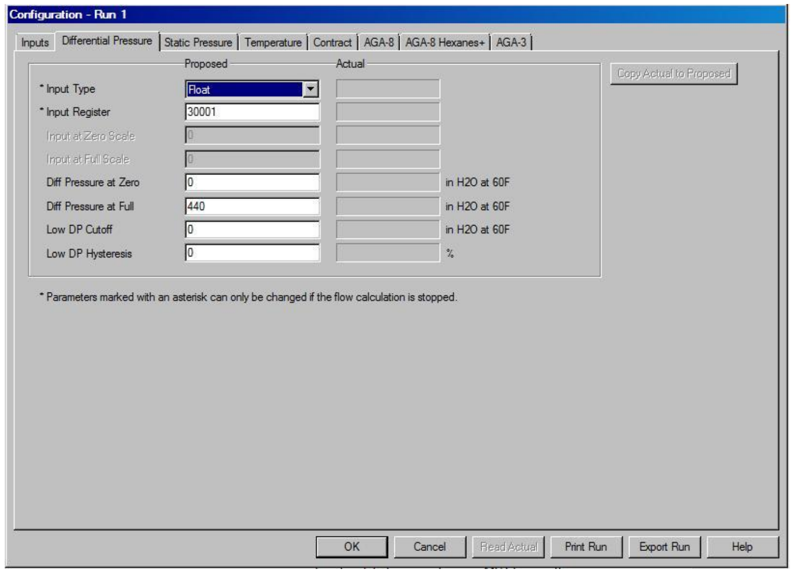
Hysteresis Units

The Hysteresis Units control selects how hysteresis is configured for the high and low level hysteresis in the Pressure, Temperature and Differential Pressure tabs. A dropdown box allows the selection of:

- Percent
- Engineering Units

Differential Pressure Tab

The controls in this tab are used to configure the differential pressure sensor for the meter run. The differential pressure controls are used only if the AGA-3 or the V-Cone flow calculation is selected.



The configuration of parameters for the **Differential Pressure** page is done using entry fields or dropdown selections for each parameter. The following edit controls are displayed. Parameter ranges are determined by the selection of the Input Units.

The tap location for the orifice meter as used in the gas flow calculation by Realflo is as follows:

- For AGA-3 1985 flange taps are used.
- For AGA-3 1992 flange taps are used.
- For V Cone meters the tap provided with the V-Cone element is used.

*** Input Type**

The type of register used for the Input Register. A dropdown box allows the selection of:

- Telepace Integer 16 –bit signed integer register.
- Float Floating-point register in engineering units.
- Raw Float Floating point register requiring scaling.
- ISaGRAF integer 32-bit signed integer register in ISaGRAF format.
- 4202 DR The internal 4202DR replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4202 DR.
- 4202 DS The internal 4202 DS replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4202 DS.
- 4203 DR The internal 4203 DR replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4203 DR.
- 4203 DS The internal 4203 DS replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4203 DS.

- SolarPack 410 The internal SolarPack 410 replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to SolarPack 410.
- Configured MVT If there are configured MVT transmitters they are displayed in the format *number (tag name)*. Refer to the **Sensor and Display** section for details on configuring MVT transmitters.

Refer to the **Register Formats** section for more information and examples for register types.

*** Input Register**

The Input Register is the address of the register in the Flow Computer I/O database that contains the reading from the differential pressure sensor. The I/O database register will be an input register (3xxxx) or a holding register (4xxxx). The flow calculation needs to be stopped in order to write this parameter to the controller. If an MVT or a SCADAPack 4202 or 4203 transmitter is selected in the ***Input Type*** selection this entry is disabled.

Input at Zero Scale

The value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. This field is grayed if the register type does not require scaling. If an MVT or a SCADAPack 4202 or 4203 transmitter is selected in the ***Input Type*** selection this entry is disabled.

Input at Full Scale

The value read from the sensor, in unscaled I/O units, when the sensor is at full scale. This field is grayed if the register type does not require scaling. If an MVT or a SCADAPack 4202 or 4203 transmitter is selected in the ***Input Type*** selection this entry is disabled.

Differential Pressure at Zero Scale

The differential pressure that corresponds to the zero scale input, or if the input does not require scaling, the minimum DP that can be read from the sensor. If a MVT or a SCADAPack 4202 or 4203 transmitter is selected in the ***Input Type*** selection this entry is disabled and the value is forced to that of the MVT Lower Operating Limit.

Differential Pressure at Full Scale

The differential pressure that corresponds to the full scale input, or if the input does not require scaling, the maximum DP that can be read from the sensor. If an MVT or a SCADAPack 4202 or 4203 transmitter is selected in the ***Input Type*** selection this entry is disabled and the value is forced to that of the MVT Upper Operating Limit.

Low DP Cutoff

This is the scaled input differential pressure where flow accumulation will stop. Valid values depend on the transmitter: refer to the transmitter band or user manual. It needs to be less than the UOL. The default value is 0.

Low DP Hysteresis

This is the amount, in percent of span, that the differential pressure needs to rise above the Low DP Cutoff to clear the low alarm and allow the flow calculations to resume.

Default Value

The **Default Value** edit box is enabled when the Input Type is set to a sensor and when the **Values on Sensor Fail** option on the **Inputs** tab is configured to **Use Default Value.**

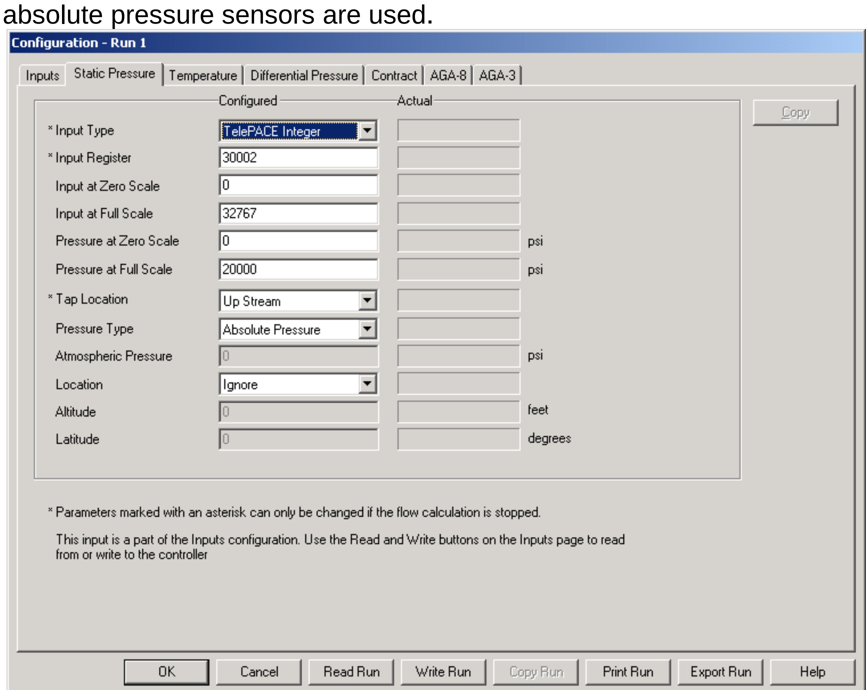
The value you can enter in **Default Value** edit box needs to be a range that is checked against the sensor configuration. The actual value needs to be uploaded from the controller when you click **Read Actual.**

Static Pressure Tab

The controls in this tab are used to configure the static pressure sensor for the meter run. The static pressure used in the flow calculations is either gauge pressure or absolute.

Gauge pressure is the pressure that a normal sensor would register. These sensors measure the pressure that is in excess of the atmospheric pressure. An atmospheric pressure value needs to be entered when gauge pressure sensors are used.

Absolute pressure sensors measure pressure relative to zero pressure (vacuum). An atmospheric pressure value of zero needs to be entered when absolute pressure sensors are used.



The configuration of parameters for the **Static Pressure** page is done using entry fields or dropdown selections for each parameter. The following edit controls are displayed. Parameter ranges are determined by the selection of the Input Units.

The tap location for static pressure as used in the gas flow calculation by Realflo is as follows:

- For AGA-3 1985 flange taps are used.
- For AGA-3 1992 flange taps are used.
- For V Cone meters the tap provided with the V-Cone element is used.

* Input Type

The type of register used for the Input Register. A dropdown box allows the selection of:

- Telepace Integer 16 –bit signed integer register.
- Float Floating-point register in engineering units.
- Raw Float Floating point register requiring scaling.

- ISaGRAF integer 32-bit signed integer register in ISaGRAF format.
- 4202 DR The internal 4202 DR replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4202 DR.
- 4202 DS The internal 4202 DS replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4202 DS.
- 4203 DR The internal 4203 DR replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4203 DR.
- 4203 DS The internal 4203 DS replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4203 DS.
- SolarPack 410 The internal SolarPack 410 replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to SolarPack 410.
- Configured MVT If there are configured MVT transmitters they are displayed in the format ***number (tag name)***. Refer to the **Sensor and Display** section for details on configuring MVT transmitters.

Refer to the **Register Formats** section for more information and examples for register types.

*** Input Register**

The Input Register is the address of the register in the Flow Computer I/O database that contains the reading from the pressure sensor. The I/O database register is an input register (3xxxx) or a holding register (4xxxx). The flow calculation needs to be stopped in order to write this parameter to the controller. If a SCADAPack 4202 or 4203 or MVT transmitter is selected in the ***Input Type*** selection this entry is disabled.

Input at Zero Scale

The value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. This field is grayed if the register type does not require scaling. If a SCADAPack 4202 or 4203 or MVT transmitter is selected in the ***Input Type*** selection this entry is disabled.

Input at Full Scale

The value read from the sensor, in unscaled I/O units, when the sensor is at full scale. This field is grayed if the register type does not require scaling. If a MVT or a SCADAPack 4202 or 4203 transmitter is selected in the ***Input Type*** selection this entry is disabled.

Pressure at Zero Scale

The pressure that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. If a SCADAPack 4202 or 4203 or MVT transmitter is selected in the ***Input Type*** selection this entry is disabled and the value is forced to that of the MVT Lower Operating Limit.

Pressure at Full Scale

The pressure that corresponds to the full scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. If a MVT transmitter or a SCADAPack 4202 or 4203 transmitter is selected in the ***Input Type*** selection this entry is disabled and the value is forced to that of the MVT Upper Operating Limit.

*** Tap Location**

This is the location of the static pressure pipe tap. The flow calculation needs to be stopped in order to write this parameter to the controller. A dropdown box allows the selection of:

- Up upstream pressure tap location.
- Down downstream pressure tap location.

Pressure Type

The Pressure Type selects if the static pressure is measured as gage or absolute pressure. A dropdown box allows the selection of:

- Absolute Pressure
- Gage Pressure

The control is disabled if the **Input Type** is set to MVT and the MVT is a SCADAPack 4202, 4203 or 4102 controller. Its value is set equal to the MVT pressure type.

The control is disabled if the **Compressibility Calculation** type is set to NX-19. The Static Pressure is set to Gage and the Atmospheric pressure is 14.7psi when NX-19 is selected.

Atmospheric Pressure

The atmospheric pressure is the weight of the atmosphere on the surface of the Earth. At sea level this value is approximately 101.3 kPa. The value entered needs to be the local atmospheric pressure for the flow computer. This control is disabled and forced to 0 if the *Pressure Type* is set to *Absolute Pressure*.

- The control is disabled if the **Input Type** is set to MVT and the MVT is a SCADAPack 4202, 4203 or 4102. Its value is set equal to the MVT atmospheric pressure.
- The control is disabled if the **Compressibility Calculation** type is set to NX-19. The Static Pressure is set to Gage and the Atmospheric pressure is 14.7psi when NX-19 is selected.

The atmospheric pressure entered needs to be greater than zero. The maximum upper limits for atmospheric pressure are:

30 psi for US1, US2, US3, US4, US5, US6, US7, US8, and PEMEX units
4320 lbf/ft2 for IP units
207 kPa for Metric1 units
2.07 bar for Metric2 units
0.207 MPa for Metric3 units
207000 Pa for SI units

Location

Location compensation is only to be used for cases where the static pressure is calibrated using a dead-weight tester. Location compensation adjusts for differences in the gravitational effect on the weights which is primarily dependent on latitude, and elevation. This is due to the centripetal effect of the spinning earth counteracting the effects of gravity. The compensation is not to be used when a pressure measurement is used as a reference instead of placing a specific amount of weight on a dead-weight tester to establish the reference pressure.

Measurement of the static pressure can be compensated for altitude and latitude. An algorithm is given in the *Manual of Petroleum Measurement Standards, Chapter 21, Section 2, Appendix E,* published by the American Petroleum Association. The algorithm for pressure compensation is used and the temperature compensation factor is not used.

The flow computer applies the compensation to the static pressure reading as it is input to the flow computer. The input pressure is multiplied by the compensation factor and then used by the flow computer whenever the static pressure is used or displayed.

Shown below are some calculated location compensation factors for different locations below.

- Ottawa, ON: the compensation factor applied is 1.0000717 (Alt=374ft, Lat=45deg)
- Calgary, AB: the compensation factor applied is 0.994447 (Alt=3438Ft, Lat=51deg)
- Midland, TX: the compensation factor applied is 1.001445 (Alt=2800Ft, Lat=32deg)

For example in Midland TX, an input pressure of 500psi with applied location compensation would result in:

500 psi * 1.001445 = 500.7225psi

A dropdown box allows the selection of:

- Ignore — Do not compensate for altitude and latitude.
- Compensate — Compensate for altitude and latitude.

Note that calibration needs to be performed at the location entered for the altitude and latitude compensation when *Compensate* is selected.

Altitude

The Altitude is the height above sea level of the location where the sensor is located. The altitude is measured in feet for US unit sets and meters for SI unit sets. This control is disabled if the ***Location*** is set to ***Ignore***. Valid inputs are –30000 to 30000.

Latitude

The Latitude is the latitude in decimal degrees of the location where the sensor is located. This control is disabled if the ***Location*** is set to ***Ignore***. Valid inputs are –90 to 90.

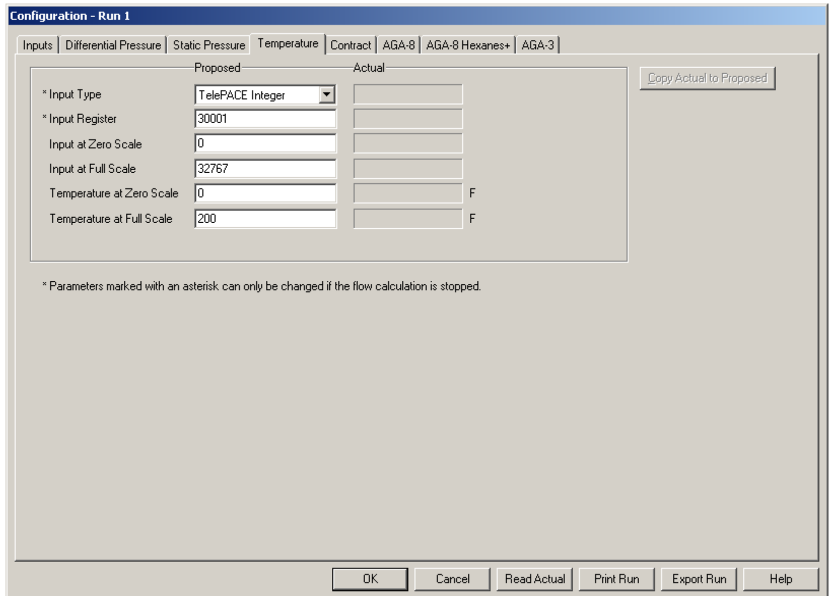
Default Value

The **Default Value** edit box is enabled when the Input Type is set to a sensor and when the **Values on Sensor Fail** option on the **Inputs** tab is configured to **Use Default Value.**

The value you can enter in **Default Value** edit box needs to be a range that is checked against the sensor configuration. The actual value needs to be uploaded from the controller when you click **Read Actual.**

Temperature Tab

The controls in this tab are used to configure the flow temperature sensor for the meter run.



The configuration of parameters for the **Temperature** page is done using entry fields or dropdown selections for each parameter. The following edit controls are displayed. Parameter ranges are determined by the selection of the Input Units.

* Input Type

The type of register used for the Input Register. A dropdown box allows the selection of:

- Telepace Integer 16 –bit signed integer register.
- Float Floating-point register in engineering units.
- Raw Float Floating point register requiring scaling.
- ISaGRAF integer 32-bit signed integer register in ISaGRAF format.
- Coriolis Meter Temperature in engineering units read from the Coriolis meter. This selection is available only when AGA-11 is selected as the flow calculation type.
- 4202 DR The internal 4202 DR replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4202 DR.
- 4202 DS The internal 4202 DS replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4202 DS.
- 4203 DR The internal 4203 DR replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4203 DR.
- 4203 DS The internal 4203 DS replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to 4203 DS.
- SolarPack 410 The internal SolarPack 410 replaces the first MVT (transmitter 1) on the MVT list when the controller type is set to SolarPack 410.

- Configured MVT If there are configured MVT transmitters they are displayed in the format ***number (tag name)***. Refer to the **Sensor and Display** section for details on configuring MVT transmitters.
- Refer to the **Register Formats** section for more information and examples for register types.

*** Input Register**

The Input Register is the address of the register in the Flow Computer I/O database that contains the reading from the temperature sensor. The I/O database register will be an input register (3xxxx) or a holding register (4xxxx). The flow calculation needs to be stopped in order to write this parameter to the controller. If an MVT or a SCADAPack 4202 or 4203 controller is selected in the ***Input Type*** selection this entry is disabled.

Input at Zero Scale

The value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. This field is grayed if the register type does not require scaling. If an MVT or a SCADAPack 4202 or 4203 controller is selected in the ***Input Type*** selection this entry is disabled.

Input at Full Scale

The value read from the sensor, in unscaled I/O units, when the sensor is at full scale. This field is grayed if the register type does not require scaling. If an MVT or a SCADAPack 4202 or 4203 controller is selected in the ***Input Type*** selection this entry is disabled.

Temperature at Zero Scale

The temperature that corresponds to the zero scale input, or if the input does not require scaling, the minimum temperature that can be read from the sensor. If an MVT or a SCADAPack 4202 or 4203 controller is selected in the ***Input Type*** selection this entry is disabled and the value is forced to that of the MVT Lower Operating Limit.

Temperature at Full Scale

The temperature that corresponds to the full scale input, or if the input does not require scaling, the maximum temperature that can be read from the sensor. If an MVT or a SCADAPack 4202 or 4203 controller is selected in the ***Input Type*** selection this entry is disabled and the value is forced to that of the MVT Upper Operating Limit.

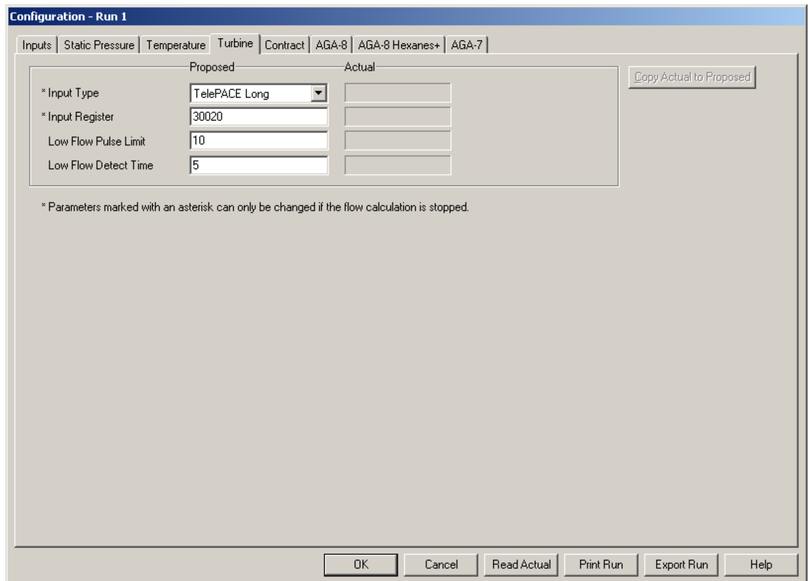
Default Value

The **Default Value** edit box is enabled when the Input Type is sset to a sensor and when the **Values on Sensor Fail** option on the **Inputs** tab is configured to **Use Default Value.**

The value you can enter in **Default Value** edit box needs to be a range that is checked against the sensor configuration. The actual value needs to be uploaded from the controller when you click **Read Actual.**

Turbine Tab

The controls in this tab are used to configure the turbine input for the meter run. The turbine controls are displayed only if the AGA-7 flow calculation is selected on the Inputs property page.



The configuration of parameters for the **Turbine** page is done using entry fields or dropdown selections for each parameter. The following edit controls are displayed.

* Input Type

This is the type of value found in the Input Register. A dropdown box allows the selection of:

- Telepace long   32-bit unsigned integer in Telepace format.
- ISaGRAF integer   32-bit signed integer in ISaGRAF format.

* Input Register

The Input Register is the address of the register in the Flow Computer I/O database that contains the reading (number of pulses) from the turbine meter. The I/O database register will be an input register (3xxxx). The flow calculation needs to be stopped in order to write this parameter to the controller.

Low Flow Pulse Limit

The number of pulses below which a low flow alarm will occur. The default value is 10.

Low Flow Detect Time

The length of time the number of pulses needs to remain below the Low Flow Pulse Limit for a low flow alarm to occur. Valid values are 1 to 5 seconds. The default value is 5.

Contract Tab

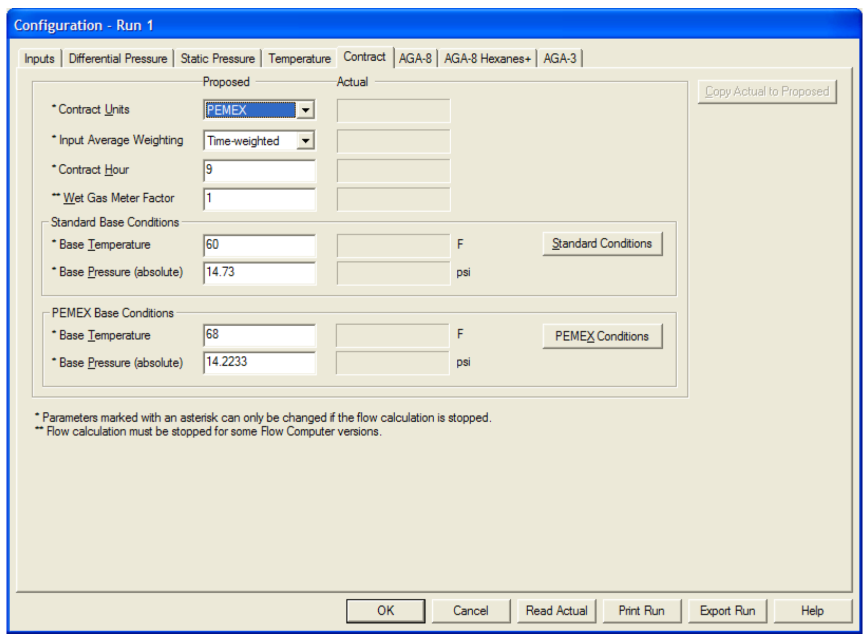
Contract Configuration defines parameters for the gas measurement contract. This is referred to as contract configuration because these parameters are often defined by a contract for selling gas.

With Realflo versions 6.0 and newer the Input Error Action control is no longer available on the Contract tab. When the configuration is written to the flow computer and Realflo detects an older flow computer (5.28 flow computers and earlier) the Input Error Action is automatically written as *Do Not Accumulate Flow*.

To enable flow accumulation for 5.28 flow computers and earlier check that the limits selected for the Differential Pressure, Static Pressure or Temperature inputs do not result in an Input Error condition for your application.

Additional Notes:

- The flow calculation needs to be stopped to write the parameters on this page to the controller.
- If changes are written to the controller a new hour and day are started in the history logs.



The configuration of parameters for the **Contract** page is done using entry fields or dropdown selections for each parameter. The following edit controls are displayed. Parameter ranges are determined by the selection of the Contract Units.

*** Contract Units**

These are the units of measurement for the contract (calculated) values. These units are used for outputs from the flow calculations for the meter run. This value may be different from the units used as inputs to the calculations. A dropdown box allows the selection of:

- US1
- US2
- US3
- IP
- Metric1

- Metric2
- Metric3
- SI
- US4
- US5
- US6
- US7
- US8
- PEMEX

Pemex contract units are not supported on 16-bit controllers.

Refer to the **Measurement Units** section of for information on unit types and how they are displayed.

*** Base Temperature**

This is the reference temperature to which contract flow values are corrected. The temperature units are displayed depending on the contract units selected.

*** Base Pressure**

This is the reference pressure to which contract flow values are corrected. The base pressure is measured as absolute pressure (not a gauge pressure). The pressure units are displayed depending on the contract units selected.

Standard Conditions

The Standard Conditions button sets default values for the Base Temperature and Base Pressure controls. The conditions are based on the Contract Units.

Contract Units	***Standard Base Temperature***	***Standard Base Pressure***
US1	60 F	14.73 psi
US2	60 F	14.73 psi
US3	60 F	14.73 psi
IP	60 F	2116.2281 lbf/ft^2
Metric1	15 C	101.325 kPa
Metric2	15 C	1.01325 bar
Metric3	15 C	0.101325 Mpa
SI	288.15 K	101325 Pa
US4	60 F	14.73 psi
US5	60 F	14.73 psi
US6	60 F	14.73 psi
US7	60 F	14.73 psi
US8	60 F	14.73 psi
PEMEX	60 F	14.73 psi

*** Contract Hour**

The hour of the day that starts a new contract day. The contract day begins at 00 minutes and 00 seconds of the specified hour. The contract hour is specified using a 24-hour clock, 00 through 23 hours.

**** Wet Gas Meter Factor**

This parameter is an adjustment to the volume, mass and energy values when there is water in the flow. Typically a test is conducted to determine the water content of the gas to be measured. The Wet Gas Meter Factor is applied to the volume, mass and energy values to get a corrected value. For example: if the water content is determined to be 5% then the meter factor is 0.95.

For Realflo versions 6.01 To 6.20, changing Wet Gas Meter Factor requires a new contract day to be started, as the flow calculation has to be stopped. For Realflo version 6.21 and later, changing the Wet Gas Meter Factor can be accomplished without stopping the flow calculations. This means that a new a new contract day does not have to be started when this parameter needs to be changed.

PEMEX Base Conditions

*** Base Temperature**

This is the reference temperature to which contract flow values are corrected. The temperature units are displayed depending on the contract units selected.

*** Base Pressure**

This is the reference pressure to which contract flow values are corrected. The base pressure is measured as absolute pressure (not a gauge pressure). The pressure units are displayed depending on the contract units selected.

PEMEX Conditions Button

The Secondary Conditions button sets default values for the secondary Base Temperature and Base Pressure controls. The conditions are based on the Contract Units.

Contract Units	***Standard Base Temperature***	***Standard Base Pressure***
US1	60 F	14.73 psi
US2	60 F	14.73 psi
US3	60 F	14.73 psi
IP	60 F	2116.2281 lbf/ft^2
Metric1	15 C	101.325 kPa
Metric2	15 C	1.01325 bar
Metric3	15 C	0.101325 Mpa
SI	288.15 K	101325 Pa
US4	60 F	14.73 psi
US5	60 F	14.73 psi
US6	60 F	14.73 psi
US7	60 F	14.73 psi
US8	60 F	14.73 psi
PEMEX	68 F	14.2233 psi

AGA-3 Configuration

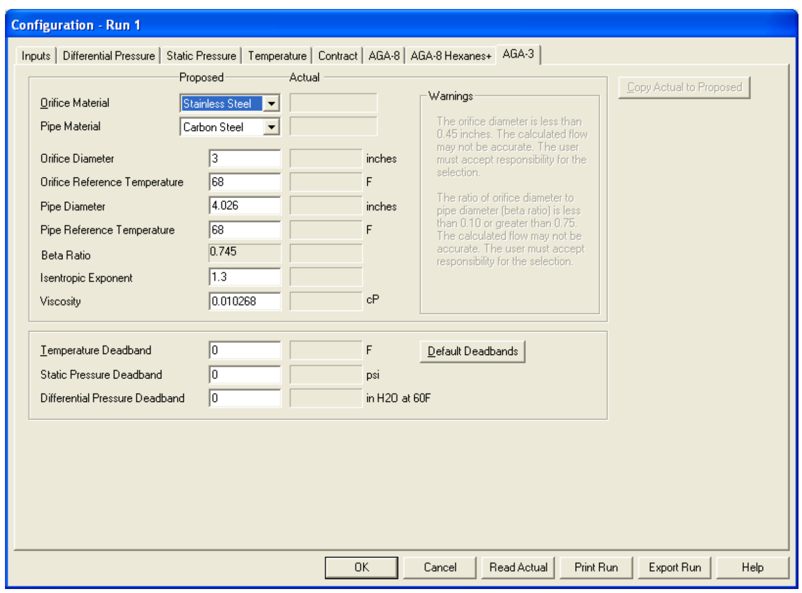
AGA-3 Configuration defines parameters unique to the AGA-3 calculation. This tab is visible only if the AGA-3 calculation is selected on the **Inputs** tab for the meter run.

The ***Warnings*** area shows messages if the parameters entered are outside the bounds of the regression database used to create the AGA-3 standard. The calculation may be used outside these bounds, but the results are extrapolated. The calculated flow may not be accurate. It is the user's responsibility to decide if the values used are appropriate.

There are two messages on the configuration page. These are grayed if they unless they apply.

If the orifice diameter is smaller than the specification suggests, the message *"The orifice diameter is less than 0.45 inches (11.4 mm). The calculated flow may not be accurate. The user needs to accept responsibility for the selection."* is displayed.

If the beta ratio is larger than the specification suggests, the message "*The ratio of orifice diameter to pipe diameter (beta ratio) is greater than 0.75. The calculated flow may not be accurate. The user must accept responsibility for the selection*." is displayed.



The configuration of parameters for the **AGA-3** page is done using entry fields or dropdown selections for each parameter. The following edit controls are displayed.

Orifice Material

The material the orifice plate for the meter run is made of. A dropdown box allows the selection of:

- Stainless Steel
- Monel
- Carbon Steel

Pipe Material

The material the meter run pipe is made of. A dropdown box allows the selection of:

- Stainless Steel
- Monel
- Carbon Steel

Orifice Diameter

The diameter of the meter run orifice used for the flow calculation. The measurement units are displayed depending on the input units selected.

Orifice reference temperature

This is the temperature at which the diameter of the meter run orifice was measured. The measurement units are displayed depending on the input units selected.

Pipe Diameter

This is the measurement of the meter run pipe inside diameter. The measurement units are displayed depending on the input units selected.

Pipe reference temperature

The temperature at which the meter run pipe diameter was measured. The measurement units are displayed depending on the input units selected.

Isentropic exponent

In general, this is a thermodynamic property of gas used to predict the relationships between pressure, temperature, volume and energy.
If you are unsure of this value a typical value of 1.3 is commonly used.

Viscosity

This is the viscosity of the measured gas. In general, this is the resistance of a gas or semi-fluid resistance to flow. The measurement units are displayed depending on the input units selected.

Temperature Deadband

The tolerated change in the flowing temperature before temperature dependent factors in the flow calculation are recalculated. Changes in the temperature smaller than the deadband will be ignored in determining the result. The default value is 0. The upper limit is 7°F or 4°C.

Static Pressure Deadband

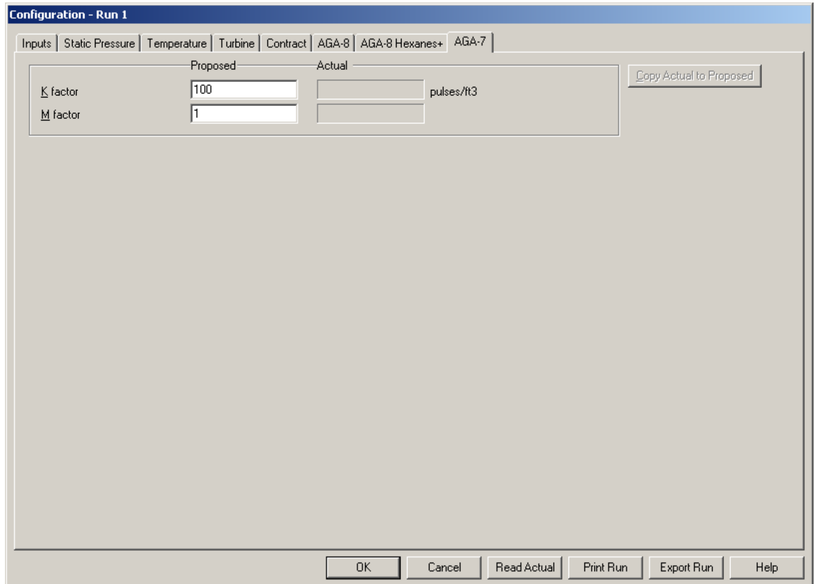
The tolerated changes in the static pressure before static pressure dependent factors in the flow calculation are recalculated. Changes in the static pressure smaller than the deadband will be ignored in determining the result. A static pressure deadband setting of up to four per cent of the typical static pressure level should have a small effect on the accuracy of the AGA-3 calculation. The default value is 0. The upper limit is 800 psi or 5500 kPa or equivalent in other units.

Differential Pressure Deadband

The tolerated changes in the differential pressure before differential pressure dependent factors in the flow calculation are recalculated. Changes in the differential pressure smaller than the deadband will be ignored in determining the result. A change of N in the differential pressure input will cause a change of 0.5 N in the calculation volume at base conditions. It is recommended that the differential pressure deadband be set to zero. The default value is 0. The upper limit is 4.5 inWC or 1.1 kPa or equivalent in other units.

AGA-7 Configuration

AGA-7 Configuration defines parameters unique to the AGA-7 calculation. This tab is visible only if the AGA-7 calculation is selected in the **Inputs** tab section for the meter run.



The configuration of parameters for the **AGA-7** page is done using entry fields or dropdown selections for each parameter. The following edit controls are displayed.

K Factor

This is the number of pulses per unit volume of the turbine meter. Valid values are 0.001 to 1000000. The default value is 100.

M Factor

This is the adjustment to the number of pulses per unit volume for the turbine meter compared to an ideal meter. Valid values are 0.001 to 1000. The default value is 1.

The SolarPack 410 does not support AGA-7 calculations.

AGA -11 Configuration

AGA-11 configuration defines parameters unique to the AGA-11 calculation. This tab is visible only if the AGA-11 calculation is selected in the ***Flow Calculation*** type selection in the ***Inputs*** tab for the meter run.

The AGA-11 configuration sets the Coriolis meter Modbus address, the flow computer serial port to use and the command timeout value for messages sent to the Coriolis meter.

The flow computer communicates with one or more Coriolis meters using serial communication. When a direct connection is used, i.e. a single Coriolis meter connected, either RS-232 or RS-485 serial communication may be used. When the flow computer is communicating with multiple Coriolis meters, or Coriolis meters and other devices, then RS-485 communication needs to be used.

The serial communication parameters for the flow computer and the Coriolis meter need to match for successful communication to take place.

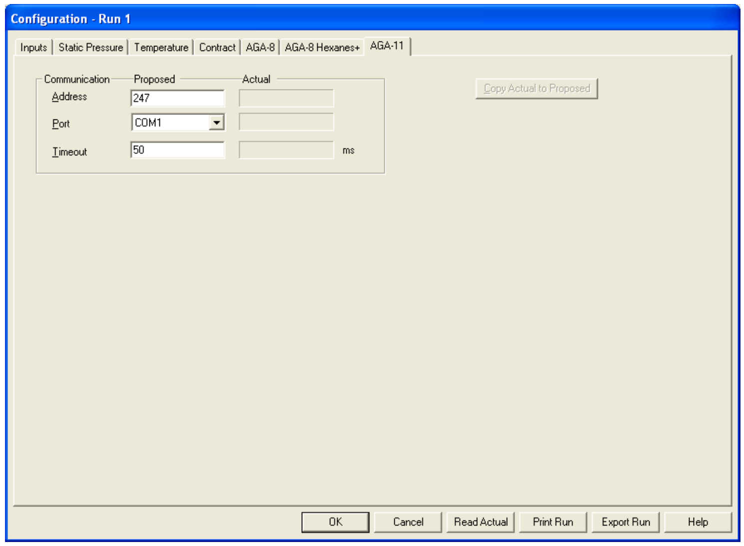
In order to use an Endress and Hauser Promass 83 Coriolis meter it needs to have the following parameters configured through the local display to match the settings that the Flow Computer will use:

- Address (factory setting is 247)
- Baud rate (factory setting is 19200)
- Parity (factory setting is Even)
- Write protection needs to be OFF (factory setting is OFF)
- Transmission mode needs to be RTU (factory setting is RTU)

The flow computer serial port settings are configured from the ***Serial Ports*** command. The serial port settings for the serial port used by the flow computer and the Coriolis meter need to match.

NOTES:

- If the Promass 83 is installed in a multi-drop fashion the only permitted Modbus master device is the Flow Computer (address 1) that is configured to poll the Promass 83. Additional master devices or a second Flow Computer polling the Promass 83 can result in communication not succeeding.
- SCADAPack 4102, 4012 and 4032 transmitters and Rosemount 3095 sensors have the parity setting fixed at No parity and 1 stop bit. The Promass 83 Coriolis meter No parity setting requires 2 stop bits. When these sensors are used by the flow computer they need to use another serial port on the flow computer.
- SCADAPack 4202 and 4203 sensors may be used on the same serial port as the Promass 83 Coriolis meter.



Address

This is the Modbus address of the Coriolis Meter for serial communications. Multiple Coriolis meters using the same serial port on the flow computer need to each have a unique Modbus address. Valid Modbus addresses are between 1 and 247. The default address is 247.

Port

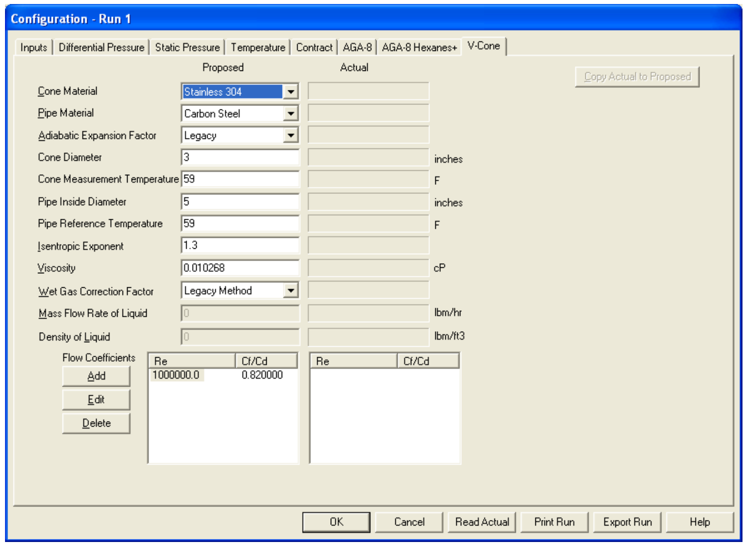
This is the communication port on the flow computer that will be used to communicate with the Coriolis meter. Valid port selections depend on the type of controller the flow computer running on. The default port is the first valid port available on the controller.

Timeout

This is the time the flow computer will wait for a response for Modbus read commands send to the Coriolis meter. When the timeout time is exceeded the command is unsuccessful and an alarm is added to the flow computer alarm list. Valid timeout values are from 0 to 1000 ms. The default value is 50 ms.

V-Cone Configuration

V-Cone Configuration defines parameters unique to the V-Cone calculation. This tab is visible only if the V-Cone calculation is selected in the ***Flow Calculation*** type selection in the ***Inputs*** tab for the meter run.



Cone Material

This is the material of the V-cone. Valid values are Carbon Steel, Stainless 304, and Stainless 316. The default value is determined by the template selected.

Pipe Material

This is the material from which the meter run pipe is made. Valid values are Carbon Steel, Stainless 304, and Stainless 316. The default value is determined by the template selected.

Adiabatic Expansion Factor

The **Adiabatic Expansion Factor** drop down list selects which calculation is used for the adiabatic expansion factor of the calculation.

- Select Legacy Calculation to use the older calculation method. This is the default selection. Flow computers prior to version 6.71 support only this selection.
- Select V-Cone to use the V-Cone specific calculation. This selection should be used with V-Cone devices.
- Select Wafer-Cone to use the Wafer-Cone specific calculation. This selection should be used with Wafer-Cone devices.

This control is disabled and forced to **Legacy Calculation** if the controller type is not one of SCADAPack 32, SCADAPack 32P, SCADAPack 314/330/334, SCADAPack 350 SCADAPack 4203 or SolarPack 410.

When reading from a flow computer that does not support the adiabatic expansion factor configuration, the method will be set to Legacy Calculation.

When writing to a flow computer that does not support the adiabatic expansion factor method, the configuration registers will be ignored and the expansion factor will not be written.

Cone Diameter

The diameter of the meter run cone used for the flow calculation. The measurement units are displayed depending on the input units selected. The default value is 3 inches.

Cone Measurement Temperature

This is the reference temperature at which the cone diameter for the meter run was measured. The measurement units are displayed depending on the input units selected. The default value is 59 degrees F.

Pipe Inside Diameter

This is the measurement of the meter run pipe inside diameter. The measurement units are displayed depending on the input units selected. The default value is 5 inches.

Pipe reference temperature

The temperature at which the meter run pipe diameter was measured. The measurement units are displayed depending on the input units selected. The default value is 59 degrees.

Isentropic Exponent

In general, this is a thermodynamic property of gas used to predict the relationships between pressure, temperature, volume and energy. If you are unsure of this value a typical value of 1.3 is commonly used. The default value is 1.3.

Viscosity

This is the viscosity of the measured gas. In general, this is the resistance of a gas or semi-fluid resistance to flow. The measurement units are displayed depending on the input units selected. Valid values are 0 to 1. The default value is 0.010268 centiPoise.

Wet Gas Correction Factor

The Wet Gas Correction Factor Method drop down list selects which calculation is used for the wet gas correction factor of the calculation.

- Select Legacy Method to use the older correction method. This is the default selection. Flow computers prior to version 6.73 support only this selection.
- Select **V-Cone or Wafer Cone** to use the V-Cone and Wafer Cone specific calculation. This selection should be used with V-Cone or Wafer Cone devices.

This control is disabled and forced to **Legacy Calculation** if the controller type is not one of SCADAPack 32, SCADAPack 32P, SCADAPack 314/330/334, SCADAPack 350 SCADAPack 4203 or SolarPack 410.

The V-Cone or Wafer Cone supported **Beta Ratios** are:

For Fr (Froude Number) < 5 supported Beta Ratio is 0.55.

For Fr (Froude Number) < 5 supported Beta Ratio is 0.75.

For Fr (Froude Number) > 5 supported Beta Ratio is 0.75.

When **V-Cone or Wafer Cone** is selected and if the current Beta ratio is not supported when executing verification, an error message is displayed.

When **V-Cone or Wafer Cone** is selected, configuration of the fixed wet gas factor parameter, as set in the Contract tab, is disabled.

When **Legacy Method** is selected, configuration of the parameters used by the V-Cone or Wafer Cone method is disabled.

Mass Flow Rate of Liquid

The Mass flow rate of liquid at flow conditions parameter is used by the V-Cone or Wafer Cone method and can be configured when **V-Cone or Wafer Cone** is selected. This information needs to be gathered using a sampling method or a tracer method. The default is 0.

Density of Liquid

The Density of liquid parameter is used by the V-Cone or Wafer Cone method and can be configured when **V-Cone or Wafer Cone** is selected. The default is 0.

Density of Liquid

The Density of liquid at flow conditions parameter is used by the V-Cone or Wafer Cone method and can be configured when **V-Cone or Wafer Cone** is selected. The default is 0.

Flow Coefficients

Reynolds number and flow coefficient pairs are entered in a table editor. The flow coefficient pairs are entered from the calibration data sheet that accompanies the V-Cone Meter. The table is a list view sorted by the Reynolds number column. The default list contains one pair: Re = 1000000; Cf = 0.82.

- The **Add** button adds an entry to the table. Up to 10 pairs may be added to the table. The button is grayed if the table is full. If the **Re** value is the same for all entries in the table only the first pair is used.
- The **Edit** button edits the selected entry. The button is grayed if no entry is selected.
- The **Delete** button removes the selected entry. The button is grayed if no entry is selected.

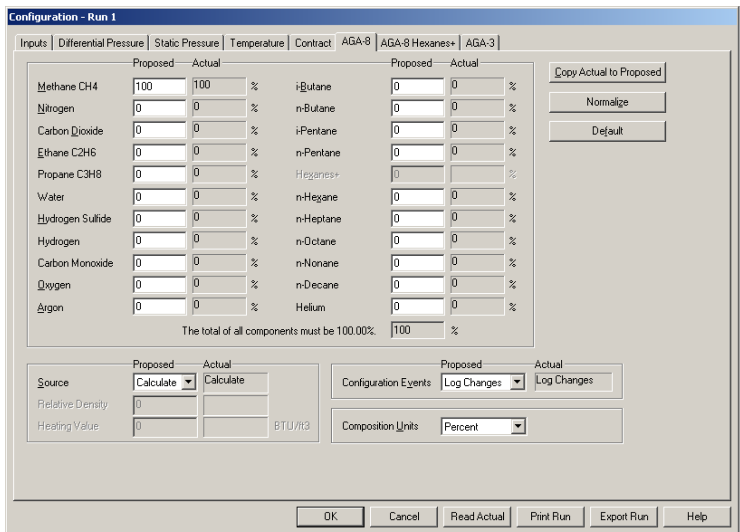
In the original McCrometer V-Cone Application Sizing sheet that is included with V-Cone meters uses the terminology **Cd** (discharge coefficient) rather than **Cf** (flow coefficient). You will need to use the **Re** and **Cd** values from the V-Cone Application Sizing sheet for the **Re** and **Cf** entries. If the **Re** value is the same for all entries in the table only the first pair is used.

McCrometer now supplies one value of **Cd** in the sizing document. You need to enter one **Re/Cd** pair only. See the McCrometer Application Sizing sheet for the **Re/Cd** pair for your meter.

AGA-8 Configuration

AGA-8 Configuration defines parameters unique to the AGA-8 Detailed calculation. This tab is visible only if the AGA-8 calculation is selected in the **Inputs** tab for the meter run.

In Flow Computer versions 6.74 and newer when gas ratios are written to the flow computer using the Write Configuration command the new gas ratios are updated in the Configuration Proposed registers and in the Configuration Actual registers. This allows a Realflo user or SCADA host to immediately confirm the new ratios were written to the flow computer. The new gas ratios are not used by the flow computer until a new density calculation is started.



The configuration of parameters for the **AGA-8** page are entered using entry fields or dropdown selections for each parameter. The following edit controls are displayed.

The AGA-8 configuration defines the composition of the gas being measured. The gas composition can be made up of a number of components. These components are usually represented as either a percentage of the gas being measured i.e. 0 to 100% or as a fraction of the gas being measured i.e. 0 to 1.0000.

For each component listed, enter the fraction of the gas that the component represents.

- See the ***AGA-8 Gas Component Range*** table below for the valid entry range of each gas component.
- The value entered needs to be in the range 0 to 1.0000 if *Composition Units* value is set to *Mole Fractions*.
- The value entered needs to be in the range 0 to 100% if *Composition Units* is set to *Percent*.

The **Total of all Components** field displays the sum of all components. The total of all components needs to be 1.0000 (+/- 0.00001) if ***Composition Units*** is set to ***Mole Fractions*** or 100% (+/- 0.00001%) if ***Composition Units*** is set to ***Percent***.

Hexane and higher components may be measured individually or may be combined. This affects the n-Hexane, n-Heptane, n-Octane, n-Nonane, and n-Decane components. This setting is on the **AGA-8 Hexanes+** tab.

Hexanes+ is the fraction of the gas that is composed of hexane and higher components. This value is included in the total of all components. This component is visible if Combined Hexanes+ Ratios are selected, and is hidden if individual ratios are selected.

The **Relative Density** and **Heating Value** can be calculated from the AGA-8 calculation or determined in a laboratory.

- Select **Calculate the Values** to have AGA-8 calculate the values.
    - The calculated **Relative Density** is displayed in the ***Calculated Compressibility*** section of the Current Readings view. This is the real relative density of the gas.
    - The calculated **Heating Value** is displayed in the ***Calculated Compressibility*** section of the Current Readings view. The heating value is calculated for dry gas.
- Select **Use Laboratory Values** to used fixed values.
    - **Relative Density** sets the real relative density of the gas. Valid values are 0.07 to 1.52. The default value is 0.554. This control is disabled if **Calculate the Values** is selected..
    - **Heating Value** sets the heating value of the dry gas. Valid values are 0 to 1800 BTU(60)/ ft^3 or the equivalent in the selected units. The default value is 1014 BTU(60)/ft^3 or the equivalent in the selected units. This control is disabled if **Calculate the Values** is selected.

The **Configuration Events** dropdown list control selects if the flow computer logs AGA-8 gas composition changes. The AGA-8 gas composition can be changed while the flow calculation is running. This allows an on-line gas chromatograph to provide updates to the gas composition. Frequent changes to the composition will result in the event log filling with gas composition events. When the log is full, further changes cannot be made until Realflo reads the log.

A dropdown box allows the selection of:

- Log Changes Log all gas composition changes.
- Ignore Disable logging of gas composition changes.

The default setting is ***Log Changes***.

The **Composition Units** drop-down list control selects the units used to enter the AGA-8 composition.

- Select ***Mole Fractions*** to enter the composition in fractions.
- Select ***Percent*** to enter the composition in percent.

The default setting is ***Percent***.

The **Normalize** button adjusts all non-zero components so that the total of all components is 1.0000 (or 100.00%). The components remain in their current ratio to each other.

The **Default** button sets components to default values. The methane component is set to 1 (or 100%). All other components are set to 0.

AGA-8 Gas Component Ranges

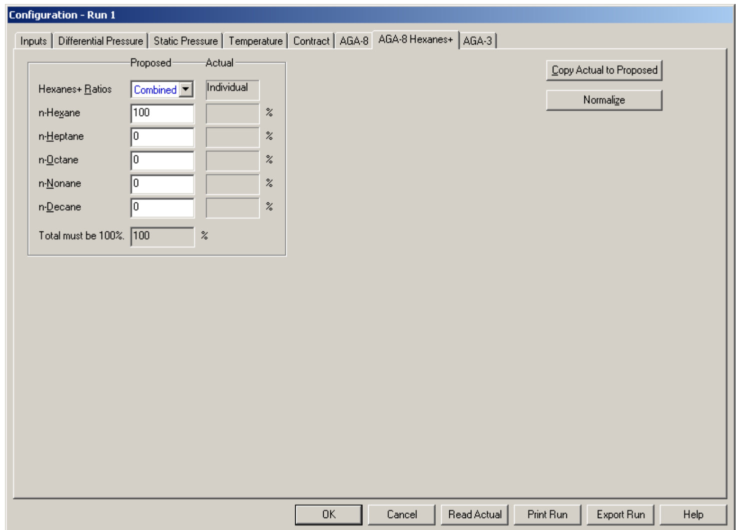
The range of the fractional values of the components cannot be predetermined. The gas components are shown in the table below. There are two ranges shown for each gas component. Realflo accepts any value in the Expanded Range. Only values in the Normal Range will work in all circumstances.

The run-time error message **"Bracket derivative negative"** occurs when the combination of the components at the current pressure and temperature results in an error. The AGA-8 calculation will produce a result even if the error occurs, but the accuracy of the result is not guaranteed.

Component	***Normal Range***	***Expanded Range***
Methane CH_4	.4500 to 1.0000	0 to 1.0000
Nitrogen	0 to 0.5000	0 to 1.0000
Carbon Dioxide	0 to 0.3000	0 to 1.0000
Ethane C_2H_6	0 to 0.1000	0 to 1.0000
Propane C_3H_8	0 to 0.0400	0 to 0.1200
Water	0 to 0.0005	0 to 0.0300
Hydrogen Sulfide	0 to 0.0002	0 to 1.0000
Hydrogen	0 to 0.1000	0 to 1.0000
Carbon Monoxide	0 to 0.0300	0 to 0.0300
Oxygen	0	0 to 0.2100
Total Butanes • iButane • nButane	0 to 0.0100	0 to 0.0600
Total Pentanes • iPentane • nPentane	0 to 0.0300	0 to 0.0400
Total Hexane Plus • nHexane • nHeptane • nOctane • nNonane • nDecane	0 to 0.0200	0 to 0.0400
Helium	0 to 0.0200	0 to 0.0300
Argon	0	0 to 0.0100

AGA-8 Hexanes +

AGA-8 Hexanes+ Configuration defines parameters unique to the AGA-8 Detailed calculation. This tab is visible only if the AGA-8 calculation is selected in the **Inputs** tab for the meter run. Settings on this tab affect settings on the AGA-8 tab.



The AGA-8 Hexanes+ configuration defines the composition of the heavier gas components being measured. There are two options.

The **Individual** option disables all controls on the property page and all gas components are entered on the AGA-8 tab.

The **Combined** option enables the edit controls for the portion of the Hexanes+ ratio that is applied to each of the listed gas component. These portions are represented as a percentage of the gas components being measured i.e. 0 to 100%.

- n-Hexane defines the percentage of the Hexanes+ contributed by n-Hexane.
- n-Heptane defines the percentage of the Hexanes+ contributed by n-Heptane.
- n-Octane defines the percentage of the Hexanes+ contributed by n-Octane.
- n-Nonane defines the percentage of the Hexanes+ contributed by n-Nonane.
- n-Decane defines the percentage of the Hexanes+ contributed by n-Decane.

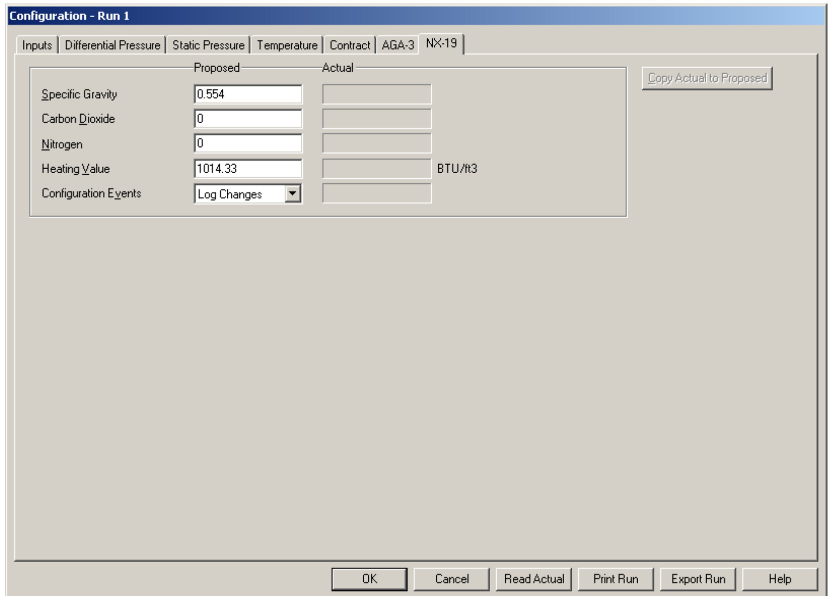
The **Total** field displays the sum of portions. This value cannot be edited. The total of portions needs to be 100 percent.

The **Copy Actual to Proposed** button copies the values in the actual column to the proposed column.

The **Normalize** button adjusts non-zero portions so that the total of portions is 100.00%. The portions remain in their current ratio to each other.

NX-19 Configuration

NX-19 Configuration defines parameters unique to the NX-19 calculation. This tab is visible only if the NX-19 calculation is selected on the **Inputs** tab. This is not supported for PEMEX flow computers.



The configuration of parameters for the **NX-19** page is done using entry fields for each parameter. The following edit controls are displayed.

The **Specific Gravity** edit box is used to enter the specific gravity of the gas being measured.

The **Fraction of Carbon Dioxide** edit box is used to enter the fractional value of carbon dioxide in the gas being measured. This value needs to be in the range 0 to 0.15.

The **Fraction of Nitrogen** edit box is used to enter the fractional value of nitrogen in the gas being measured. This value needs to be in the range 0 to 0.15.

The **Heating Value** edit box is used to enter the heating value of the gas being measured. The units are displayed depending on the contract units selected.

The **Configuration Events** control selects if the flow computer logs NX-19 gas composition changes. The NX-19 gas composition can be changed while the flow calculation is running. This allows an on-line gas chromatograph to provide updates to the gas composition. Frequent changes to the composition will result in the event log filling with gas composition events. When the log is full, further changes cannot be made until Realflo reads the log.

A dropdown box allows the selection of:

- Log Changes Log all gas composition changes.
- Ignore Disable logging of gas composition changes.

The default setting is ***Log Changes***.

Select ***Log Changes*** to log all gas composition changes. Select *Ignore* to disable logging of gas composition changes. The default setting is ***Log Changes***.

Register Formats

Input configuration values are stored in the controller I/O database registers in the following formats.

Register Type	Registers	Description
Telepace integer	1	Signed integer in the range –32768 to 32767
Telepace long	2	Unsigned long integer in the range 0 to 4,294,967,295. The lower numbered register contains the lower 16 bits of the number.
float	2	Floating-point value in the IEEE 754 standard. The lower numbered register contains the upper 16 bits of the number.
raw float	2	Floating-point value in the IEEE 754 standard. The lower numbered register contains the upper 16 bits of the number.
ISaGRAF integer	2	Signed long integer in the range –2,147,483,648 to 2,147,483,647. The lower numbered register contains the upper 16 bits of the number.

Telepace Long Example

The Telepace long integer 65550 is represented, in hexadecimal, as 0001000Eh. If this value is stored at register 30010 then:

- register 30010 contains the lower 16 bits of the value = 14 (000Eh)
- register 30011 contains the upper 16 bits of the value = 1 (0001h)

Floating Point Example

The floating-point value 1.0 is represented, in hexadecimal, as 3F800000h. If this value is stored at register 30004 then:

- register 30004 contains the upper 16 bits of the value = 16256 (3F80h)
- register 30005 contains the lower 16 bits of the value = 0 (0000h)

ISaGRAF Integer Example

The ISaGRAF integer 65550 is represented, in hexadecimal, as 0001000Eh. If this value is stored at register 30020 then:

- register 30020 contains the upper 16 bits of the value = 1 (0001h)
- register 30021 contains the lower 16 bits of the value = 14 (000Eh)

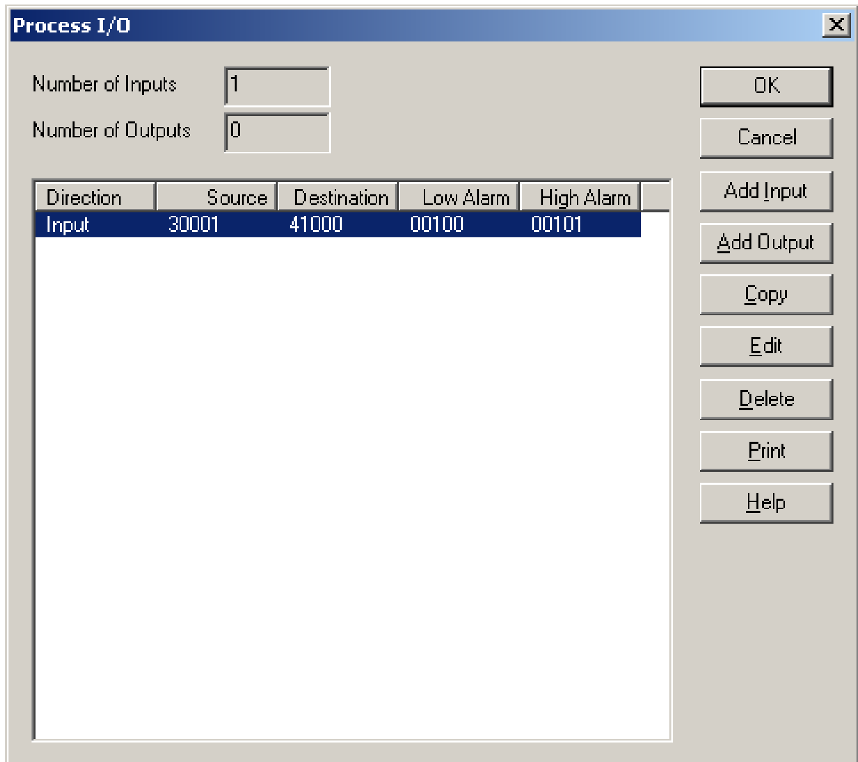
Process I/O

The Process I/O command configures scaling and alarms for input and output points used by your process. Input points convert integer values read from input modules into floating-point values. Output points convert floating-point values into integer values for output modules.

Process I/O is normally used with I/O points that are not related to the flow runs. Use the Run Configuration command to scale inputs to flow runs.

Process I/O is available on SCADAPack 32, SCADAPack 314/330/334, SCADAPack 350, SCADAPack 4202 or 4203 controllers and the SolarPack 410.

The Process I/O command opens the Process I/O dialog.



Number of Inputs window indicates the number of inputs in the list. On SCADAPack, SCADAPack 4202 or 4203 controllers the maximum number of inputs is 10. For SCADAPack 32, SCADAPack 314/330/334, SCADAPack 350 or SCADAPack 4202 or 4203 controllers and SolarPack 410 the maximum number of inputs 30.

Number of Outputs window indicates the number of outputs in the list. The maximum number of outputs is 10.

The list box displays the configured process I/O points.

- Direction indicates if the point is an input or an output.
- Source shows the source register for the point.
- Destination shows the destination register for the point.
- Low Alarm shows the low alarm output register for the point. If no alarm is configured it shows "none".
- High Alarm shows the high alarm output register for the point. If no alarm is configured it shows "none".

Click on a row to select the I/O point.

Double-click on a row to edit the I/O point.

Click on the column headings to sort the data. Clicking once sorts the data in ascending order. Clicking again sorts the data in descending order.

The **OK** button saves the configuration and closes the dialog. In PEMEX mode the OK button is not active if the user is not logged on with Administrator privileges.

The **Cancel** button closes the dialog without saving changes.

The **Add Input** button adds an input point. It opens the *Process Input* dialog. The button is disabled if the list already contains the maximum number of inputs.

The **Add Output** button adds an output point. It opens the *Process Output* dialog. The button is disabled if the list already contains the maximum number of outputs.

The **Copy** button adds a copy of the selected point. The button is disabled if no point is selected, or if the list already contains the maximum number of points of the selected type.

The **Edit** button edits the selected point. It opens the *Process Input* dialog for input points and the *Process Output* dialog for output points. The button is disabled if no point is selected.

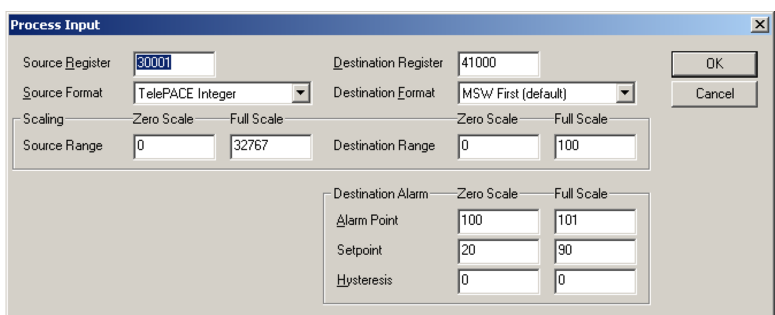
The **Delete** button deletes the selected point from the list. The button is disabled if no point is selected.

The **Print** button prints the Process I/O configuration.

The **Help** button opens the user manual.

Process Input Dialog

The **Process Input** dialog edits the configuration of a process input point. Use an input point to scale a value read from a hardware input module.



Source Register is the address of the register or registers that hold the value to be scaled. Valid values are 30001 to 39999, and 40001 to 49999 if the source format is Telepace Integer and 30001 to 39998, and 40001 to 49998 if the source format is ISaGRAF integer.

Source Format is the format of the data in the register. Valid values are Telepace Integer and ISaGRAF Integer. The default value is Telepace integer. A Telepace integer is a 16-bit signed number stored in one register. An ISaGRAF integer is a 32-bit signed value stored in two registers.

Source Range defines the range of the source register. The zero scale is the value of the input at its lowest value. The full scale is the value of the input at its highest value. Valid values are -32768 to 32767 for Telepace

Integer format, and –2,147,483,648 to 2,147,483,647 for the ISaGRAF Integer format. The default zero scale is 0. The default full scale is 32767.

Destination Register is the address of the first of two registers that hold the floating-point result. Registers used by the flow computer are not permitted to be destination registers. These depend on the flow computer type. Valid values are displayed in the table below.

Flow Computer Type	Valid Register Ranges
SCADAPack 4202 or 4203 SolarPack 410	40500 to 43179 43800 to 46498
Micro 16 SCADAPack SCADAPack Light SCADAPack Plus SCADAPack LP SCADAPack 100: 1024K	40001 to 43179 43800 to 45498
SCADAPack 32 SCADAPack 32P SCADAPack 314/330/334 SCADAPack 350	40001 to 43179

Destination Format is the format of the data in the destination registers. Valid values are MSW First (most significant word first) and LSW First (least significant word first). The default value is MSW First. This is the format of floating point values used by Telepace and ISaGRAF.

Destination Range defines the range of the destination register. The zero scale is the value corresponding to the input at its lowest value. The full scale is the value corresponding to the input at its highest value. Valid values are any floating-point number.

The **Destination Alarm** section configures alarms for the destination register. A high and low alarm can be configured.

Alarm Point is the coil register that will be turned on if an alarm occurs. Valid values are 0 and 00001 to 09999. Enter 0 to disable the alarm. The default value is zero.

Setpoint is the value at which the alarm occurs. The low alarm occurs when the destination register is less than the low alarm setpoint. The high alarm occurs when the destination register is greater than the high alarm setpoint. Valid values are any floating-point number; Realflo does not check the setpoint values. The control is disabled if the corresponding alarm point is set to 0.

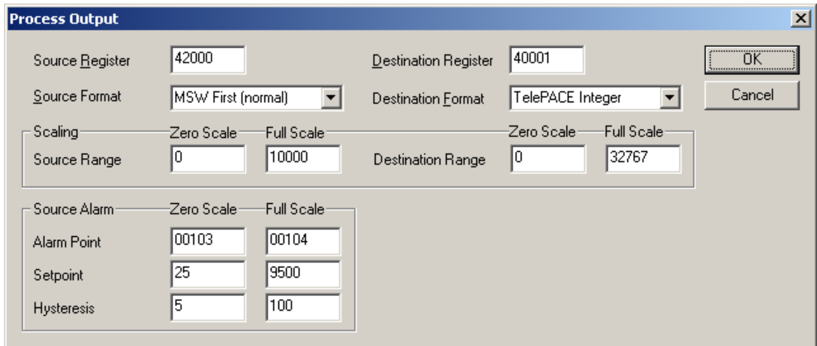
Hysteresis keeps minor changes from causing multiple alarms. The Low Alarm Hysteresis is the amount above the setpoint that the value needs to rise to clear the alarm. The High Alarm Hysteresis is the amount below the setpoint that the value needs to fall to clear the alarm. Valid values are any floating-point number. The control is disabled if the corresponding alarm point is set to 0.

The **OK** button saves the configuration and closes the dialog. All parameters are checked against their limits. The destination registers and alarm points are checked for conflicts with any other input or output points.

The **Cancel** button closes the dialog without saving changes.

Process Output Dialog

The **Process Output** dialog edits the configuration of a process output point. Use an output point to scale a value so it can be written to a hardware output module.



Source Register is the address of the first of two registers that hold the floating-point value to be scaled. Valid values are 30001 to 39998, and 40001 to 49998.

Source Format is format of the data in the source registers. Valid values are MSW First (most significant word first) and LSW First (least significant word first). The default value is MSW First: this is the format of floating point values used by Telepace and ISaGRAF.

Source Range defines the range of the source register. The zero scale is the value corresponding to the output at its lowest value. The full scale is the value corresponding to the output at its highest value. Valid values are any floating-point number.

Destination Register is the address of the register or registers that hold the result. Registers used by the flow computer are not permitted to be destination registers. These depend on the flow computer type. Valid values are displayed in the table below.

Flow Computer Type	Valid Register Ranges ISaGRAF Integer	Valid Register Ranges Telepace Integer
SCADAPack 4202 or 4203. SolarPack 410 **The ISaGRAF Registers apply only to the SCADAPack 4203 controllers**	40500 to 43179 43800 to 46498	40500 to 43179 43800 to 46499
Micro16 SCADAPack SCADAPack Light SCADAPack Plus SCADAPack LP SCADAPack 100: 1024K	40001 to 43179 43800 to 45498	40001 to 43179 43800 to 45499
SCADAPack 32 SCADAPack 32P SCADAPack 314/330/334 SCADAPack 350	40001 to 43179	40001 to 43179

Destination Format is format of the data in the register. Valid values are Telepace Integer and ISaGRAF Integer. The default value is Telepace integer. A Telepace integer is a 16-bit signed number stored in one register. An ISaGRAF integer is a 32-bit signed value stored in two registers.

Destination Range defines the range of the destination register. The zero scale is the value of the output at its lowest value. The full scale is the value in the register when the input is at its highest value. Valid values are -32768 to 32767 for Telepace Integer format, and –2,147,483,648 to 2,147,483,647 for the ISaGRAF Integer format. The default zero scale is 0. The default full scale is 32767.

The **Source Alarm** section configures alarms for the source register. A high and low alarm can be configured.

Alarm Point is the coil register that will be turned on if an alarm occurs. Valid values are 0 and 00001 to 09999. Enter 0 to disable the alarm. The default value is zero.

Setpoint is the value at which the alarm occurs. The low alarm occurs when the source register is less than the low alarm setpoint. The high alarm occurs when the source register is greater than the high alarm setpoint. Valid values are any floating-point number; Realflo does not check the setpoint values. The control is disabled if the corresponding alarm point is set to 0.

Hysteresis keeps minor changes from causing multiple alarms. The Low Alarm Hysteresis is the amount above the setpoint that the value needs to rise to clear the alarm. The High Alarm Hysteresis is the amount below the setpoint that the value needs to fall to clear the alarm. Valid values are any floating-point number. The control is disabled if the corresponding alarm point is set to 0.

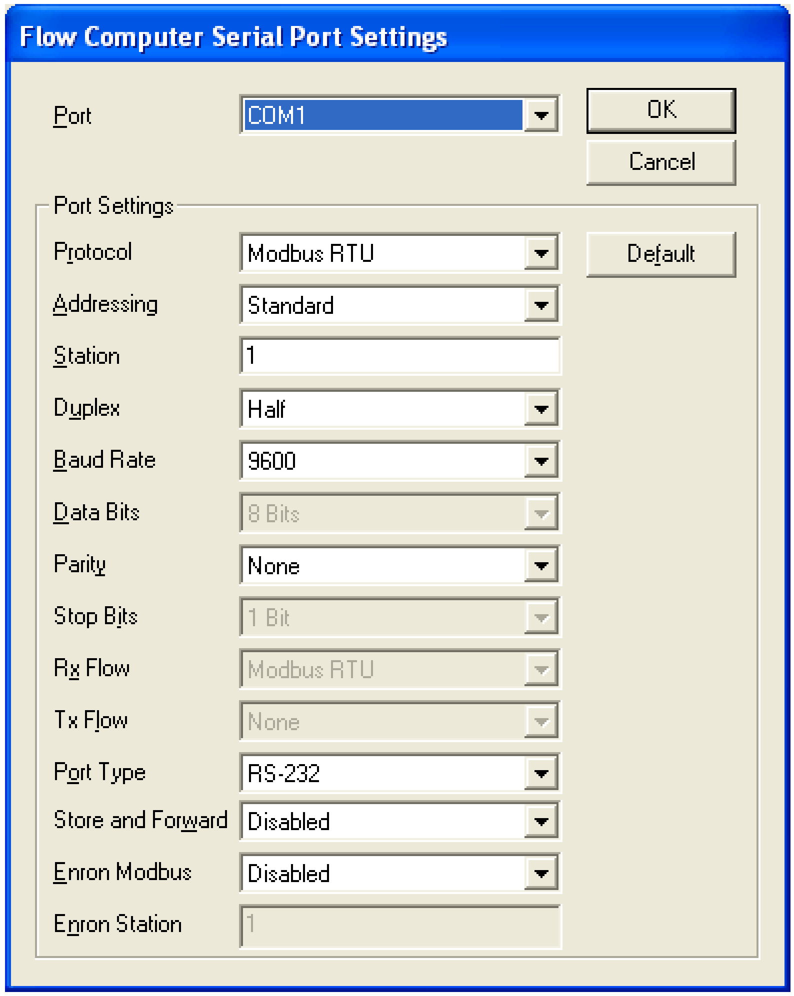
The **OK** button saves the configuration and closes the dialog. All parameters are checked against their limits. The destination registers and alarm points are checked for conflicts with any other input or output points.

The **Cancel** button closes the dialog without saving changes.

Serial Ports

The Serial Ports command configures the serial ports on the flow computer. The command opens the Flow Computer Serial Port Settings dialog.

The SCADAPack 4202 controllers support Sensor protocol only on com1. The serial port settings for com1 cannot be edited. The settings are described in the following sections.



The **Port** dropdown menu selects the controller serial port to configure. The settings for the port are displayed in the Port Settings controls section of the dialog. The valid serial ports depend on the controller type. The default serial port is com1.

Controller Type	com1	com2	com3	com4
Micro16	X	X		
SCADAPack	X	X	X	
SCADAPack Plus	X	X	X	X
SCADAPack Light	X	X		X
SCADAPack LP	X	X	X	
SCADAPack 100	X	X		
SCADAPack 32	X	X	X	X
SCADAPack 32P	X	X		X
SCADAPack 314	X	X		
SCADAPack 330/334	X	X	X	
SCADAPack 350	X	X	X	

Controller Type	com1	com2	com3	com4
SCADAPack 4202 DR	X	X	X	
SCADAPack 4202 DS	X	X	X	
SCADAPack 4203 DR	X	X	X	
SCADAPack 4203 DS	X	X	X	
SolarPack 410	X	X	X	

The **Protocol** dropdown menu selects the communication protocol type. Valid protocols depend on the controller type as shown in the following table.

Controller Type	Valid Protocols	Default Protocol
Micro16 SCADAPack SCADAPack Plus SCADAPack Light SCADAPack LP SCADAPack 100	None Modbus RTU Modbus ASCII DF1 Full Duplex BCC DF1 Full Duplex CRC DF1 Half Duplex BCC DF1 Half Duplex CRC DNP * DF1 protocols are not supported on SCADAPack 100 controllers with firmware older than version 1.80.	Modbus RTU
SCADAPack 32 SCADAPack 32P	None Modbus RTU Modbus ASCII DF1 Full Duplex BCC DF1 Full Duplex CRC DF1 Half Duplex BCC DF1 Half Duplex CRC DNP PPP	Modbus RTU
SCADAPack family of programmable controllers (4202 DR, 4202 DS, 4203 DR and 4203 DS)	Com 1 fixed as Sensor. Com 2 and Com 3: None Modbus RTU Modbus ASCII DF1 Full Duplex BCC DF1 Full Duplex CRC DF1 Half Duplex BCC DF1 Half Duplex CRC DNP	Com 1 fixed as Sensor. Com 2 and Com 3 default is Modbus RTU.
SCADAPack 314/330/334 SCADAPack 350	None Modbus RTU Modbus ASCII DF1 Full Duplex BCC DF1 Full Duplex CRC	Modbus RTU

Controller Type	Valid Protocols	Default Protocol
	DF1 Half Duplex BCC DF1 Half Duplex CRC DNP	
SolarPack 410	Com 1 fixed as Sensor. Com 2 and Com 3: None Modbus RTU Modbus ASCII DF1 Full Duplex BCC DF1 Full Duplex CRC DF1 Half Duplex BCC DF1 Half Duplex CRC DNP	Com 1 fixed as Sensor. Com 2 and Com 3 default is Modbus RTU.

The **Addressing** dropdown menu selects the addressing mode for the selected protocol. The control is disabled if the protocol does not support it. Valid addressing modes depend on the selected protocol as shown in the following table.

Protocol	Valid Mode	Default Mode
Modbus RTU Modbus ASCII	Standard Extended	Standard
DF1 Full Duplex BCC DF1 Full Duplex CRC DF1 Half Duplex BCC DF1 Half Duplex CRC	Control is disabled	N/A
DNP	Control is disabled	N/A
PPP	Control is disabled	N/A
None	Control is disabled	N/A

The **Station** entry sets the station address for the selected controller serial port. Valid addresses depend on the protocol and addressing mode selected, as shown in the table below.

Protocol	Valid Addresses	Default Address
Modbus RTU Modbus ASCII	Standard addressing: 1 to 255 Extended addressing: 1 to 65534	1
DF1 Full Duplex BCC DF1 Full Duplex CRC DF1 Half Duplex BCC DF1 Half Duplex CRC	0 to 254	N/A
DNP	Control is disabled	N/A
PPP	Control is disabled	N/A
None	Control is disabled	N/A

The **Duplex** dropdown menu selects full or half-duplex operation for the selected Port. Valid and default duplex settings depend on the serial port and controller type, as shown in the table below. The duplex is forced to Half if a MVT transmitter is configured on the port.

Controller Type	**com1**		**com2**		**com3**		**com4**	
	Valid	**Def.**	**Valid**	**Def.**	**Valid**	**Def.**	**Valid**	**Def.**
Micro16	Full Half	Full	Full Half	Full				
SCADAPack	Full Half	Full	Full Half	Full	Half	Half		
SCADAPack Plus	Full Half	Full	Full Half	Full	Half	Half	Half	Half
SCADAPack Light	Full Half	Full	Full Half	Full			Half	Half
SCADAPack LP	Half	Half	Full Half	Full	Half	Half		
SCADAPack 100	Full Half	Full	Full Half	Full				
SCADAPack 32	Full Half	Half	Full Half	Half	Half	Half	Full Half	Half
SCADAPack 32P	Full Half	Full	Full Half	Full			Full Half	Full
SCADAPack 4202 DR SCADAPack 4202 DS	Full	Full	Half	Half	Half	Half		
SCADAPack 4203 DR SCADAPack 4203 DS	Half	Half	Full Half	Half	Full Half	Half		
SCADAPack 314	Full Half	Half	Full Half	Half				
SCADAPack 330/334	Full Half	Half	Full Half	Half	Half Full	Full		
SCADAPack 350	Half	Half	Full Half	Half	Half Full	Full		
SolarPack 410	Half	Half	Full Half	Half	Full	Full		

The **Baud Rate** dropdown menu selects the communication speed for the selected serial port. Valid baud rates depend on the serial port and controller type, as shown in the table below. The default value is always 9600 baud.

Baud Rate / **Controller**	**300**	**600**	**1200**	**2400**	**4800**	**9600**	**19200**	**38400**	**57600**	**115200**
Micro 16										
Com 1, Com 2	X	X	X	X	X	X	X	X		
SCADAPack										
Com 1, Com 2	X	X	X	X	X	X	X	X		

Baud Rate Controller	300	600	1200	2400	4800	9600	19200	38400	57600	115200
Com 3			X	X	X	X	X	X	X	X
SCADAPack Plus										
Com 1, Com 2	X	X	X	X	X	X	X	X		
Com 3, Com 4			X	X	X	X	X	X	X	X
SCADAPack Light										
Com 1, Com 2	X	X	X	X	X	X	X	X		
Com 4			X	X	X	X	X	X	X	X
SCADAPack LP										
Com 1, Com 2	X	X	X	X	X	X	X	X		
Com 3			X	X	X	X	X	X	X	X
SCADAPack 100: 1024K										
Com 1, Com 2	X	X	X	X	X	X	X	X		
SCADAPack32										
Com 1, Com 2, Com 4	X	X	X	X	X	X	X	X	X	X
Com 3			X	X	X	X	X	X	X	X
SCADAPack32P										
Com 1, Com 2, Com 4	X	X	X	X	X	X	X	X	X	X
SCADAPack 314										
Com 1 and Com 2	X	X	X	X	X	X	X	X	X	X
SCADAPack 330/334										
Com 1, Com 2, Com 3	X	X	X	X	X	X	X	X	X	X
SCADAPack 350										
Com 1, Com2, Com3	X	X	X	X	X	X	X	X	X	X
SCADAPack of Programmable Controllers										
Com1					X					

Baud Rate **Controller**	**300**	**600**	**1200**	**2400**	**4800**	**9600**	**19200**	**38400**	**57600**	**115200**
Com2	X	X	X	X	X	X	X	X		
Com3			X	X	X	X	X	X	X	X
SolarPack 410										
Com1 (disabled)							X			
Com2	X	X	X	X	X	X	X	X	X	X
Com3										X

The **Data Bits** dropdown menu selects the number of data bits. Valid selections are 7 and 8 bits. This parameter is forced to 8 bits when the protocol type is Modbus RTU, PPP or any DF1 protocol. The default selection is 8 bits.

The **Parity** dropdown menu selects the parity for the selected port. Valid selections depend on the serial port, controller type and data bits, as shown in the table below. The default selection is none.

Controller Type	**com1**	**com2**	**com3**		**com4**	
			7 bits	**8 bits**	**7 bits**	**8 bits**
Micro16	None even odd	none even odd	N/A		N/A	
SCADAPack	None even odd	none even odd	even odd space mark	none even odd mark	N/A	
SCADAPack Plus	None even odd	none even odd	even odd space mark	none even odd mark	even odd space mark	none even odd mark
SCADAPack Light	none even odd	none even odd	N/A		even odd space mark	none even odd mark
SCADAPack LP	none even odd	none even odd	even odd space mark	none even odd mark	N/A	

Controller Type	com1	com2	com3		com4	
			7 bits	8 bits	7 bits	8 bits
SCADAPack 100	none even odd	none even odd				
SCADAPack 32	none even odd	none even odd	even odd space mark	none even odd mark	none even odd	
SCADAPack 32P	none even odd	none even odd	N/A		none even odd	
SCADAPack 4202 DR SCADAPack 4202 DS	none	none even odd	none even odd mark		N/A	
SCADAPack 4203 DR SCADAPack 4203 DS	none	none even odd	none even odd		N/A	
SCADAPack 314	none even odd	none even odd	N/A		N/A	
SCADAPack 330/334 SCADAPack 350	none even odd	none even odd	none even odd		N/A	
SolarPack 410	none	none even odd	none		N/A	

The **Stop Bits** dropdown menu selects the number of stop bits for the selected serial port. Valid selections are 1 and 2. Valid selection for com3 is 1 stop bit. The default selection is 1.

The **Rx Flow** dropdown menu selects the receiver flow control for the selected port. Valid selections depend on the protocol, controller type, and serial port, as shown in the table below. If there is only one valid value the control is disabled. If there is more than one possible value, the default selection is none.

Protocol	Controller	com1	com2	com3	com4
DF1 Full BCC DF1 Full CRC DF1 Half BCC DF1 Half CRC DNP	Micro16	None	None	N/A	N/A
	SP	None	None	None	N/A
	SP Plus	None	None	None	None
	SP Light	None	None	N/A	None
	SP LP	None	None	None	N/A
	SP 100	None	None	N/A	N/A
	SP 32	None	None	None	None

Protocol	Controller	com1	com2	com3	com4
	SP 32P	None	None	None	None
	SCADAPack 4202 DR SCADAPack 4202 DS	None	None	None Ignore CTS	N/A
	SCADAPack 4203 DR SCADAPack 4203 DS	None	None	None	N/A
	SCADAPack 314/330/334 SCADAPack 350	None	None	None	N/A
	SolarPack 410	None	None	None	N/A
Modbus RTU	Micro16	None	None	N/A	N/A
	SP	None	None	Modbus RTU	N/A
	SP Plus	None	None	Modbus RTU	Modbus RTU
	SP Light	None	None	N/A	Modbus RTU
	SP LP	None	None	Modbus RTU	N/A
	SP 100	None	None	N/A	N/A
	SP 32	Modbus RTU	Modbus RTU	Modbus RTU	Modbus RTU
	SP 32P	Modbus RTU	Modbus RTU	Modbus RTU	Modbus RTU
	SCADAPack 4202 DR SCADAPack 4202 DS	None	None	None Ignore CTS	N/A
	SCADAPack 4203 DR SCADAPack 4203 DS	None	None	None	N/A
	SCADAPack 330/334 SCADAPack 350	None	None	None	N/A
	SCADAPack 314	None	None	N/A	N/A
	SCADAPack 330/334 SCADAPack 350	None	None	None	N/A
	SolarPack 410	None	None	None	N/A

Protocol	Controller	com1	com2	com3	com4
None Modbus ASCII	Micro16	None Xon/Xoff	None Xon/Xoff	N/A	N/A
	SP	None Xon/Xoff	None Xon/Xoff	none	N/A
	SP Plus	None Xon/Xoff	None Xon/Xoff	none	none
	SP Light	None Xon/Xoff	None Xon/Xoff	N/A	none
	SP LP	None Xon/Xoff	None Xon/Xoff	none	N/A
	SP 100	None Xon/Xoff	None Xon/Xoff	N/A	N/A
	SP 32	none Modbus RTU	none Modbus RTU	none Modbus RTU	none Modbus RTU
	SP 32P	none Modbus RTU	none Modbus RTU	none Modbus RTU	none Modbus RTU
	SCADAPack 4202 DR SCADAPack 4202 DS	None	None	None Modbus RTU	N/A
	SCADAPack 4203 DR SCADAPack 4203 DS	None	None	None	N/A
	SCADAPack 330/334 SCADAPack 350	None	None	None	N/A
	SCOLARPack 410	None	None	N/A	N/A
	SCADAPack 314	None	None	N/A	N/A
	SCADAPack 330/334 SCADAPack 350	None	None	None	N/A
	SolarPack 410	None	None	None	N/A

Protocol	Controller	com1	com2	com3	com4
PPP	SP 32	Queue d	Queu ed	Queued	Queued
	SP 32P	Queue d	Queu ed	Queued	Queued

The **Tx Flow** dropdown menu selects the transmitter flow control for the selected port. Valid selections depend on the protocol, controller type, and serial port, as shown in the table below. The default selection is none.

Protocol	Controller	com1	com2	com3	com4
Modbus RTU DF1 Full BCC DF1 Full CRC DF1 Half BCC DF1 Half CRC DNP	Micro16	None	None	N/A	N/A
	SP	None	None	None Ignore CTS	N/A
	SP Plus	None	None	None Ignore CTS	None Ignore CTS
	SP Light	None	None	N/A	None Ignore CTS
	SP LP	None	None	None Ignore CTS	N/A
	SP 100	None	None	N/A	N/A
	SP 32	None Ignore CTS	None Ignore CTS	None Ignore CTS	None Ignore CTS
	SP 32P	None Ignore CTS	None Ignore CTS	N/A	None Ignore CTS
	SCADAPack 4202 DR SCADAPack 4202 DS	None	None	None Ignore CTS	N/A
	SCADAPack 4203 DR SCADAPack 4203 DS	None	None	None	N/A
	SCADAPack 314	None	None	N/A	N/A
	SCADAPack 330/334 SCADAPack 350	None	None	None	N/A
	SolarPack 410	None	None	None	N/A
None Modbus ASCII	Micro16	None Xon/Xo ff	None Xon/X off	N/A	N/A

Protocol	Controller	com1	com2	com3	com4
	SP	None Xon/Xoff	None Xon/Xoff	None Ignore CTS	N/A
	SP Plus	None Xon/Xoff	None Xon/Xoff	None Ignore CTS	None Ignore CTS
	SP Light	None Xon/Xoff	None Xon/Xoff	N/A	None Ignore CTS
	SP LP	None Xon/Xoff	None Xon/Xoff	None Ignore CTS	N/A
	SP 100	None Xon/Xoff	None Xon/Xoff	N/A	N/A
	SP 32	None Ignore CTS	None Ignore CTS	None Ignore CTS	None Ignore CTS
	SP 32P	None Ignore CTS	None Ignore CTS	N/A	None Ignore CTS
	SCADAPack 4202 DR SCADAPack 4202 DS	N/A	None	None Ignore CTS	N/A
	SCADAPack 4203 DR SCADAPack 4203 DS	N/A	None	None	N/A
	SCADAPack 314	None	None	N/A	N/A
	SCADAPack 330/334 SCADAPack 350	None	None	None	N/A
	SolarPack 410	None	None	None	N/A
PPP	SP 32	None Ignore CTS	None Ignore CTS	None Ignore CTS	None Ignore CTS
	SP 32P	None Ignore CTS	None Ignore CTS	None Ignore CTS	None Ignore CTS

The **Port Type** dropdown menu selects the type of serial port. Valid selections depend on the serial port and controller type as shown in the table below. The default selection is RS-232. The options are as follows:

- RS-232: for a regular RS-232 connection.
- RS-232 Dial-up modem: If an external dial-up modem is used on the RS-232 connection.

- **RS-232 Collision Avoidance**: RS-232 connection with collision avoidance based on the CD signal is available only when the DNP protocol type is selected on the serial port, and the serial port supports handshaking.
- When this flow control is enabled, the protocol uses the Carrier Detect (CD) signal provided by the serial port to detect if the communication medium is in use. If it is, it waits until the medium is free before transmitting.
- Prior to transmitting each Data Link (DL) frame, the controller will test the CD line. If it is active, a countdown equal to the DL timeout will be set and CD will be monitored every 100 ms throughout this countdown period. If the Data Link timeout is set to the minimum of 100 ms, the CD line will be tested once.
- If the CD line reports inactive (line not in use), a frame will be transmitted immediately, and a new DL timeout is started as normal. On the other hand, if CD remains active during the DL timeout, the transmission attempt will be unsuccessful. If a non-zero retry is configured in the Data Link layer, the test will be repeated until the number of retries has been exhausted.

RS-232 Collision Avoidance is supported only on serial ports which support handshaking and whose protocol type is set for DNP.

- RS-485: for a regular RS-485 connection.

Controller Type	com1	com2, com4	com3
Micro16 SCADAPack SCADAPack Plus SCADAPack Light	RS-232 RS-232 dial-up modem RS-232 Collision Avoidance RS-485	RS-232 RS-232 dial-up modem RS-232 Collision Avoidance com4 is available on the SCADAPack Light and Plus only.	RS-232 RS-232 dial-up modem
SCADAPack 32 SCADAPack 32P	RS-232 RS-232 dial-up modem RS-232 Collision Avoidance Port type RS-232 applies for RS-232 or RS-485 operation on COM1.	RS-232 RS-232 dial-up modem RS-232 Collision Avoidance	RS-232 RS-232 dial-up modem

Controller Type	com1	com2, com4	com3
	Jumper J9 on the controller board needs to be installed to configure COM1 for RS-485 operation.		

Controller Type	com1	com2, com3
SCADAPack Programmable Controllers (4202 DR, 4202 DS, 4203 DR and 4203 DS).	N/A (RS-232)	RS-232 RS-232 Dialup Up Modem (com 2 only) RS-232 Port Type applies for RS-232 or RS-485 operation.
SCADAPack 100	RS-232 RS-232 Collision Avoidance Port type RS-232 applies for RS-232 or RS-485 operation on Com 1.	RS-232 RS-232 dial-up modem RS-232 Collision Avoidance Com 3: not available
SCADAPack LP	RS-485	RS-232 RS-232 dial-up modem RS-232 Collision Avoidance
SCADAPack 314	RS-232 RS-232 dial-up modem RS-232 Collision Avoidance RS-485 Port type RS-232 applies for RS-232 or RS-485 operation on COM1. Jumper J8 on the controller board needs to be installed to configure COM1 for RS-485 operation.	RS-232 RS-232 dial-up modem RS-232 Collision Avoidance Port type RS-232 applies for RS-232 or RS-485 operation on COM2. Jumper J10 on the controller board needs to be installed to configure COM2 for RS-485 operation.

Controller Type	com1	com2, com3
SCADAPack 330/334	RS-232 RS-232 dial-up modem RS-232 Collision Avoidance RS-485 Port type RS-232 applies for RS-232 or RS-485 operation on COM1. Jumper J8 on the controller board needs to be installed to configure COM1 for RS-485 operation.	RS-232 RS-232 dial-up modem RS-232 Collision Avoidance Port type RS-232 applies for RS-232 or RS-485 operation on COM2. Jumper J10 on the controller board needs to be installed to configure COM2 for RS-485 operation.
SCADAPack 350	RS-485	RS-232 RS-232 dial-up modem RS-232 Collision Avoidance Port type RS-232 applies for RS-232 or RS-485 operation on COM2. Jumper J13 on the controller board needs to be installed to configure COM2 for RS-485 operation.
SolarPack 410	RS-232	RS-232

The **Store and Forward** dropdown menu selects whether store and forward messaging is enabled for the port. Valid selections are enabled and disabled. If this option is enabled, messages will be forwarded according to the settings in the store and forward routing table. The default selection is disabled. This control is disabled when PPP protocol is selected for a serial port, or if any of the DF1 protocols are selected and for com 1 on the SCADAPack 4202 or 4203 of controllers.

The **Store and Forward** menu selection changes to **Routing** menu selection when DNP protocol is selected for a serial port. Valid selections are enabled and disabled. Routing needs to be enabled on a serial port to enable routing of DNP messages.

The **Enron Modbus or PEMEX Modbus** dropdown menu lets you enable or disable Enron Modbus or PEMEX Modbus for the port. If this option is enabled, the controller, in addition to regular Modbus messages, will handle Enron Modbus or PEMEX Modbus messages. Valid selections depend on the protocol as shown in the table below. This control is disabled when PPP protocol is selected for a serial port and for com 1 on the 4202 controllers.

Protocol	Valid Selections	Default Selection
Modbus RTU Modbus ASCII	Enabled Disabled	Disabled

Protocol	Valid Selections	Default Selection
DF1 Full Duplex BCC DF1 Full Duplex CRC DF1 Half Duplex BCC DF1 Half Duplex CRC	Control is disabled	N/A
DNP	Control is disabled	N/A
None	Control is disabled	N/A

The **Enron Station** or **PEMEX Station** entry selects the Enron Modbus or PEMEX Modbus station address for the serial port. Valid entries depend on the protocol. The station needs to be different from the Modbus station set in the **Station** control. This allows Enron Modbus or PEMEX Modbus and Modbus communication can occur on the same port. This entry is greyed out if Enron Modbus or PEMEX Modbus is not enabled.

Protocol	Valid Values	Default Value
Modbus RTU Modbus ASCII	Standard addressing: 1 to 255 Extended addressing: 1 to 65534	2
DF1 Full Duplex BCC DF1 Full Duplex CRC DF1 Half Duplex BCC DF1 Half Duplex CRC	Control is disabled	N/A
DNP	Control is disabled	N/A
None	Control is disabled	N/A

The **OK** button saves the settings for all serial ports and closes the dialog. In PEMEX mode the OK button is not active if the user is not logged on with Administrator privileges.

The **Cancel** button closes the dialog without saving.

The **Default** button sets the parameters for the port to their default values.

IP Command

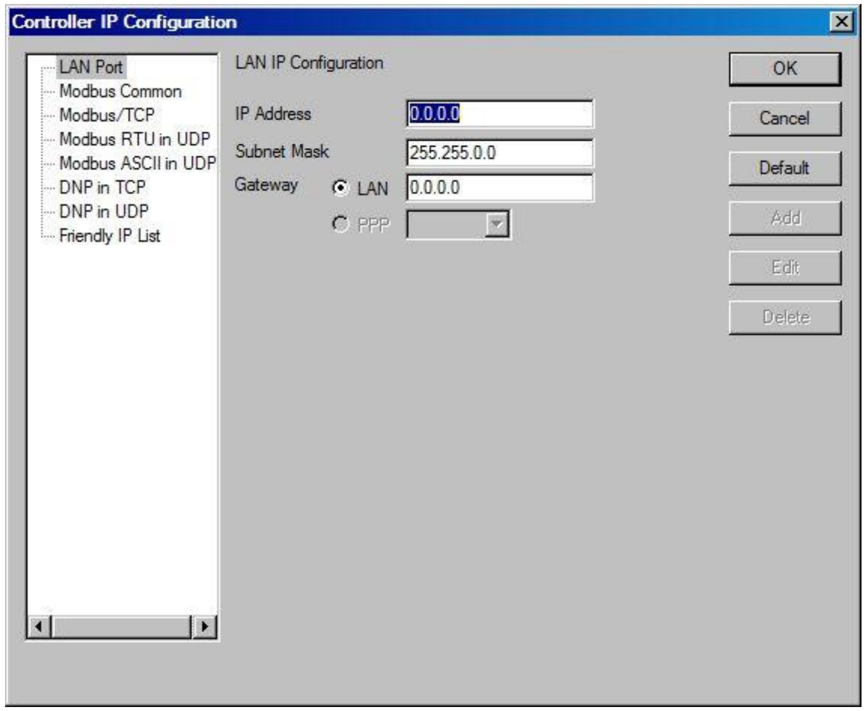
When the IP Configuration menu item is clicked under the Controller menu the IP Configuration dialog is opened. This dialog is available only when the controller type is set to SCADAPack 314/330/334, SCADAPack 350, SCADAPack 32 or SCADAPack 32P.

The IP Configuration dialog has a tree control on the left side of the window. Headings on the tree control are enabled or disabled depending on the controller type.

- The SCADAPack 32 and SCADAPack 32P support Point-To-Point Protocol (PPP) on the serial ports. The tree control displays headings for com 1 Port through com 4 Port and PPP Login are displayed for configuring the serial ports for PPP. PPP is not supported on SCADAPack 314/330/334 and SCADAPack 350 the headings for com 1 Port through com 4 Port and PPP Login are not displayed.
- The SCADAPack 314/330/334 and SCADAPack 350 support an FTP (File Transfer Protocol) server. The tree control will display a heading for

FTP when these controllers are used. FTP is not supported on SCADAPack 32 and SCADAPack 32P.

Each of the tree control selections is explained in the following sections of this user manual.



The IP Configuration dialog has a tree control on the left side of the window. This tree control contains headings for:

- LAN Port
- Modbus Common
- Modbus/TCP
- Modbus RTU in UDP
- Modbus ASCII in UDP
- DNP in TCP
- DNP in UDP
- Friendly IP List

When a tree control is selected by clicking the mouse on a heading, a property page is opened for the header selected. From the property page the IP configuration parameters for the selected header is displayed.

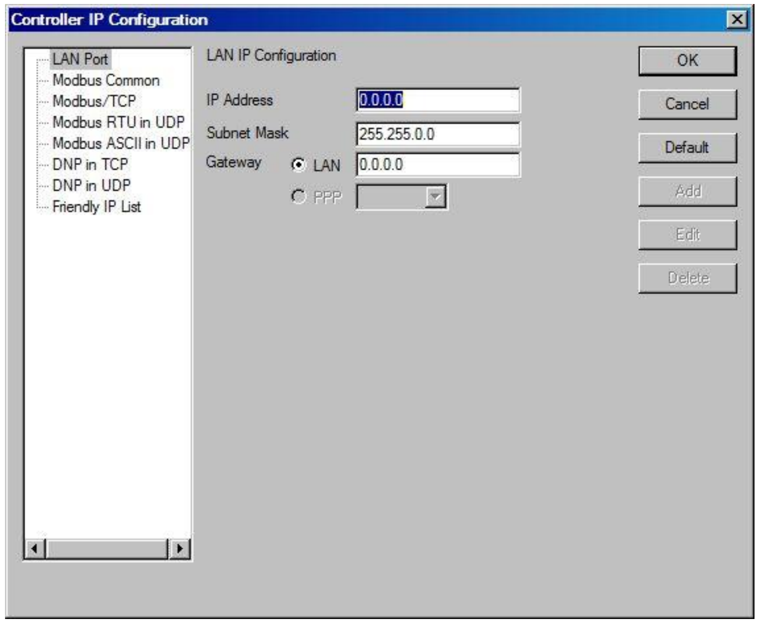
The **Default** button selects the default values for the current property page.

The **OK** button saves the configuration and closes the Controller IP Configuration dialog. In PEMEX mode, the OK button is not active if the user is not logged on with Administrator privileges.

The **Cancel** button closes the Controller IP Configuration dialog without saving any changes.

LAN Port

The LAN Port property page is selected for editing by clicking LAN Port in the tree control section of the **Controller IP Configuration** dialog. When selected the LAN Port property page is active.



The **IP Address** is the address of the controller LAN port. The IP address is statically assigned. Contact your network administrator to obtain an IP address for the controller. The default value is 0.0.0.0.

The **Subnet Mask** is determines the subnet on which the controller LAN port is located. The subnet mask is statically assigned. Contact your network administrator to obtain the subnet mask for the controller. The default value is 255.255.255.0.

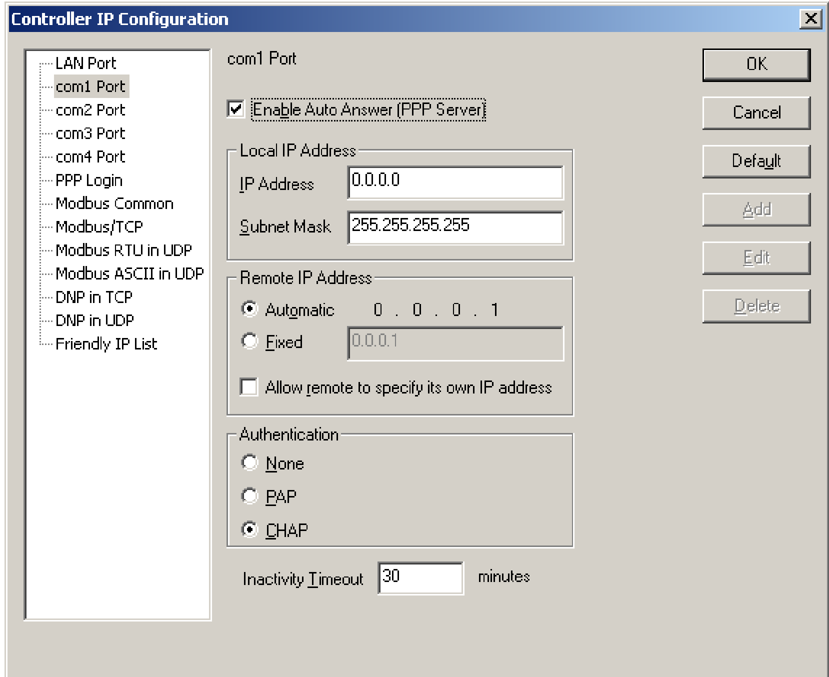
The **Gateway** determines how your controller communicates with devices outside its subnet. The **LAN** radio button selects the gateway specified in the **LAN** edit box. Enter the IP address of the gateway. The gateway is located on the LAN port subnet. The gateway is statically assigned. Contact your network administrator to obtain the gateway IP address. The default value is 0.0.0.0.

The **PPP** radio button selects the serial port where the gateway is located. The **PPP** dropdown menu displays only those serial ports currently configured for the PPP protocol. Select a serial port from this menu to select its remote IP address as the gateway. The gateway is automatically assigned to the remote IP address of the selected serial port.

SCADAPack 32 or SCADAPack 32P PPP Controls

com1 Port

The com1 Port property page is selected for editing by clicking com1 Port in the tree control section of the Controller IP Configuration dialog. When selected, the com1 Port property page is active. This page configures the IP settings for com1 when the PPP protocol is selected for this serial port.



The **Enable Auto Answer (PPP Server)** checkbox enables the PPP Server on this serial port. Check this box if you want to allow a remote PPP client to connect to this port. This checkbox enables the remaining settings in the page.

The **IP Address** is the address of this serial port. The IP address is statically assigned. Contact your network administrator to obtain an IP address for this serial port.

The **Subnet Mask** determines the subnet on which this serial port is located. The subnet mask is statically assigned. Contact your network administrator to obtain the subnet mask for this serial port. In a standard PPP configuration, a subnet mask of 255.255.255.255 is used to restrict routing on this serial port to a single host (i.e. the **Remote IP Address**).

If another subnet mask is used, packets on that subnet will be forwarded to this serial port. Any address on that subnet in addition to the **Remote IP Address** can be used for the remote host in this case.

The **Remote IP Address** is the address that will be assigned to the remote PPP client connected to this serial port. The **Automatic** radio button automatically selects the address to be the serial port's IP address + 1. The second radio button selects the address specified in the edit box. Enter the IP address to assign to the remote client.

The **Allow remote to specify its own IP address** checkbox allows the remote PPP client to assign its own IP address. Check this box if you want to allow this option. The client may or may not request its own IP address. If the client does not make this request, the PPP Server will assign the IP address selected.

The **Authentication** determines the login protocol used at the start of every PPP connection. The **None** radio button removes the login step. The **PAP** radio button selects the Password Authentication Protocol (PAP). The **CHAP** radio button selects the Challenge-Handshake Authentication

Protocol (CHAP). PAP and CHAP usernames and passwords are configured on the **PPP Login** page.

The **Inactivity Timeout** is the inactivity timeout for this serial port. If there has been no activity on an existing PPP connection for the selected number of minutes, then the connection is automatically closed. If there is a modem connected it is hung up. Setting this value to zero disables the timeout.

com2 Port

The com2 Port property page is selected for editing by clicking com2 Port in the tree control section of the IP Configuration dialog. When selected the com2 Port property page is active. This page configures the IP settings for com2 when the PPP protocol is selected for this serial port.

The com2 Port property page provides the same options as the com1 Port page. See the com1 Port page for a description of these options.

com3 Port

The com3 Port property page is selected for editing by clicking com3 Port in the tree control section of the IP Configuration dialog. When selected the com3 Port property page is active. This page configures the IP settings for com3 when the PPP protocol is selected for this serial port.

The com3 Port property page provides the same options as the com1 Port page. See the com1 Port page for a description of these options.

com4 Port

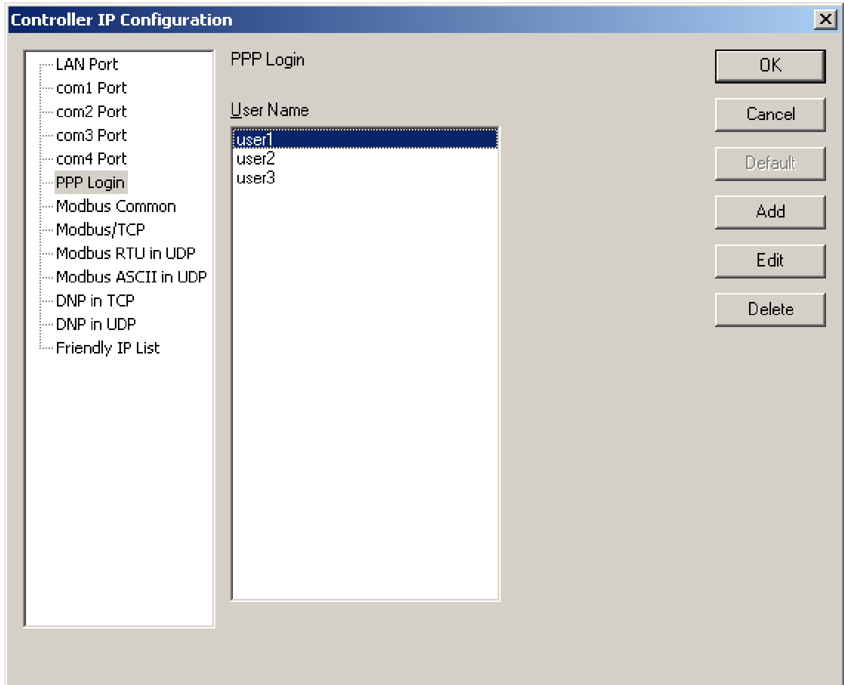
The com4 Port property page is selected for editing by clicking com4 Port in the tree control section of the IP Configuration dialog. When selected the com4 Port property page is active. This page configures the IP settings for com4 when the PPP protocol is selected for this serial port.

The com4 Port property page provides the same options as the com1 Port page. See the com1 Port page for a description of these options.

PPP Login

The PPP Login property page is selected for editing by clicking PPP Login in the tree control section of the IP Configuration dialog. When selected the PPP Login property page is active.

This page configures the username and password list for PPP login authentication. The list is used only by those serial ports configured for the PPP protocol using PAP or CHAP authentication.



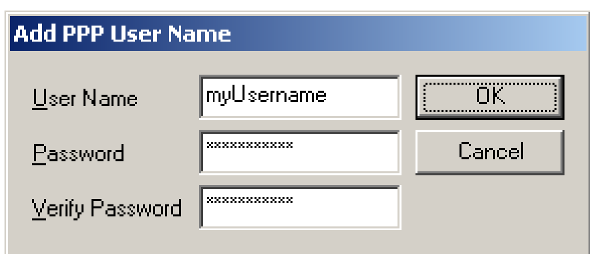
Select the **Add** button to enter a new username to the list. Selecting the Add button opens the **Add PPP Username** dialog.

Select the **Edit** button to edit the username highlighted in the list. Selecting the Edit button opens the **Edit PPP Username** dialog. This button is disabled if there are no entries in the list.

The **Delete** button removes the selected usernames from the list. This button is disabled if there are no entries in the list.

Add PPP Username dialog

This dialog selects a new PPP username and password.



The **Username** edit box selects the username. A username is any alphanumeric string 1 to 16 characters in length, and is case sensitive.

The **Password** edit box selects the password. A password is any alphanumeric string 1 to 16 characters in length, and is case sensitive.

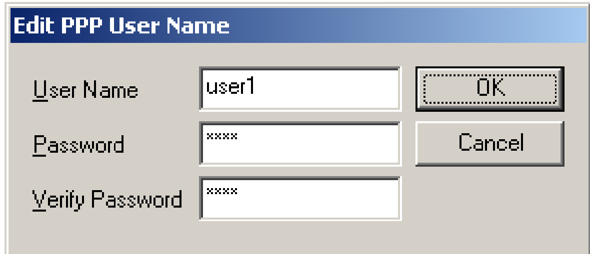
The **Verify Password** edit box selects the verify password. Enter the same string entered for the password.

The **Cancel** button discards any changes made to this dialog and exits the dialog.

The **OK** button to accept changes made to this dialog and exits the dialog.

Edit PPP Username dialog

This dialog edits a PPP username and password selected from the list.



The **Username** edit box selects the username. A username is any alphanumeric string 1 to 16 characters in length, and is case sensitive.

The **Password** edit box selects the password. A password is any alphanumeric string 1 to 16 characters in length, and is case sensitive.

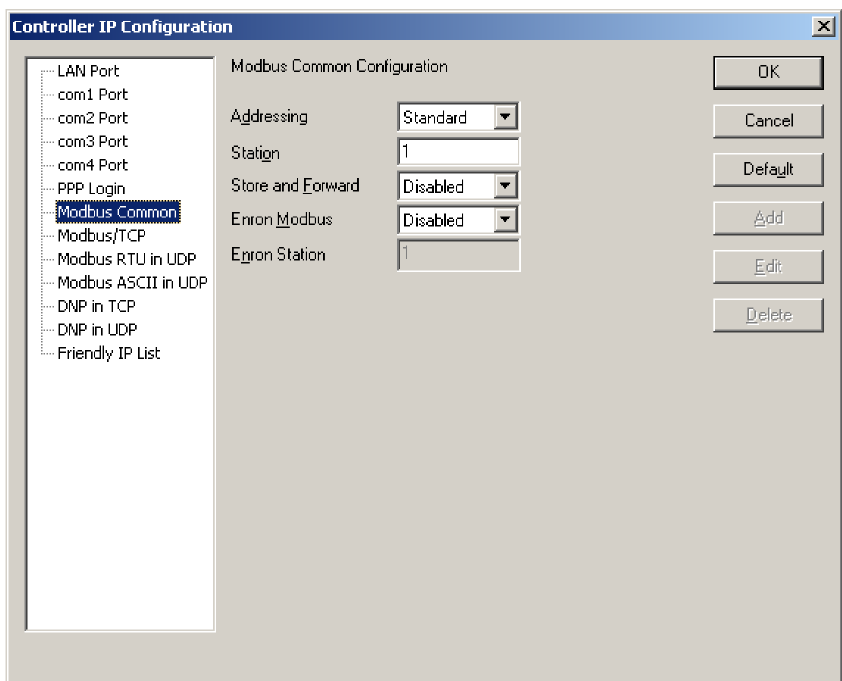
The **Verify Password** edit box selects the verify password. Enter the same string entered for the password.

The **Cancel** button discards any changes made to this dialog and exits the dialog.

The **OK** button to accept changes made to this dialog and exits the dialog.

Modbus Common

The **Modbus Common** property page is selected for editing by clicking Modbus Common in the tree control section of the **IP Configuration** dialog. When selected the **Modbus Common** property page is active.



The **Addressing** menu selects standard or extended Modbus addressing. Standard addressing allows 255 stations and is compatible with standard Modbus devices. Extended addressing allows 65534 stations, with stations 1 to 254 compatible with standard Modbus devices. The default value is standard.

The **Station** menu sets the station number of the controller. The valid range is 1 to 255 if standard addressing is used, and 1 to 65534 if extended addressing is used. The default value is 1.

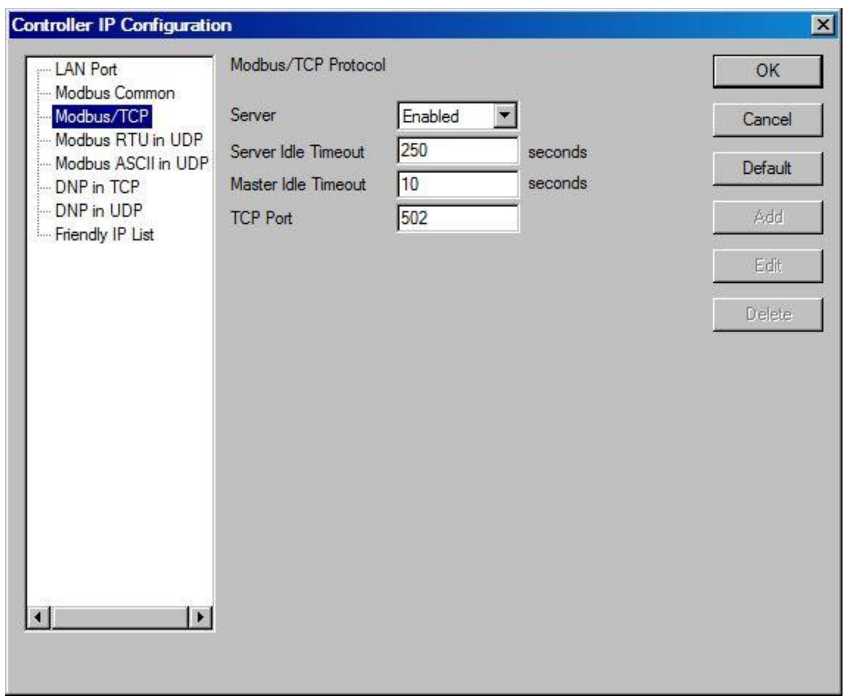
The **Store and Forward** selection controls forwarding of messages using IP based protocols. If this option is enabled, messages will be forwarded according to the settings in the store and forward routing table. The default value is disabled.

The **Enron Modbus** box selects whether or not Enron Modbus is enabled for the port. If this option is enabled, the controller, in addition to regular Modbus messages, will handle Enron Modbus messages.

The **Enron Station** box selects the Enron Modbus station address. The valid range for Enron Station is 1 to 255 if the Addressing control is set to Standard. The valid range for Enron Station is 1 to 65534 if the Addressing control is set to Extended. The Enron station needs to be different from the Modbus station set in the **Station** edit box. This allows Enron Modbus and Modbus communication to occur on the same port.

Modbus/TCP

The Modbus/TCP property page is selected for editing by clicking Modbus/TCP in the tree control section of the IP Configuration dialog. When selected the Modbus/TCP property page is active.



The **Server** selection selects whether the server is enabled. If this option is enabled the controller supports incoming slave messages. Disabling this option stops the controller from processing slave messages. Master messaging is always enabled.

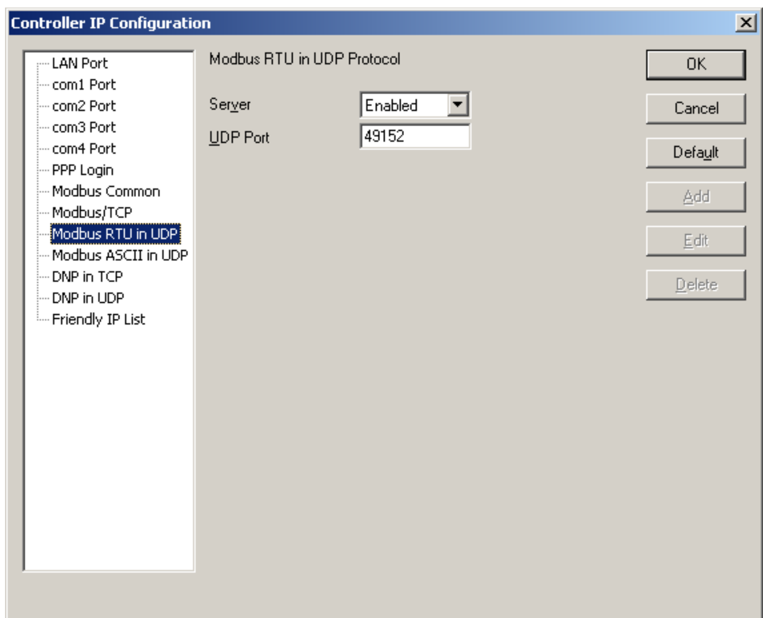
The **Master Idle Timeout** determines when connections to a slave controller are closed. Setting this value to zero disables the timeout; the connection will be closed only when your program closes it. Any other value sets the timeout in seconds. The connection will be closed if no messages are sent in that time. This allows the slave device to free unused connections. Valid timeout range is 0 to 4294967295 seconds. The default value is 10 seconds.

The **Server Idle Timeout** determines when connections from a remote device are closed. Setting this value to zero disables the timeout; the connection will be closed only when the remote device closes it. Any other value sets the timeout in seconds. The connection will be closed if no messages are received in that time. This allows the controller to free unused connections. Valid timeout range is 0 to 4294967295 seconds. The default value is 250 seconds.

The **TCP Port** sets the port used by the Modbus/TCP protocol. In all cases this should be set to 502. This is the well-known port number for Modbus/TCP. Modbus/TCP devices use 502 by default, and on many devices the value cannot be changed. It is suggested that you change this value only if this port is used by another service on your network. Valid port number range is 1 to 65534. Consult your network administrator to obtain a port if you are not using the default.

Modbus RTU in UDP

The Modbus RTU in UDP property page is selected for editing by clicking Modbus RTU in UDP in the tree control section of the IP Configuration dialog. When selected the Modbus RTU in UDP property page is active.

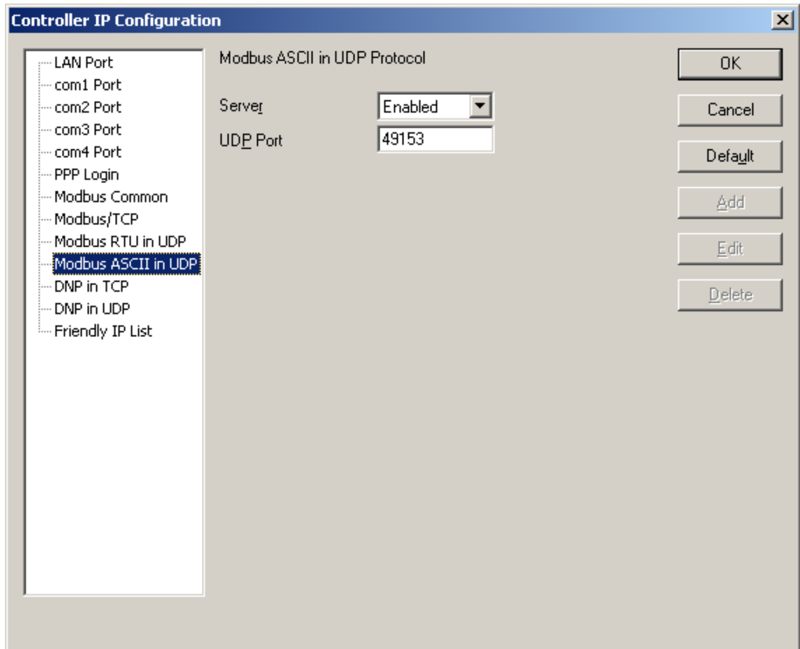


The **Server** selection selects whether the server is enabled. If this option is enabled the controller supports incoming slave messages. Disabling this option keeps the controller from processing slave messages. Master messaging is always enabled.

The **UDP Port** sets the port used by the protocol. Valid port number range is 1 to 65535. The default value is 49152. This is a recommendation only. Consult your network administrator to obtain a port if you are not using the default.

Modbus ASCII in UDP

The Modbus ASCII in UDP property page is selected for editing by clicking Modbus ASCII in UDP in the tree control section of the IP Configuration dialog. When selected the Modbus ASCII in UDP property page is active.

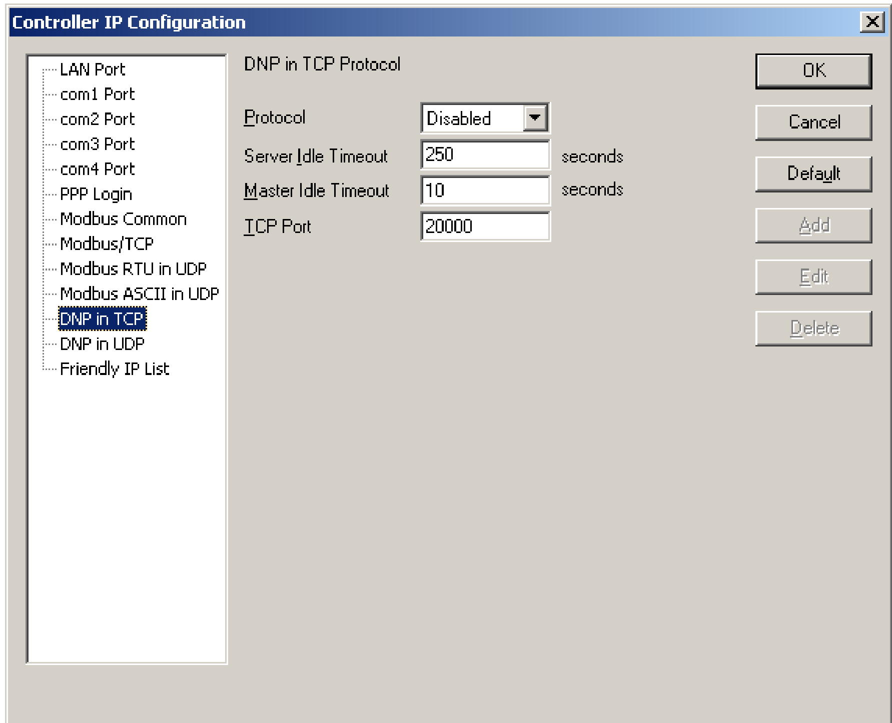


The **Server** selection selects whether the server is enabled. If this option is enabled the controller supports incoming slave messages. Disabling this option keeps the controller from processing slave messages. Master messaging is always enabled.

The **UDP Port** sets the port used by the protocol. Valid port number range is 1 to 65534. The default value is 49153. This is a recommendation only. Consult your network administrator to obtain a port if you are not using the default.

DNP in TCP

The DNP in TCP property page is selected for editing by DNP in TCP in the tree control section of the IP Configuration dialog. When selected the DNP in TCP property page is active.



The **Protocol** selection selects whether the DNP in TCP protocol is enabled. If this option is enabled the controller supports DNP in TCP protocol. Disabling this option keeps the controller from processing DNP in TCP protocol messages. Master messaging is always enabled. The default selection is disabled.

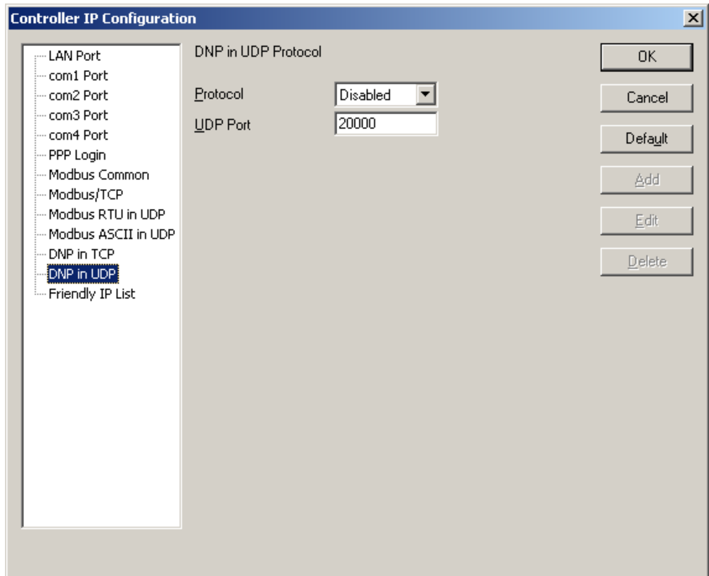
The **Server Idle Timeout** determines when connections from a remote device are closed. Setting this value to zero disables the timeout; the connection will be closed only when the remote device closes it. Any other value sets the timeout in seconds. The connection will be closed if no messages are received in that time. This allows the controller to free unused connections. Valid timeout range is 0 to 4294967295 seconds. The default value is 250 seconds.

The **Master Idle Timeout** determines when connections to a slave controller are closed. Setting this value to zero disables the timeout; the connection will be closed only when your program closes it. Any other value sets the timeout in seconds. The connection will be closed if no messages are sent in that time. This allows the slave device to free unused connections. Valid timeout range is 0 to 4294967295 seconds. The default value is 10 seconds.

The **TCP Port** sets the port used by the DNP in TCP protocol. Valid port number range is 1 to 65534. The default value is 20000. Consult your network administrator to obtain a port if you are not using the default.

DNP in UDP

The DNP in UDP property page is selected for editing by DNP in UDP in the tree control section of the IP Configuration dialog. When selected the DNP in UDP property page is active.

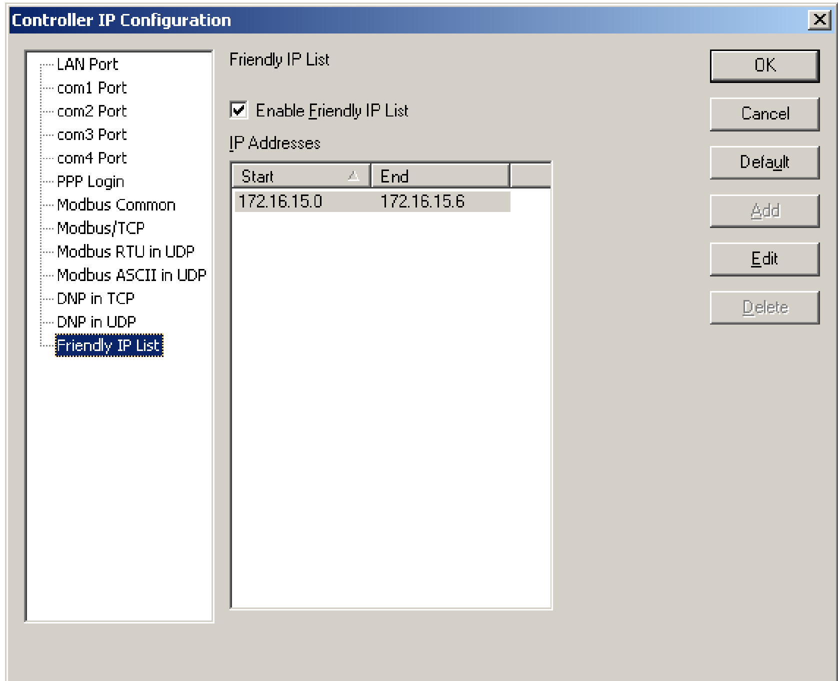


The **Protocol** selection selects whether the DNP in UDP protocol is enabled. If this option is enabled the controller supports DNP in UDP protocol. Disabling this option keeps the controller from processing DNP in UDP protocol messages and sending DNP in UDP master messages. The default selection is disabled.

The **UDP Port** sets the port used by the DNP in UDP protocol. Valid port number range is 1 to 65534. The default value is 20000. Consult your network administrator to obtain a port if you are not using the default.

Friendly IP List

The Friendly IP property page is selected for editing by Friendly IP in the tree control section of the IP Configuration dialog.



The **Enable Friendly IP List** checkbox enables or disables the friendly IP list. Check this box to accept messages from only the IP addresses in the list. Uncheck this to accept message from any IP address.

Select the **Add** button to enter a new row in the Friendly IP list. Selecting the Add button opens the **Add Friendly IP address** dialog. The button is disabled if the **Enable Friendly IP List** control is not checked. The button is disabled if the table is full. Up to 32 entries can be added to the table.

Select the **Edit** button to edit range in the Friendly IP list. Selecting the Edit button opens the **Edit Friendly IP address** dialog. The button is disabled if the **Enable Friendly IP List** control is not checked.

The **Delete** button removes the selected rows from the list. This button is disabled if there are no entries in the list. The button is disabled if the **Enable Friendly IP List** control is not checked.

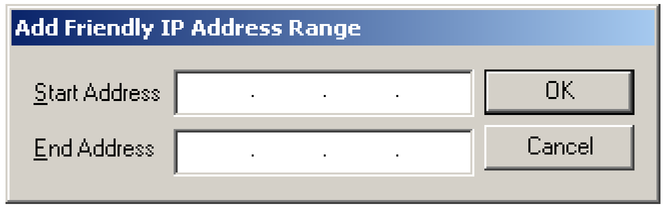
Click on the column headings to sort the list by that column. Click a second time to reverse the sort order. The order is indicated by the triangle next to the text.

The settings are verified when the OK button is pressed or another settings page is selected.

- A message is displayed if the friendly IP list is enabled and the list is empty.
- A message is displayed if the IP address of the PC is not in the friendly IP table.

Add Friendly IP Address Range Dialog

The Add Friendly IP Address Range dialog specifies an IP address range to add to the Friendly IP list.



Start Address specifies the starting IP address in the range. Enter any valid IP address.

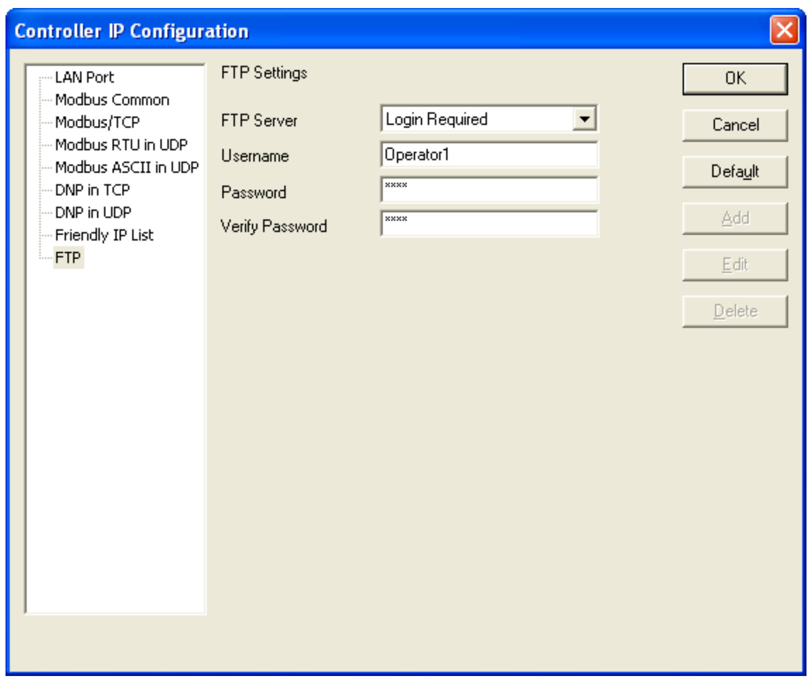
End Address specifies the ending IP address in the range. Enter a valid IP address that is numerically greater than or equal to the IP Start Address. This field can be left blank if only a single IP address is required.

The **OK** button adds the IP address range to the list and closes the dialog. A message is displayed if the address range is invalid.

The **Cancel** button closes the dialog without making any changes.

FTP

When the FTP tree control is selected the FTP property page becomes active allowing for the configuration of the FTP server on the controller.



FTP Server enables the FTP server in the controller. There are three selections available.

- Select **Disabled** to disable the FTP server and stop FTP access to the file system
- Select **Login Required** to enable the FTP server. A username and password are required to access the file system.
- Select **Anonymous Allowed** to enable the FTP server. A username and password may be used to access the file system. The server will accept an anonymous login; it will accept any username and password.

Username specifies the username for the FTP server account. It is used when **Login Required** is selected. Enter a User Name of 1 to 16 characters long.

Password specifies the password for the FTP server account. It is used when **Login Required** is selected. Enter a password of 1 to 16 characters long.

Verify Password specifies the password a second time to confirm the value. Enter the same value as for the password.

The **setftp** function can be used to enable and disable the FTP server using program logic in the controller.

FTP Server functions operate at a high priority in the controller. The execution of Telepace and IEC 61131-3 logic applications is impacted during file uploads and downloads. The logic applications will slow significantly during large file uploads to the controller.

To reduce the impact on logic applications:

Use a number of small files rather than a single large file.

Use the LS (list) command rather than the DIR (directory) command.

FTP usernames and passwords are transmitted in the clear when reading/writing controller configuration. In order to minimize the possibility of reading of credentials the controller should be kept locked against programming commands except when the configuration is being read or written.

FTP Practices

These practices should be followed to maximize the effectiveness of the FTP feature.

Binary vs ASCII Mode

- Files can be transferred via either Binary or ASCII modes. Binary file transfers are recommended because they are more efficient. FTP clients will support both types of file transfers.

File Locations

The internal file system on the SCADAPack 330/334/350/357 controllers may use either of two available drives:

- The internal Controller Disk Drive is labeled /d0.
- The External USB Drive is labeled /bd0.

The internal file system on the SCADAPack 314 and SCADAPack 4203 controllers has one drive:

- The internal **Controller Disk Drive** is labeled **/d0**.

The controller internal flash drive **d0** contains all system and user files. The system files should not be modified via FTP or user processes.

Many system files can be found in the **d0/SYSTEM** folder. It is strongly recommended that only system files reside in this folder to prevent accidental corruption of controller settings.

C programs can be found in the root directory **d0**. These programs have a suffix of “.out” and should not be modified.

Log files created by the data log to file functionality are stored in sub-folders of **d0/LOGS/**. These files may be read, but writing to or deleting these files is discouraged. The data log to file functionality will manage these files as required.

Users are encouraged to create their own folders and store all files that they need to access in folders they create to minimize accidentally altering a system file. i.e. create a directory called **d0/SCADA** to keep files that will be modified via FTP in.

Register Assignment

The Register Assignment command is used to configure the register assignment for flow computers using Telepace firmware. When selected the command opens the Register assignment dialog and displays the current register assignment list. The user may edit the list or the entries in the list. This feature is available only on Telepace firmware. The settings have no effect on ISaGRAF firmware.

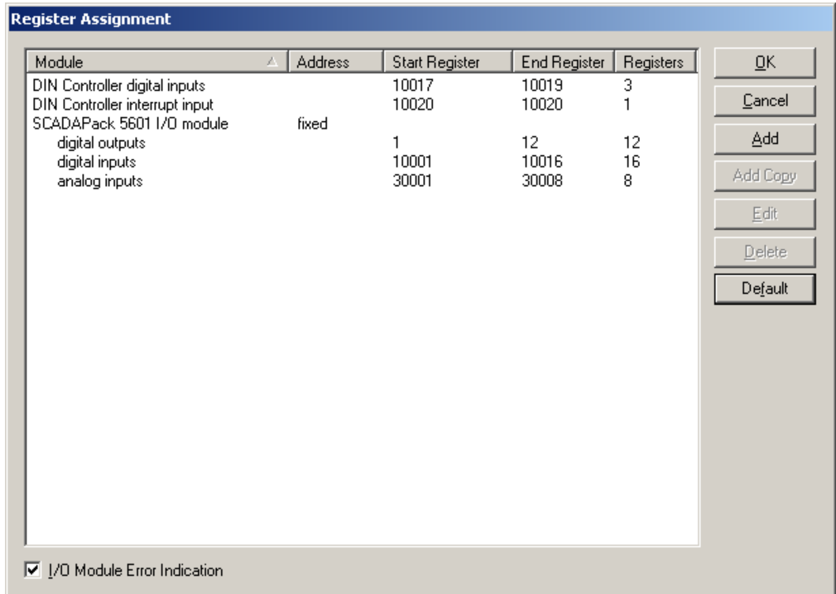
For complete information on the Register Assignment modules available refer to the ***Telepace Studio User and Reference*** manual.

Realflo uses the following registers for flow calculation data. These registers cannot be used in any register assignment.

Configuration and Control Registers	49500 to 49999
Requested Data Registers	48500 to 49499.
Meter Run 1 Data Registers	47500 to 48499
Meter Run 2 Data Registers	46500 to 47499
Meter Run 3 Data Registers	45500 to 46499
Requested Daily History Registers	44500 to 45499.
Meter Run 4 Data Registers	44400 to 44499
Meter Run 5 Data Registers	44300 to 44399
Meter Run 6 Data Registers	44200 to 44299
Meter Run 7 Data Registers	44100 to 44199
Meter Run 8 Data Registers	44000 to 44099
Meter Run 9 Data Registers	43900 to 43999
Meter Run 10 Data Registers	43800 to 43899
MVT Configuration Registers	43700 to 43799
MVT Data Registers	43600 to 43689
MVT Internal Registers	38000 to 38999
Display Configuration Registers	43470 to 43499
Process I/O Configuration Registers	43400 to 43469
Uncorrected Accumulated Flow, runs 1 to 10	43300 to 43398
SolarPack Configuration / Accumulation	43180 to 43260

In addition to the above registers the SCADAPack 4202 and 4203 controllers use the following registers for transmitter parameters and data. These registers cannot be used in any register assignment if a SCADAPack 4202 or 4203 controller is used.

SCADAPack 4202 and 4203 data and parameters registers 40001 to 40499



The main portion of the dialog is a list showing the modules in the register assignment list. The module list displays the Module, Module Address, Start Register, End Register and the number of Registers for the module.

The **Module** field displays the type and name of I/O modules that have been added to the Register Assignment. For modules that support more than one type of I/O, there are multiple lines in the row of the table, one for each input or output I/O type.

The **Address** field displays the unique module address of the physical hardware, such as a 5000 5401 Digital I/O module. Some module types have no address that can be set by the user. The address is blank for these modules.

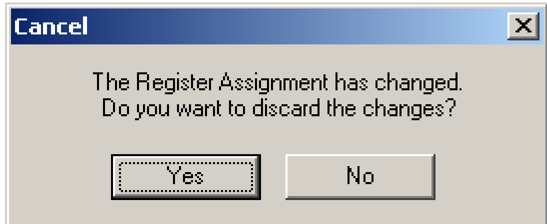
The **Start Register** field displays the first register address in the I/O database where the module data is stored. A start register is required for each type of input or output on the module.

The **End Register** field displays the last address in the I/O database used by the module. An end register is required for each type of input or output on the module.

The **Registers** field displays the number of registers used by the module. A size is required for each type of input or output on the module.

The **OK** button updates the register assignment list and closes the dialog. This is the default button. Pressing the ENTER key selects the OK button.

The **Cancel** button exits the dialog without saving changes. If changes were made, the user is prompted for confirmation before exiting. Pressing the ESC key selects the Cancel button. If changes were made the following dialog appears.



- Selecting **Yes** closes the Register Assignment dialog and the register assignment list is not changed.
- Selecting **No** returns to the Register Assignment dialog. The No button is the default selection. Pressing the Enter or ESC keys selects the No button.

The **Add** button adds a new module to the register assignment. The Edit Register Assignment dialog opens.

The **Add Copy** button adds a copy of the selected module to the register assignment. The Edit Register Assignment dialog opens. The Address field is set to the first unused address for the currently selected module type. Other fields are set to the values from the currently selected I/O module. The Add Copy button is grayed if the table is empty, or I/O modules of the given type are in use (i.e. modules are already defined for possible addresses for the selected module type).

The **Edit** button modifies the selected module. The Edit Register Assignment dialog opens with data from the currently selected I/O module. The Edit button is grayed if the table is empty, or no module is selected in the table.

The **Delete** function removes the selected module from the register assignment. The button is grayed if the table is empty, or no module is selected in the table.

The **Default** button replaces the current Register Assignment with the Default Register Assignment for the controller. The controller type is selected using the **Flow Computer Setup** command. The dialog displayed is dependent on the type of controller used. See the ***Default Register Assignments*** section below.

The **I/O Module Error Indication** check box determines if the controller displays I/O module communication errors. If enabled, the controller will blink the Status LED if there is an I/O error. See the DIAG Controller Status Code diagnostic module for information on the controller status code. If disabled, the controller will not display the module communication status.

The module communication status is checked. This option controls only the indication on the Status LED.

Module Selection

Clicking anywhere in a row selects the module. Double clicking anywhere in a row selects the data for the module and invokes the Edit Register Assignment dialog.

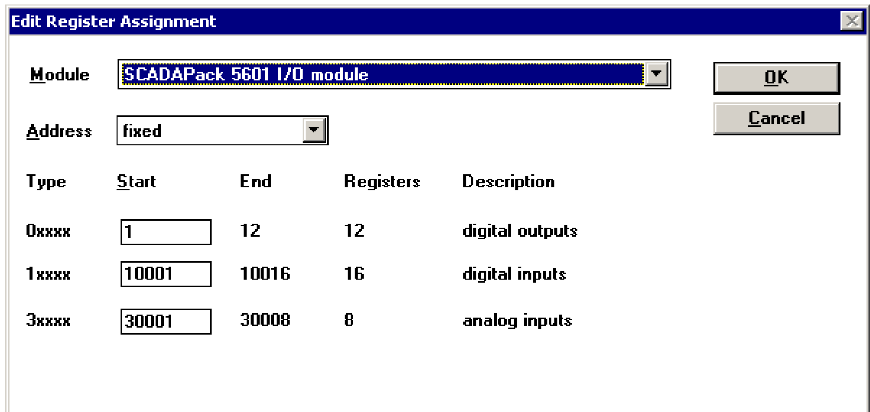
Sorting

Click on the column headings to sort the data. Clicking once sorts the data in ascending order. Clicking again sorts the data in descending order.

If a module has more than one value in a column, data is sorted by the first value.

Edit Register Assignment Dialog

The Edit Register Assignment dialog modifies an entry in the register assignment. The following example shows the dialog editing a module with more than one I/O type.



The **Module** drop-down list box shows the current module type. The dropdown list displays available modules. Refer to the **Telepace Studio User and Reference** manual for complete information on the Register Assignment module types available.

The **Address** drop-down list box shows the current module address. The drop-down list displays addresses valid for the current module type that are not already used. If all addresses are in use, the list will be empty.

There are up to four type description fields. The text displays the type of the input or output register. The type descriptions are 0xxxx, 1xxxx, 3xxxx and 4xxxx.

- Digital output data is read from coil (**0xxxx**) registers. The digital outputs are updated continuously with data read from the coil registers.
- Digital input data is stored in status (**1xxxx**) registers. The status registers are updated continuously with data read from the digital inputs.
- Analog input data is stored in input (**3xxxx**) registers. The input registers are updated continuously with data read from the analog inputs.
- Analog output data is stored in holding (**4xxxx**) registers. The analog output registers are updated continuously with data read from the holding registers.

The **Start** edit box holds the starting register in the I/O database for the I/O type. The edit box allows any number to be entered.

The **End** field shows the last register used by the module for the I/O type.

The **Registers** field shows the number of registers in the I/O module.

The **Description** field displays the I/O type for multiple I/O modules.

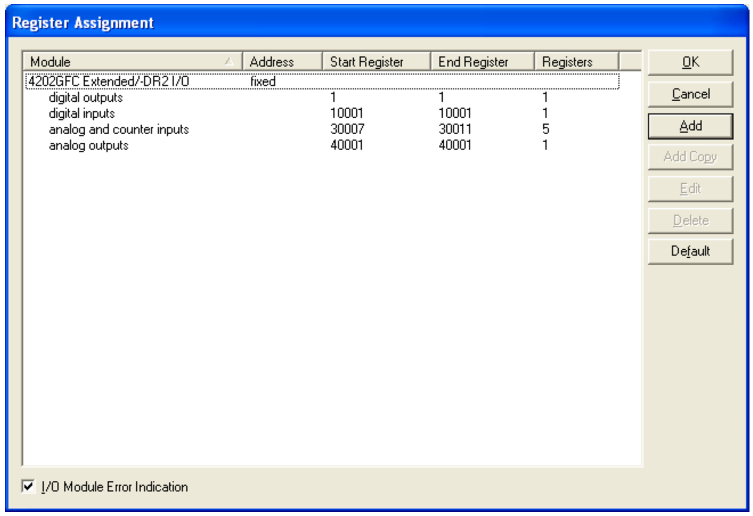
Selecting **OK** checks the data entered. If the data is correct the dialog is closed and the Register Assignment dialog returns with the changes made. An error message is displayed if any data is incorrect. Pressing the ENTER key selects the **OK** button.

Selecting **Cancel** exits the dialog without saving changes. Pressing the ESC key selects the **Cancel** button.

Default Register Assignments

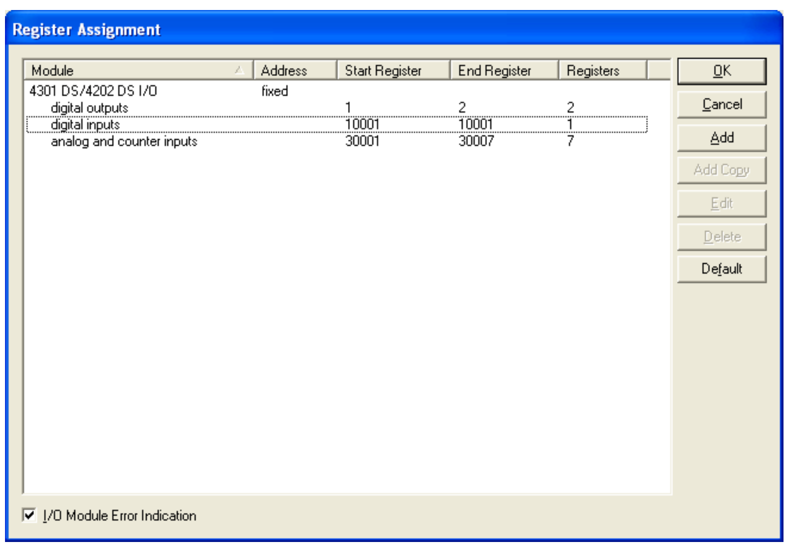
SCADAPack 4202 or 4203

If the controller type is a SCADAPack 4202 or 4203 with controller board version 5 and terminal board version 6, the following dialog appears.



SCADAPack 4202 DR manufactured after July 13, 2004 may use the 4202 DS Extended I/O register assignment. The 4202-DR needs to have controller board version 5 and terminal board version 6. Previous versions of the SCADAPack 4202 DR require the 4202 DR I/O register assignment module.

If the controller type is a SCADAPack 4202 DS or 4203 DS the following dialog appears.



SCADAPack, SCADAPack Plus, SCADAPack 32

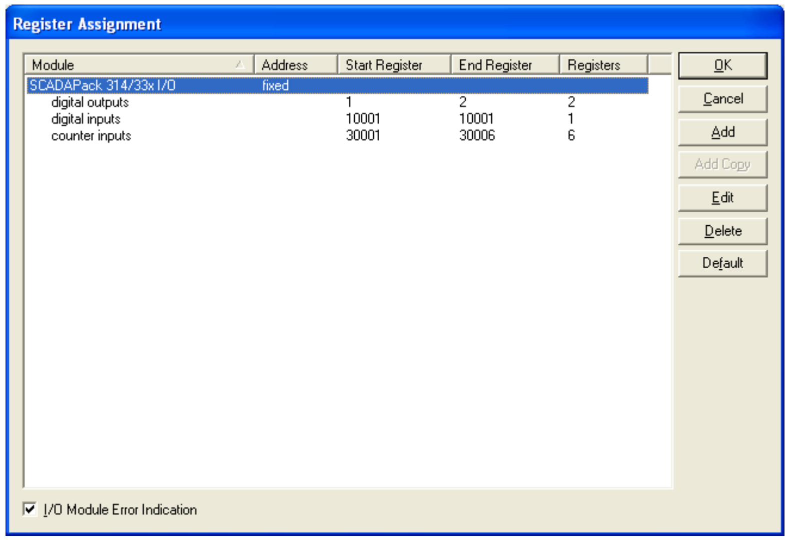
If the controller type is a SCADAPack, SCADAPack Plus, or SCADAPack 32 the default register assignment will include the supported integrated I/O modules for the controller. Clicking the Default button in the Register Assignment opens a dialog displaying the supported integrated I/O modules.

- SCADAPack 5601 I/O module

- SCADAPack 5604 10V/40mA I/O module
- SCADAPack 5604 5V/20mA I/O module
- SCADAPack 5606 I/O module

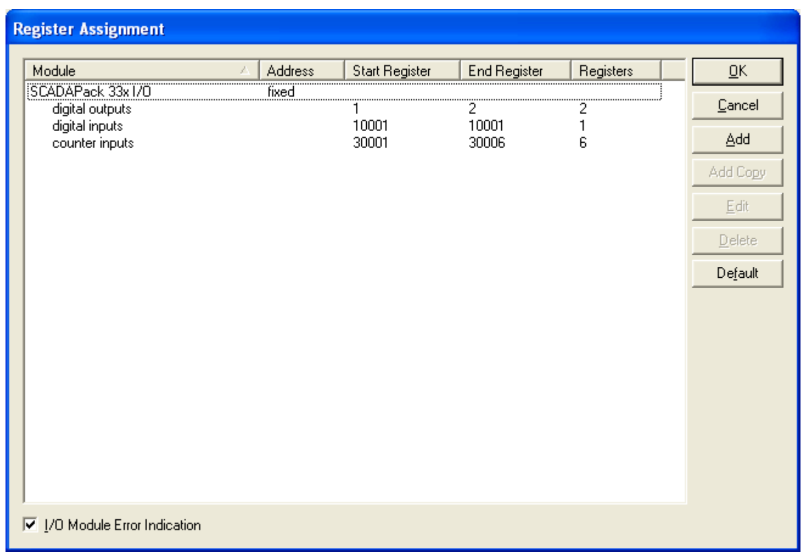
SCADAPack 314

If the controller type is a SCADAPack 314 the following dialog appears.



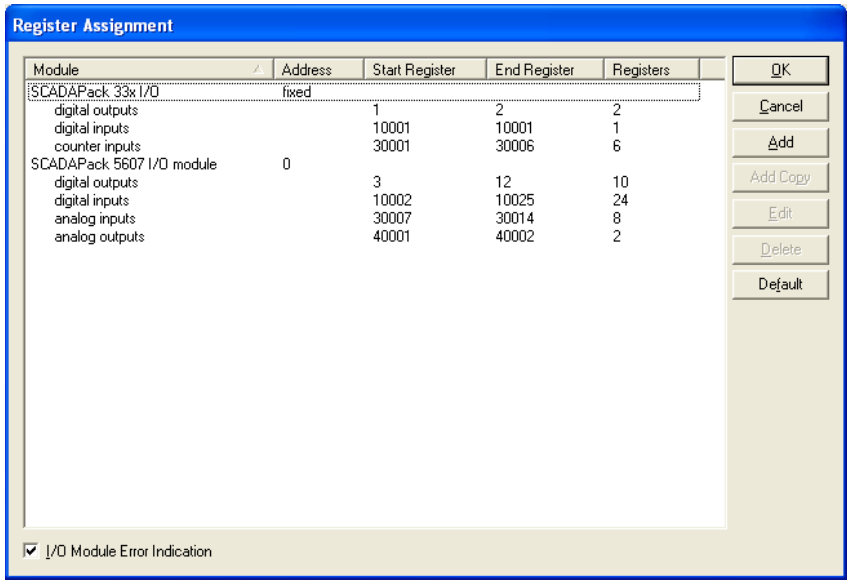
SCADAPack 330

If the controller type is a SCADAPack 330 the following dialog appears.



SCADAPack 334

If the controller type is a SCADAPack 334 the following dialog appears.



SCADAPack 350

If the controller type is a SCADAPack 350 register assignment will include the supported integrated I/O modules for the controller. Clicking the Default button in the Register Assignment opens a dialog displaying the supported integrated I/O modules.

- SCADAPack 350 10V/40mA I/O module
- SCADAPack 350 5V/20mA I/O module
- SCADAPack 357 Controller (SCADAPack 350 and SCADAPack 5607 I/O module).

DNP

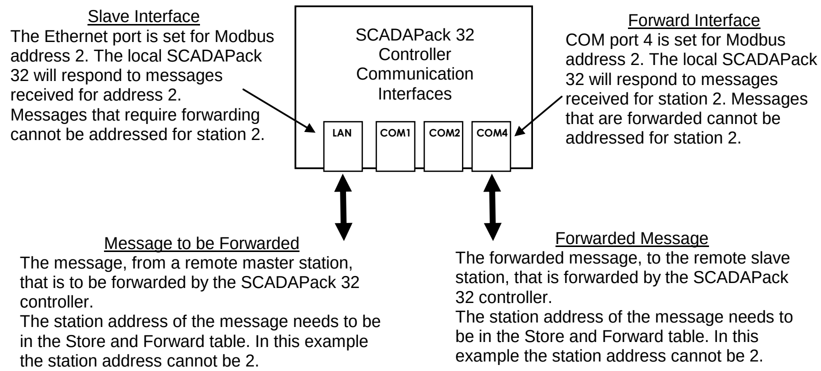
The DNP command is used to configure the DNP protocol settings for the controller. When selected the DNP Settings window is opened.

For complete information on DNP configuration refer to the ***DNP3 Protocol User Manual*** section of this manual***.***

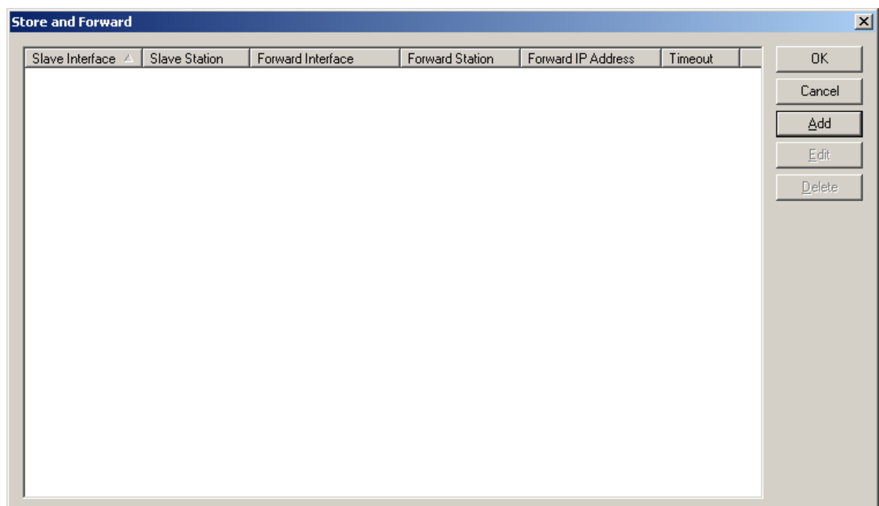
Store and Forward

The Store and Forward command configures the Store and Forward settings for a SCADAPack 32, SCADAPack 314/330/334, SCADAPack 350 controller or SolarPack 410. A controller configured for store and forward operation receives messages destined for a remote Slave Station on the Slave Interface. The controller forwards the message on the Forward Interface to the Forward Station.

Refer to the following diagram as a reference for the terminology used in the following Store and Forward command reference.



When the Store and Forward command is selected the Store and Forward dialog appears. This dialog displays the Store and Forward table for the controller. This command is available only when the controller type is set to SCADAPack 330/334, SCADAPack 350, SCADAPack 32, SCADAPack 32P or SolarPack 410.



The Store and Forward table displays each Store and Forward translation as a row, with column headings, in the table. The table may have up to 128 entries. A vertical scroll bar is used if the list exceeds the window size.

The **Slave Interface** heading displays the receiving slave interface the message is received from for each translation.

The **Slave Station** heading displays the Modbus station address of the slave message.

The **Forward Interface** heading displays the interface the message is forwarded from. When forwarding to a Modbus TCP or UDP network, the protocol type is selected for the Forward Interface. The IP Stack automatically determines the exact interface (e.g. LAN/PPP) to use when it searches the network for the Forward IP Address. If a serial port is selected for the Forward Interface, and the serial port is configured for PPP protocol, the message will not be forwarded.

The **Forward Station** heading displays the Modbus station address of the forwarded message.

The **Forward IP Address** heading displays the IP address of the Forward Station. This field is blank unless a TCP or UDP network is selected for Forward Interface.

The **Time Out** heading displays the maximum time (in tenths of seconds) the forwarding task waits for a valid response from the Forward Station. The time out should be equal to or less than the time out set for the master message received on the Slave Interface.

The **OK** button saves the table data. No checking is done on the table data.

The **Cancel** button closes the dialog without saving changes.

Select the **Add** button to enter a new row in the store and forward table. Selecting the Add button opens the **Add/Edit Store and Forward** dialog.

Select the **Edit** button to modify the selected row in the store and forward table. Selecting the Edit button opens the **Add/Edit Store and Forward** dialog containing the data from the selected row. This button is disabled if more than one row is selected. This button is disabled if there are no entries in the table.

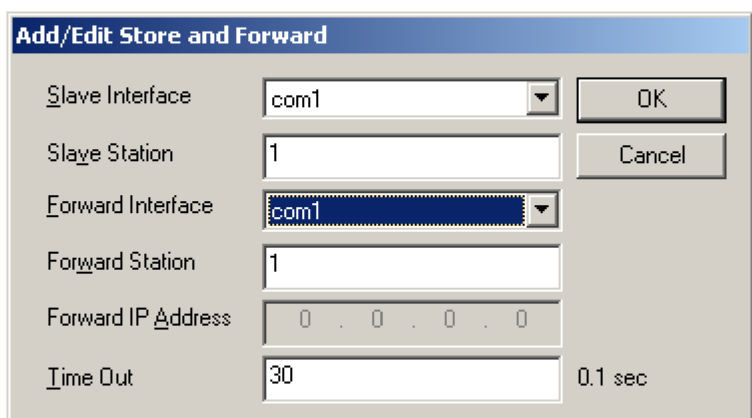
The **Delete** button removes the selected rows from the table. This button is disabled if there are no entries in the table.

The **Undo** button undoes the action performed by the last button selection since the dialog was opened. This applies to the buttons Add, Edit, Delete and Undo. This button is disabled when the dialog is opened, and is enabled as soon as any of the applicable buttons are selected.

The **Sorted by** menu box lists each of the five column headings. The rows are sorted according to the selected heading. Headings in the table are, by default, sorted by the Slave Interface heading.

Add/Edit Store and Forward Dialog

This dialog is used to edit an entry or add a new entry in the store and forward table.



The **Slave Interface** is the receiving slave interface the message received from. The dropdown list allows the following selection:

- com1
- com2
- com3
- com4

- LAN/PPP

The **Slave Station** is the Modbus station address of the slave message. This address needs to be different from the Modbus address assigned to the Slave Interface. Valid range for Slave Station is:

- 1 to 255 when standard addressing is selected for the interface.
- 1 to 65534 when extended addressing is selected for the interface.

The **Forward Interface** is the interface the message is forwarded from. The dropdown list allows the following selection:

- com1
- com2
- com3
- com4
- Modbus/TCP
- Modbus RTU in UDP
- Modbus ASCII in UDP

The **Forward Station** is the Modbus station address of the forwarded message. This address needs to be different from the Modbus address assigned to the Forward Interface. Valid range for Forward Station is:

- 1 to 255 when standard addressing is selected for the interface.
- 1 to 65534 when extended addressing is selected for the interface.

The **Forward IP Address** edit box is disabled and the address is forced to “0.0.0.0“ whenever the Forward Interface is set to com1, com2, com3 or com4. The Forward IP Address edit box is enabled only when the Forward Interface is set to a TCP or UDP network. Valid entries are 0 to 255 for each byte in the IP address.

The **Time Out** is the maximum time the forwarding task waits for a valid response from the Forward Station, in tenths of second. Valid entries are 0 to 65535. The time out should be equal to or less than the time out set for the master message received on the Slave Interface.

The **OK** button checks the data for this table entry. If the data is valid the dialog is closed. If the table data entered is invalid, a message is displayed and the dialog remains open. The table entry is invalid if any of the fields is out of range. The data is also invalid if it conflicts with another entry in the table. In PEMEX mode the OK button is not active if the user is not logged on with Administrator privileges.

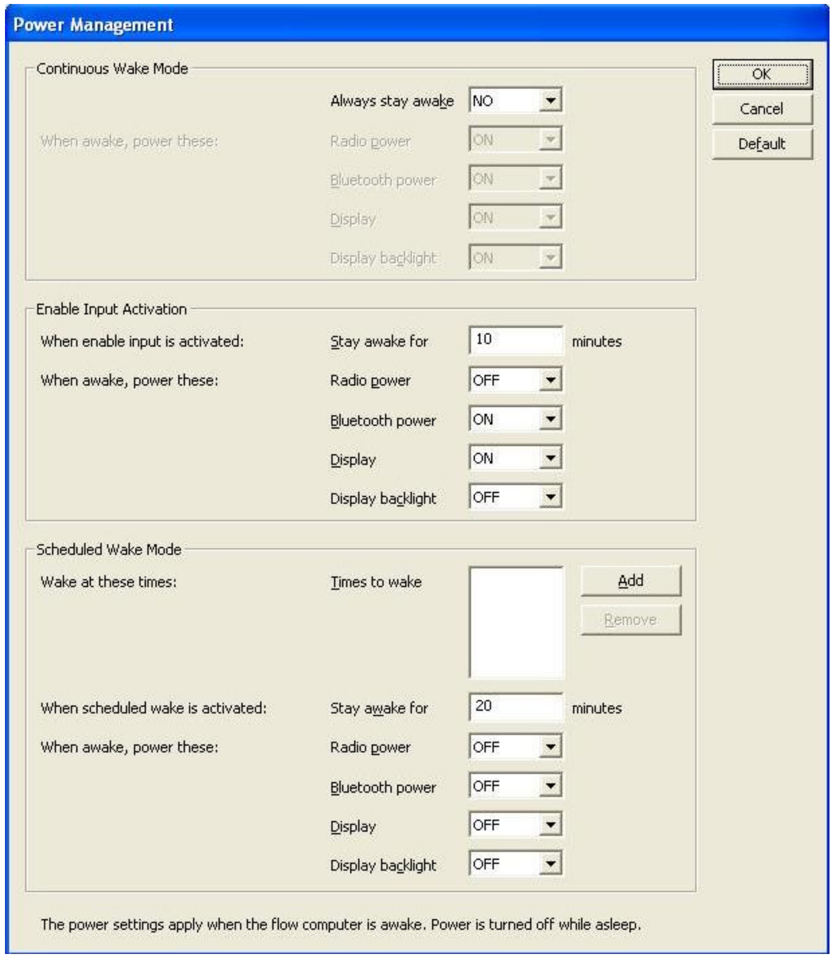
The **Cancel** button closes the dialog without saving changes.

Power Management Configuration

The SolarPack 410 provides power management features to minimize the power consumption.

Power Management Dialog

The power management dialog appears as follows.



The Continuous Wake Mode section specifies if the flow computer stays in the continuous power mode.

The following parameters can be configured for this mode.

- **Always Stay Awake** specifies if the flow computer should stay awake. Valid values are Yes and No. The default value is No.
- **Radio Power** selects if the SCADA radio is powered. Valid values are ON or OFF. The default value is ON.
- ***Bluetooth* Power** selects if the *Bluetooth* radio is powered. Valid values are ON or OFF. The default value is ON.
- **Display** selects if the display is powered. Valid values are ON or OFF. The default value is ON.
- **Display Backlight** selects if the display backlight is powered. Valid values are ON or OFF. The default value is ON. This control is set to OFF when the display control is set to OFF.

The Enable Input Activation section specifies what happens when the enable input is activated. Activating the enable input places the flow computer in the continuous power mode. A power off timer starts when entering continuous power mode. The flow computer remains in this mode until the power off timer expires, then enters the power saving mode.

The following parameters can be configured for this mode. These controls are disabled when the controller is in the continuous wake mode.

- **Stay Awake For** specifies the number of minutes until power off. Valid values are 1 to 240. The default value is 10 minutes.
- **Radio Power** selects if the SCADA radio is powered. Valid values are ON or OFF. The default value is OFF.
- **Bluetooth Power** selects if the Bluetooth radio is powered. Valid values are ON or OFF. The default value is ON.
- **Display** selects if the display is powered. Valid values are ON or OFF. The default value is ON.
- **Display Backlight** selects if the display backlight is powered. Valid values are ON or OFF. The default value is OFF. This control is set to ON when the display control is set to ON.

The Scheduled Wake Mode section specifies when the flow computer should wake up. The flow computer stays awake for a fixed period of time in this mode. The controller is in the continuous power mode for the specified duration at the specified times, then it enters the power saving mode.

The following parameters can be configured for this mode. These controls are disabled when the controller is in the continuous wake mode.

Times to Wake lists the times at which the flow computer should wake. Up to 24 times can be added. The default value is an empty list.

Stay Awake For specifies the number of minutes until power off. Valid values are 1 to 240. The default value is 20 minutes.

Radio Power selects if the SCADA radio is powered. Valid values are ON or OFF. The default value is OFF.

***Bluetooth* Power** selects if the *Bluetooth* radio is powered. Valid values are ON or OFF. The default value is OFF.

Display selects if the display is powered. Valid values are ON or OFF. The default value is OFF.

Display Backlight selects if the display backlight is powered. Valid values are ON or OFF. The default value is OFF This control is set to ON when the display control is set to ON.

Selecting Power Management Configuration

In Expert mode do one of the following:

- Select the **Power Management** command on the **Configuration** menu to open the Power Management configuration dialog.
- Double-click the **Power Management** item in the configuration tree to open the Power Management configuration dialog.

In Maintenance mode:

- Select View and Change Configuration.
- Advance to the Edit Configuration page.
- Double-click the Power Management item in the configuration tree.

Communication

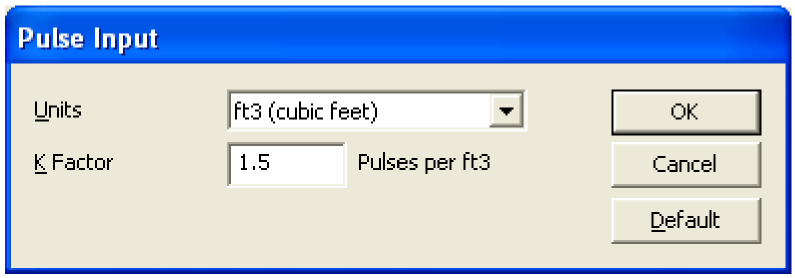
The power management settings are written to the flow computer with the flow computer configuration. The settings are read from the flow computer with the flow computer configuration.

Pulse Input Configuration

The SolarPack 410 flow computer can accumulate pulse inputs. The flow computer counts the number of pulses, multiplies by a K factor and accumulates the results. Total volume, today’s volume, yesterday’s volume, this month’s volume, and last month’s volume accumulators are provided.

Pulse Input Configuration Dialog

The Pulse Input Configuration dialog appears as follows.



Units specify the units for volume. Valid values are cubic feet (ft^3) and cubic metres (m^3), litres, and US gallons, barrels (42 US gallons). The default value is cubic feet.

K Factor specifies the factor by which the raw count is divided to obtain the volume. Valid values are any number greater than 0. The default value is 1.0. Units are pulses/volume.

Selecting Pulse Input Configuration

Select the **Pulse Input** command on the **Configuration** menu to open the Pulse Input configuration dialog.

Double-click on the **Pulse Input** item in the configuration tree to open the Pulse Input configuration dialog.

Communication

The Pulse Input settings are written to the flow computer with the flow computer configuration. The settings are read from the flow computer with the flow computer configuration.

Changes to settings can generate up to three events in the event log for run 1.

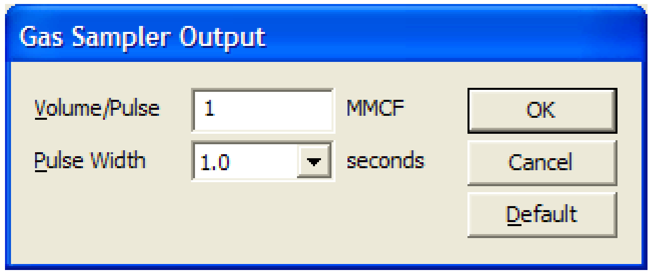
Number	Description
10096	Set pulse input K factor
10097	Set pulse input units

Gas Sampler Output Configuration

The gas sampler output is pulsed based on the current flow. The pulse rate is configurable with a factor based on the current volume. The pulse width is user adjustable from 0.1 seconds to 5.0 seconds.

Gas Sampler Output Dialog

The Gas Sampler Output dialog appears as follows.



Volume/Pulse specifies the flow volume for each pulse output. The measurement units are the same as the contract units for run 1. Any positive value is valid. The default value is 1,000,000 ft^3/pulse or the equivalent in the current unit set.

Pulse Width specifies the pulse width. Valid values are 0.1 to 5.0 seconds in increments of 0.1 seconds. The default value is 1.0 seconds.

Selecting Gas Sampler Output Configuration

Select the **Gas Sampler Output** command on the **Configuration** menu to open the Gas Sampler Output configuration dialog.

Double-click on the **Gas Sampler Output** item in the configuration tree to open the Gas Sampler Output configuration dialog.

Communication

The Gas Sampler Output settings are written to the flow computer with the flow computer configuration. The settings are read from the flow computer with the flow computer configuration.

Modbus Mapping

Modbus mapping provides a simplified method for SCADA host software to make configuration changes to the gas quality ratios, orifice plate size and the real time clock settings in the flow computer. Using Modbus mapping a sequential block of registers containing the gas quality ratios and orifice plate size for a meter run can be written to the flow computer and applied to the flow computer configuration in one Modbus write from the SCADA host.

The Modbus Mapping table cannot be modified unless the user is logged on with Administrator privileges. The OK button is grayed out in the Modbus Mapping Settings dialog if the account privileges are not at the ADMIN level. See the Accounts section for information on creating and using accounts in Realflo.

If an attempt is made to write a Realflo configuration that contains a Modbus Mapping table that is different from the one in the flow computer by a user without Administration privileges a message is displayed and the Modbus Mapping table is **not** written to the flow computer.

Modbus mapping may be applied to the following flow computer configurations:

- The **Real Time Clock Registers** table requires a sequential block of 9 holding registers. These registers are described in the ***Real Time Clock Registers*** section below.
- The **Shared Read/Write Run Registers** table requires a sequential block of 63 holding registers. These registers can be used to read or write to the AGA8 gas composition parameters and the orifice plate size for any meter run. These registers are described in the ***Shared Read/Write Run Data Registers*** section below.
- The **Run Read/Write Registers** table requires a sequential block of 62 holding registers. These registers can be used to read or write to the AGA8 gas composition parameters and the orifice plate size for the selected meter run. The number of meter runs displayed depends on the number of meter runs configured in the flow computer. These registers are described in the ***Meter Run Data Registers*** section below.
- The **Run Read Only Registers** table requires a sequential block of 60 input registers. These registers can be used to read the AGA8 gas composition parameters and the orifice plate size for the selected meter run. The number of meter runs displayed depends on the number of meter runs configured in the flow computer. These registers are described in the ***Meter Run Data Registers*** section below.

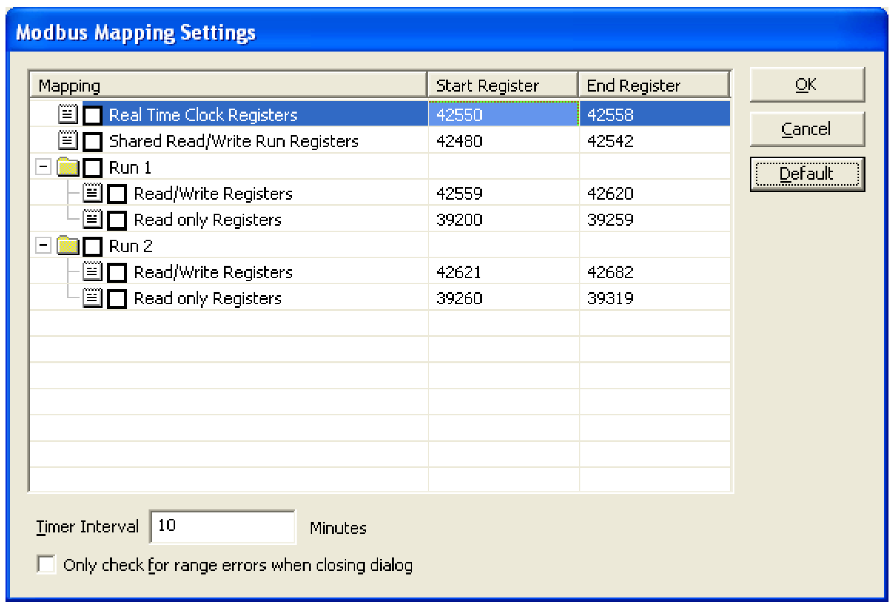
The Modbus mapping table operates according to the following rules:

- The flow computer reads the registers, for each configured run, from the mapping table on each scan. Verification is done and the status of the current mapping table is reported via the **Configuration Mapping Range status** register for each table**.**
- Only valid new settings are used to update the flow computer configuration when the **Apply Request** register is set to 1. The Apply Request register is reset to zero after the request is executed.
- A Timer restricts incomplete configuration settings from staying in the Modbus mapping table forever. If changes have not been applied in a specified number minutes (default is 10 minutes), since the last change,

the mapping table is synchronized with the current flow computer settings and user mapping changes will be lost.

- The Modbus Mapping registers may be set to a user defined range. The mapping table is initialized with the current flow computer configuration when the mapping range changed.
- The Mapping Table registers are automatically updated when any flow computer interface (i.e. Realflo) changes the AGA-8, AGA-8 Hexanes+, AGA-3 or Real Time Clock configuration.
- The **Configuration Mapping Range status** register indicates the status of the Mapping Range for each configuration. A Host computer can use this register to know if other flow computer interface is updating the same configuration.

When the Modbus Mapping command is selected the Modbus Mapping Settings dialog opens as shown below.



The Modbus mapping dialog is divided into three columns and a number of rows depending on the number of meter runs configured in the flow computer. The rows in the table list the flow computer configurations that can be assigned to Modbus Mapping.

The **Real Time Clock Registers** are a sequential block of 9 holding registers. The block of registers used cannot include any registers used by the flow computer. See the ***TeleBUS Registers Used by the Flow Computer*** section for a listing of flow computer registers.

The **Shared Read/Write Run Registers** are a sequential block of 63 holding registers. These registers can be used to read or write to the AGA8 gas composition parameters and the orifice plate size for any meter run. The block of registers used cannot include any registers used by the flow computer. See the ***TeleBUS Registers Used by the Flow Computer*** section for a listing of flow computer registers.

The **Run Read/Write Registers** are a sequential block of 62 holding registers. These registers can be used to read or write to the AGA8 gas composition parameters and the orifice plate size for the selected meter run. The block of registers used cannot include any registers used by the flow computer. See the ***TeleBUS Registers Used by the Flow Computer*** section for a listing of flow computer registers.

The **Run Read Only Registers** are a sequential block of 60 input registers. These registers can be used to read the AGA8 gas composition parameters and the orifice plate size for the selected meter run. The block of registers used cannot include any registers used by the flow computer. See the ***TeleBUS Registers Used by the Flow Computer*** section for a listing of flow computer registers.

Using the Modbus Mapping Settings Table

The mapping for each configuration is enabled or disabled by clicking your mouse in the box to the left of each configuration type.

- The Shared Read/Write Run Registers and the individual meter run Read/Write Registers mapping cannot be enabled at the same time.
- The Shared Read/Write Run Registers and the individual meter run Read Only Registers mapping may be enabled at the same time.
- The Real Time Clock Registers maybe used with any mapping selection.

The Modbus Mapping table uses the default Start Register and End Register values unless the Start Register is changed. When the Start Register is changed the End Register automatically updates to the end of the configuration range. To change the Start Register:

- Click on the Start Register Modbus register.
- Press the keyboard Enter key to open the window for editing.
- Enter the new Start Register Modbus address and press the Enter key again.

The Modbus registers used for Modbus Mapping cannot include any registers used by the flow computer. See the ***TeleBUS Registers Used by the Flow Computer*** section for a listing of flow computer registers.

The **Timer Interval** selection is used to apply a timeout value for pending changes to a configuration table. If changes have not been applied in a specified number minutes (default is 10 minutes), since the last change, the mapping table is synchronized with the current flow computer settings and user mapping changes will be lost. The default timer interval value is 10 minutes. Any values between 1 and 1000 minutes may be entered.

The **Only check for range errors when closing dialog** selection is used to limit range validation errors when configuring the mapping table. Each range is validated and needs to not overlap with another range or conflict with registers used by the flow computer. Using this control the validation will only be checked when the dialog is closed.

Real Time Clock Registers

The **Real Time Clock Registers** are a sequential block of 9 holding registers. The block of registers used cannot include any registers used by the flow computer. The following table describes the registers. The default registers are described, when the register range is changed the registers are offset from the entered Start Register.

To write a complete Real Time Clock configuration from a Host:

- Enter the Real Time Clock values into the range of registers and enter a 1 into the **Apply Request** register.
- Write the registers to the flow computer.
- Read the **Configuration Mapping Range status** register to confirm the changes have been made in the flow computer

To write an incomplete Real Time Clock configuration from a Host (i.e. change the hour only):

- Enter a value of 100 in the Apply Request register to read the current flow computer settings and write this register to the flow computer.
- Enter the selected new Real Time Clock values into the appropriate register(s) and enter a 1 into the **Apply Request** register.
- Write the registers to the flow computer.
- Read the **Configuration Mapping Range status** register to confirm the changes have been made in the flow computer

Description	**Read/Write Register Range**	**Register Type**
Years = 1997 to 2096	42550	uint
Months = 1 to 12	42551	uint
Days = 1 to 31, with exceptions	42552	uint
Hours = 0 to 23	42553	uint
Minutes = 0 to 59	42554	uint
Seconds = 0 to 59	42555	uint
Seconds = -32000 to 32000, Increment / Decrement number of seconds	42556	sint
Apply Request 0 = No operation 1 = Apply new setting 100 = Synchronize with Flow Computer	42557	uint
Configuration Mapping Range status 0 = Reset and Synchronized with Flow Computer by Apply Request commands 1 and 100. 1 = Settings have changed. 2 = The current settings are invalid. 3 = Reset and Synchronized with Flow computer as a result of a timeout. 4 = The event log is full and no further change events are allowed. 5 = Invalid command	42558	uint

Shared Read/Write Run Data Registers

The **Shared Read/Write Run Registers** are a sequential block of 63 holding registers. These registers can be used to read or write to the AGA8 gas composition parameters and the orifice plate size for any meter run. The following table describes the registers. The default registers are described, when the register range is changed the registers are offset from the entered Start Register.

To write a complete Run Configuration from a Host:

- Enter the meter run number in the Meter Run register.
- Enter the Run Configuration values into the range of registers and enter a 1 into the **Apply Request** register.
- Write the registers to the flow computer.
- Read the **Configuration Mapping Range status** register to confirm the changes have been made in the flow computer

To write an incomplete Run Configuration from a Host (i.e. change the orifice plate size only):

- Enter the meter run in the **Meter Run** register.
- Enter a value of 100 in the **Apply Request** register to read the current flow computer settings and write this register to the flow computer.
- Enter the selected new Run Configuration values into the appropriate register(s) and enter a 1 into the **Apply Request** register.
- Write the registers to the flow computer.
- Read the **Configuration Mapping Range status** register to confirm the changes have been made in the flow computer.

Description	Default Read/Write Register Range	Register Type
Shared Run Data Registers	42480 to 42542	
Meter Run = 1 to 10	42480	uint
Methane	42481	float
Nitrogen	42483	float
Carbon Dioxide	42485	float
Ethane	42487	float
Propane	42489	float
Water	42491	float
Hydrogen Sulfide	42493	float
Hydrogen	42495	float
Carbon Monoxide	42497	float
Oxygen	42499	float
iButane	42501	float
nButane	42503	float
iPentane	42505	float
nPentane	42507	float
Hexane and higher components may be measured individually or may be combined. This affects the n-Hexane, n-Heptane, n-Octane, n-Nonane, and n-Decane components. See the Hexanes+ register for details. The following registers are used when the Hexane and higher components are used.		
n-Hexane • This register contains the n-Hexane value when individual components are	42509	float

Description	Default Read/Write Register Range	Register Type
selected. • The register contains the total Hexanes+ when combined components are selected. See the Hexanes+ register description.		
n-Heptane	42511	float
n-Octane	42513	float
n-Nonane	42515	float
n-Decane	42517	float
Helium	42519	float
Argon	42521	float
Composition logging control This register selects if the flow computer logs AGA-8 gas composition changes. Frequent changes to the composition will result in the event log filling with gas composition events. When the log is full, further changes cannot be made until Realflo reads the log. 0 = log composition changes 1 = do not log composition changes	42522	uint
Real Relative Gas Density 0 = calculate live value A non-zero value will be interpreted by the flow computer as the Real Relative Density. This value will be used with the Heating value register. Valid range for value 0 to 1800 BTU(60)/ft3.	42524	float
Heating Value 0 = calculate live value A non-zero value will be interpreted by the flow computer as the Heating Value. This value will be used with the Real Relative Density register. Valid range for value 0.07 to 1.52	42526	float
Hexanes + The AGA-8 Hexanes+ configuration registers define the composition of the heavier gas components being measured. There are two options, individual components (selected above) or combined (selected below). The Hexanes+ register below determines which method is used.		
n-Hexane portion This register defines the percentage of the Hexanes+ contributed by n-Hexane.	42528	float
n-Heptane portion This register defines the percentage of the Hexanes+ contributed by n- Heptane.	42530	float
n-Octane portion This register defines the percentage of the	42532	float

Description	Default Read/Write Register Range	Register Type
Hexanes+ contributed by n- Octane.		
n-Nonane portion This register defines the percentage of the Hexanes+ contributed by n- Nonane.	42534	float
n-Decane portion This register defines the percentage of the Hexanes+ contributed by n- Decane.	42536	float
The **Hexanes+** register determines how the Hexanes+ values are entered. 0 = Use individual gas components (default) When 0 is entered for the register the Hexane+ registers are entered using registers for n- Hexane, n-Heptane, n-Octane, n-Nonane and n-Decane listed above (registers 42509 to 42518). 1 = Use combined value for hexane and higher components. When 1 is entered (use registers 42528 to 42537) the portion of the Hexanes+ ratio that is applied to each of the n- Hexane, n-Heptane, n-Octane, n-Nonane and n-Decane gas components. These portions are represented as a percentage of the gas components being measured i.e. 0 to 100%. The total of the Hexanes+ components needs to add to 100 percent.	42538	uint
Orifice diameter	42539	float
Apply Request 0 = No operation 1 = Apply new setting 100 = Synchronize with Flow Computer	42541	uint
Configuration Mapping Range status 0 = Reset and Synchronized with Flow Computer by Apply Request commands 1 and 100. 1 = Settings have changed. 2 = The current settings are invalid. 3 = Reset and Synchronized with Flow computer as a result of a timeout. 4 = The event log is full and no further change events are allowed. 5 = Invalid command	42542	uint

Meter Run Data Registers

The **Meter Run Registers Read/ Write Registers** are a sequential block of 62 holding registers. These registers can be used to read or write to the AGA8 gas composition parameters and the orifice plate size for the selected meter run. The following table describes the registers. The default registers are described, when the register range is changed the registers are offset from the entered Start Register.

To write a complete Run Configuration from a Host:

- Enter the Run Configuration values into the range of registers and enter a 1 into the **Apply Request** register.
- Write the registers to the flow computer.
- Read the **Configuration Mapping Range status** register to confirm the changes have been made in the flow computer

To write an incomplete Run Configuration from a Host (i.e. change the orifice plate size only):

- Enter a value of 100 in the **Apply Request** register to read the current flow computer settings and write this register to the flow computer.
- Enter the selected new Run Configuration values into the appropriate register(s) and enter a 1 into the **Apply Request** register.
- Write the registers to the flow computer.
- Read the **Configuration Mapping Range status** register to confirm the changes have been made in the flow computer.

Description	Default Read/Write Register Range	Default Read Register Range	Register Type
Meter Run 1 Data Registers	42559 to 42620	39200 to 39259	
Methane	42559	39200	float
Nitrogen	42561	39202	float
Carbon Dioxide	42563	39204	float
Ethane	42565	39206	float
Propane	42567	39208	float
Water	42569	39210	float
Hydrogen Sulfide	42571	39212	float
Hydrogen	42573	39214	float
Carbon Monoxide	42575	39216	float
Oxygen	42577	39218	float
iButane	42579	39220	float
nButane	42581	39222	float
iPentane	42583	39224	float
nPentane	42585	39226	float
Hexane and higher components may be measured individually or may be combined. This affects the n-Hexane, n-Heptane, n-Octane, n-Nonane, and n-Decane components. See the Hexanes+ register for details. The following registers are used when the Hexane and			

Description	Default Read/Write Register Range	Default Read Register Range	Register Type
higher components are used.			
n-Hexane • This register contains the n-Hexane value when individual components are selected. • The register contains the total Hexanes+ when combined components are selected. See the Hexanes+ register description.	42587	39228	float
n-Heptane	42589	39230	float
n-Octane	42591	39232	float
n-Nonane	42593	39234	float
n-Decane	42595	39236	float
Helium	42597	39238	float
Argon	42599	39240	float
Composition logging control This register selects if the flow computer logs AGA-8 gas composition changes. Frequent changes to the composition will result in the event log filling with gas composition events. When the log is full, further changes cannot be made until Realflo reads the log. 0 = log composition changes 1 = do not log composition changes	42601	39242	uint
Real Relative Gas Density 0 = calculate live value A non-zero value will be interpreted by the flow computer as the Real Relative Density. This value will be used with the Heating value register. Valid range for value is 0.07 to 1.52.	42602	39243	float
Heating Value 0 = calculate live value A non-zero value will be interpreted by the flow computer as the Heating Value. This value will be used with the Real Relative	42604	39245	float

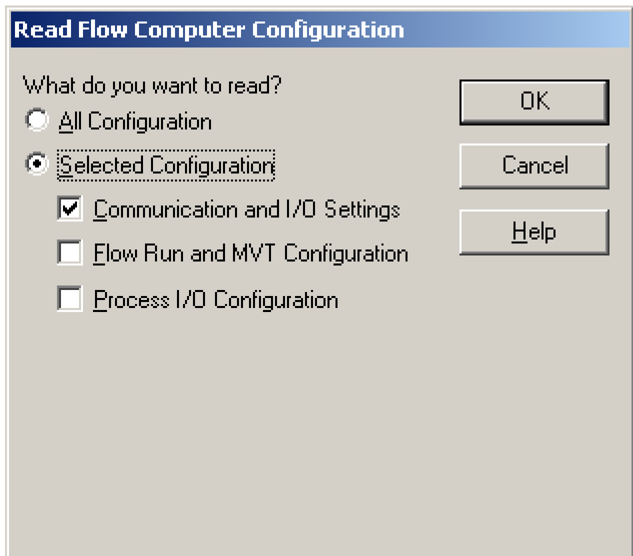
Description	Default Read/Write Register Range	Default Read Register Range	Register Type
Density register. Valid range for value is 0 to 1800 BTU(60)/ft3			
Hexanes + The AGA-8 Hexanes+ configuration registers define the composition of the heavier gas components being measured. There are two options, individual components (selected above) or combined (selected below). See the Hexanes+ register below.			
n-Hexane portion This register defines the percentage of the Hexanes+ contributed by n-Hexane.	42606	39247	float
n-Heptane portion This register defines the percentage of the Hexanes+ contributed by n- Heptane.	42608	39249	float
n-Octane portion This register defines the percentage of the Hexanes+ contributed by n- Octane.	42610	39251	float
n-Nonane portion This register defines the percentage of the Hexanes+ contributed by n- Nonane.	42612	39253	float
n-Decane portion This register defines the percentage of the Hexanes+ contributed by n- Decane.	42614	39255	float
The **Hexanes+** register determines how the Hexanes+ values are entered. 0 = Use individual gas components (default) When 0 is entered for the register the Hexane+ registers are entered using registers for n- Hexane, n-Heptane, n-Octane, n-Nonane and n-Decane listed above (registers 42587 to 42600). 1 = Use combined value for hexane and higher	42616	39257	uint

Description	Default Read/Write Register Range	Default Read Register Range	Register Type
components. When 1 is entered (registers 42606 to 42615)the portion of the Hexanes+ ratio that is applied to each of the n-Hexane, n-Heptane, n-Octane, n-Nonane and n-Decane gas components. These portions are represented as a percentage of the gas components being measured i.e. 0 to 100%. The total of the Hexanes+ components needs to add to 100 percent.			
Orifice diameter	42617	39258	float
Apply Request 0 = No operation 1 = Apply new setting 100 = Synchronize with Flow Computer	42619	N/A	uint
Configuration Mapping Range status 0 = Reset and Synchronized with Flow Computer by Apply Request commands 1 and 100. 1 = Settings have changed. 2 = The current settings are invalid. 3 = Reset and Synchronized with Flow computer as a result of a timeout. 4 = The event log is full and no further change events are allowed. 5 = Invalid command	42620	N/A	uint
Meter Run 2 Data Registers See meter run 1 details.	42621 to 42682	39260 to 39319	
Meter Run 3 Data Registers See meter run 1 details.	42683 to 42744	39320 to 39379	
Meter Run 4 Data Registers See meter run 1 details.	42745 to 42806	39380 to 39439	
Meter Run 5 Data Registers See meter run 1 details.	42807 to 42868	39440 to 39499	
Meter Run 6 Data Registers See meter run 1 details.	42869 to 42930	39500 to 39559	
Meter Run 7 Data Registers See meter run 1 details.	42931 to 42992	39560 to 39619	

Description	Default Read/Write Register Range	Default Read Register Range	Register Type
Meter Run 8 Data Registers See meter run 1 details.	42993 to 43054	39620 to 39679	
Meter Run 9 Data Registers See meter run 1 details.	43055 to 43116	39680 to 39739	
Meter Run 10 Data Registers See meter run 1 details.	43117 to 43178	39740 to 39799	

Read Configuration

The Read Configuration command is used to read all or selected parts of the Flow Computer Configuration. When selected the command displays the Read Flow Computer Configuration dialog as shown below.



The **All Configuration** radio button, when selected, results in the reading of all configuration data from the flow computer.

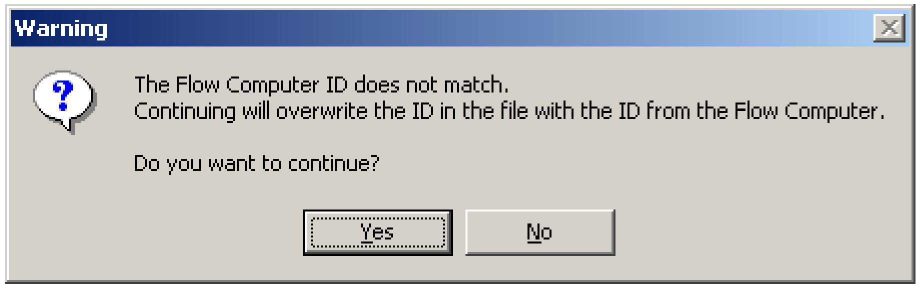
The **Selected Configuration** radio button enables specific configuration data to be read from the flow computer.

- Select **Communication and I/O Settings** to read the serial port and register assignment configuration information.
- Select **Flow Run and MVT Configuration** to read the flow run configuration and the MVT transmitter configuration.
- Select **Process I/O Configuration** to read the Process I/O configuration.

Click on the **OK** button to read the selected items from the flow computer.

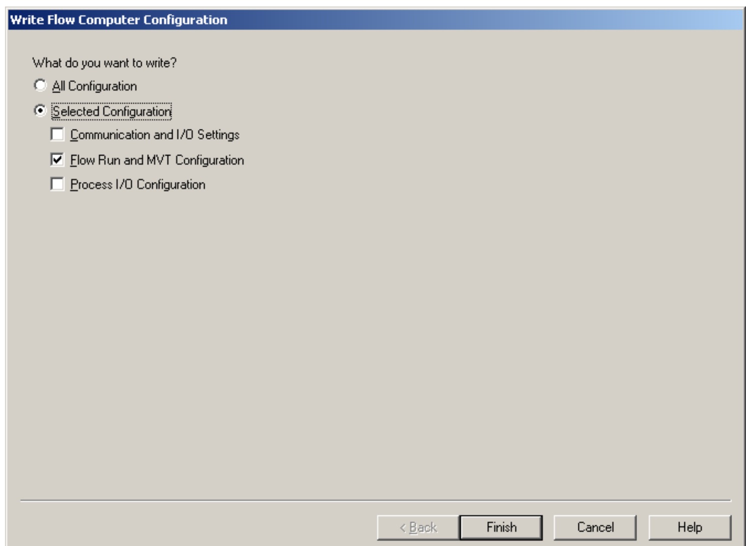
Click the **Cancel** button to cancel the operation and close the dialog.

The Flow Computer ID is checked before reading. If the Flow Computer ID does not match the ID in the dialog Realflo displays the following message.



Write Configuration

The Write Configuration command is used to write all or selected parts of the Flow Computer Configuration. When selected the command displays the Write Flow Computer Configuration dialog as shown below.



The **All Configuration** radio button, when selected, results in the writing of all configuration data from the flow computer.

The **Selected Configuration** radio button enables specific configuration data to be written to the flow computer.

- Select **Communication and I/O Settings** to write the serial port, register assignment configuration information and mapping table.
- Select **Flow Run and MVT Configuration** to write the flow run configuration and the MVT transmitter configuration.
- Select **Process I/O Configuration** to write the Process I/O configuration.

Click on the **OK** button to write the selected items to the flow computer.

Click the **Cancel** button to cancel the operation and close the dialog.

- The Flow Computer ID is checked before writing. If the Flow Computer ID does not match the ID in the dialog Realflo displays a message.
- An error occurs if Controller Configuration is selected and the flow computer type is different from the flow computer type selected in the Controller Type dialog. A message is displayed.

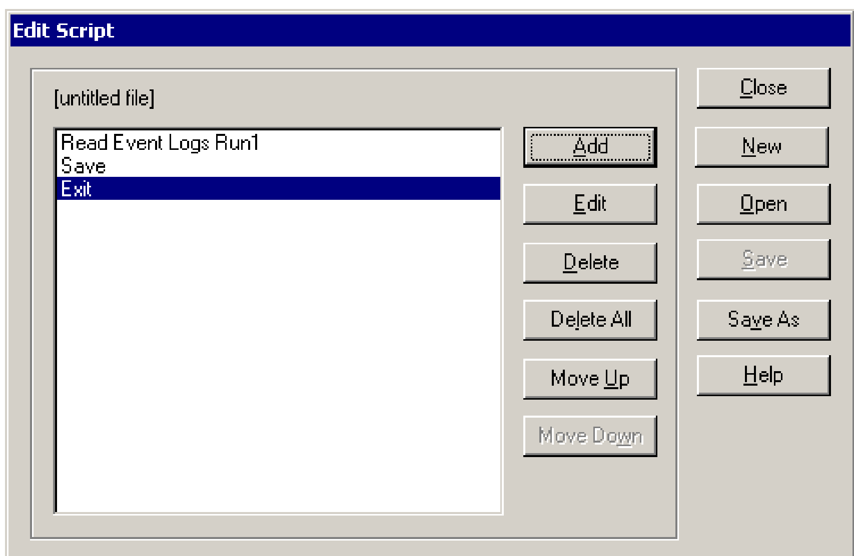
In Flow Computer versions 6.73 and older, when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers. The Actual registers are not updated until a new Density calculation is started with the new values. The new values are not available to SCADA host software reading the Actual registers until a until a new Density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers and in the Actual registers. This allows a SCADA host to immediately confirm the new values were written to the flow computer. The new gas values are not used by the flow computer until a new density calculation is started.

Edit Script

Use this command to edit Realflo script commands. Scripts are text files that contain a list of Realflo commands. The script files can be executed either manually, (under direct control of the user) or automatically, (under control of another program).

The Edit Script command opens the **Edit Script dialog**.



This command edits and saves script files that can be accessed by Realflo applications. The script file is not related to the currently open Realflo application. The script command line determines which Realflo application executes which script file.

The Edit Script dialog consists of the currently opened script file name, a list of commands configured in the opened script, script configuration command buttons and Edit Script dialog command buttons.

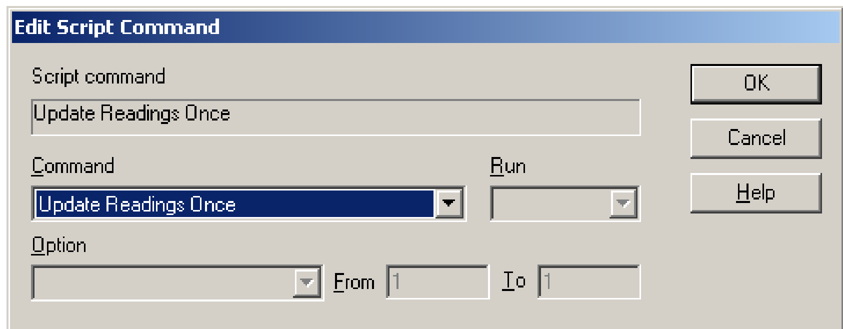
The currently opened script file name displays the file name of the currently opened script file. The format is `X:\…..…\file name.aut`, where `X` is the disk drive letter assignment, `\……\` is the subdirectory or subdirectories where the script file is located, `file name` is the script file name and `.aut` is the file name extension.

In the above example the opened script file is called `Meter1 Script File.aut` and is located in the `C:\Program Files\Realflo` subfolder. When the Edit Script command is selected, a script file is not yet open. The file name is displayed as `[untitled file]` in this case.

The configured command list displays the commands that have be configured for the open script file. These commands are configured with the **Add** and **Edit** commands and are executed in the order that they appear in the command list. Listed commands may be acted upon by selecting the particular command, with the cursor, and then executing one of the script configuration commands.

The script configuration commands are used to configure the script file.

The **Add** command opens the Edit Script Command dialog for the configuring of a new script command.



The **Script command** field displays the currently selected script command as determined by the Command field.

The **Commands** dropdown menu displays the list of available commands for selection. Selecting the arrow icon with the cursor will make these commands visible for selecting. For commands the **Run** dropdown menu selects the meter run for the command. The commands are:

- **Update Readings Once.** Use this command to update the Current Readings once from the flow computer for the selected **Run**.
- **Read Event Logs.** Use this command to read the event log for the selected **Run**. The Option selection allows for **All** events or **New** events.
- **Read Alarm Logs**. Use this command to read the alarm log for the selected **Run**. The Option selection allows for **All** alarms or **New** alarms.
- **Read Hourly History**. Use this command to read the hourly history for the selected **Run**. The Option selection allows for **All** hourly history or for a selected **Period**.
- **Read Daily History**. Use this command to read the daily history for the selected Run. The Option selection allows for All daily history or for a selected Period.
- **Export Readings**. Use this command to export the Current Readings data in the flow computer to a CSV file. Name of CSV file is: <*Realflo file name*> - TFR< *Run Number* > <(Run ID)>.CSV
- **Export Event Logs**. Use this command to export the Event Log data in the flow computer to a CSV file. The Option selection allows for **All**

alarms or for a selected **Period**. Name of CSV file is: <*Realflo file name*> - TFE< *Run Number* > <(Run ID)>.CSV

- **Export Alarm Logs**. Use this command to export the Alarm Log data, for the selected **Run**, from the flow computer to a CSV file. The Option selection allows for **All** alarms or for a selected **Period**. The CSV file name is: <*Realflo file name*>-TFA<*Run Number*>.CSV
- **Export Hourly History**. Use this command to export the Hourly History data, for the selected **Run**, from the flow computer to a CSV file. The Option selection allows for **All** alarms or for a selected **Period**. The CSV file name is: <*Realflo file name*> - TFH<*Run Number*> <(Run ID)>.CSV
- **Export Daily History**. Use this command to export the Daily History data, for the selected **Run**, from the flow computer to a CSV file. The Option selection allows for **All** alarms or for a selected **Period**. The CSV file name is: <*Realflo file name*> - TFD<*Run Number*> <(Run ID)>.CSV
- **Export Specific CFX**. Use this command to export configuration, current readings, alarm log, event log and hourly history in the flow computer to a CFX file. Data are exported to a single file for each run. The Option selection allows for **All** events, alarms and logs or for a selected **Period**. The name of the CFX file is <Realflo file name>(<FC ID>) - <Run Number> (<Run ID>).CFX.
- **Export Dated CFX**. Use this command to export configuration, current readings, alarm log, event log and hourly history in the flow computer to a CFX file. Each day's data is exported to a separate file. The file name is based on the time and date according to the CFX standard (YYYYMMDD.CFX). The Option selection allows for **All** events, alarms and logs or for a selected **Period**. Files for each run are saved to a folder. The name of the folder is <Realflo file name>(<FC ID>) - <Run Number> (<Run ID>).CFX.
- **Read Flow Run Configuration**. Use this command to read the Flow Run Configuration for the selected **Run**. The Option selection allows for **All** runs to be read.
- **Export Flow Run Configuration**. Use this command to export the Flow Run Configuration, for the selected **Run**, from the flow computer to a CSV file. The Option selection allows for **All** runs. The CSV file name is: <*Realflo file name*> - TFC<*Run Number*> <(Run ID)>.CSV
- **Save**. Use this command to save the Realflo application files.
- **Exit**. Use this command to close Realflo.

The **Option** dropdown menu is used to define the limits of some of the commands. The selections available depend on the command selected.

- The **All** selection specifies all the data for a command.
- The **New** selection specifies only new alarms and events for the Read Events and Read Alarms commands.
- The **Period** selection specifies a **From** and **To** period of data for the command. For hourly data the From entry is the oldest hour and the To entry is the newest hour. For daily data the From entry is the oldest contract day and the To entry is the newest contract day. For either entry 0 is the current hour or contract day, 1 is the previous hour or contract day, etc.

The **OK** button retains the settings for the current script command and closes the Edit Script Command dialog.

The **Cancel** button discards any new changes to the current script command and closes the Edit Script Command dialog.

The **Help** button displays help for the dialog.

The **Edit** button opens the Edit Script Command dialog to edit the currently selected command. This command will appear in both the Script command and Command fields in the Edit Script Command dialog. See the **Add** command for details on the Edit Script Command dialog. This command is grayed if the command list is empty.

The **Delete** button removes the currently selected command from the command list. This command is grayed if the command list is empty.

The **Delete All** button removes all commands from the command list. This command is grayed if the command list is empty.

The **Move Up** button moves the currently selected command up one position in the command list. This command is grayed if the command list is empty or if top command in the list is selected.

The **Move Down** button moves the currently selected command down one position in the command list. This command is grayed if the command list is empty or if the bottom command in the list is selected.

The edit script dialog commands are used to manage the script files for editing.

The **Close** button closes the Edit Script dialog. If a script file has been configured but not yet saved, a dialog will appear prompting the user to save the changes to a script file. The Save As dialog is displayed. (see the **Save As** command section for more information).

The **New** button is used to create a new script. If changes have been made to the current script you will be asked if you wish to save the changes first. Once the changes have been saved, or not, the ***Edit Script*** dialog is opened.

The **Open** button opens an existing script file for editing. If the current command list has not yet been saved to a script file, a dialog will appear prompting the user to save the changes to a script file. When the **Open** command is used the Open dialog is displayed. The following options allow the user to specify which file to open.

- The **Look in:** box lists the available folders and files.
- The **File name:** box allows you to type or select the file name you want to open. This box lists files with the script file extension “aut”.
- The **Files of type:** box displays the only type of file that this command can open: Realflo script files, with the file extension “aut”.
- The **Open** command opens the script file that is displayed in the **File name:** box and closes the Open dialog. The commands contained in the script file are displayed in the command list.
- The **Cancel** command cancels the **Open** command and closes the Open dialog.

The **Save** button saves the currently open script file. This command is grayed if the script file has not been saved using the **Save As** command.

The **Save As** button saves the current command list to either an existing or new script file. This command is grayed if the command list is empty.

The Save As dialog is displayed with the following options to allow the user to specify the script file name.

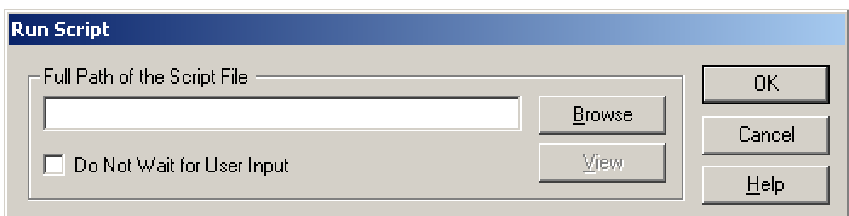
- The **Save in:** box lists the available folders and files.
- The **File name:** box allows you to type or select the file name you want to save.
- The **Save as type:** box displays the only type of file that this command can save: Realflo script file, with the file extension “aut”.
- The **Save** command saves the current command list to the script file specified in the **File name**: box and closes the Save dialog.
- The **Cancel** command cancels the **Save As** command and closes the Save As dialog.

Realflo 6.70 files are compatible with files saved using earlier versions of Realflo.

- The Help button displays help for the dialog.

Run Script

The Run Script command enables the user to manually execute Realflo script files. This command is disabled if the Update Readings command is enabled. The Run Script command opens the **Run Script dialog**.



Enter the Realflo script file name and path in the **Full Path of the Script File** window or select the **Browse** button and find the Realflo script file.

Once a Realflo script file is entered in the Full Path of the Script File window the **View** button opens the **View Script** window. The View Script window displays the Realflo script commands.

Check the **Do Not Wait for User Input** to run the script without input from the user. The script will run without displaying dialog boxes to the user. This is equivalent to running a script in the No Window mode from the command line.

The **OK** button closes the Run Script dialog and executes the script file.

The **Cancel** button closes the Run Script dialog without executing the script file.

The **Help** button displays help for the dialog.

Log Results

The Log Results command allows the user to set if the results of the script command execution is logged or not. When the **Log Results** menu is checked, the results of the script-enabled Realflo operations will be written into a log file. The results are saved in a text file as *Realflo file name*.LOG.

The log information consists of three parts as follows:

Time stamp	Operation	Result

The **Time stamp** indicates the date and time at the end of the operation. The date is recorded using the short date format defined in the Control Panel. The time is recorded using the time format defined in the Control Panel.

The **Operation** indicates the script command that was executed.

The **Result** indicates the normal result or error message.

For example,

2001/05/28 15:20:30 – Update Readings

2001/05/28 15:20:30 -- Read Event Logs Run1 – 5 Events added, cancelled

2001/05/28 15:20:30 -- Read Alarm Logs Run2– Error: Controller did not respond

2001/05/28 15:20:30 -- Read Hourly History Run3 – 2 Hours added, Error: Controller did not respond

Automatic Script Execution

Automatic script execution allows the user to configure other applications to execute the Realflo script command automatically. Direct user-operation of Realflo is not necessary in this scenario. Realflo is completely run by another application.

Applications that would typically run a Realflo script file include HMI packages and custom interface applications. Refer to the HMI or application reference material for information on executing external programs.

Applications such as WindowsNT Scheduler enable tasks such as Realflo flow scripts to be executed on a timed basis. Refer to the Help files for your PC operating system for more information.

To run the Realflo script automatically, a command line has to be configured in the user application. The command line is in following format:

```
Realflo configfile.tfc /s=scriptfile.aut /NoWindow
```

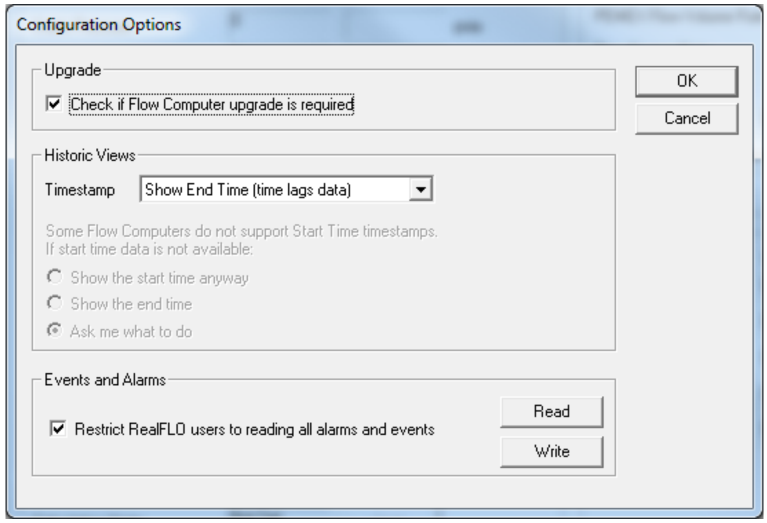
where /NoWindow is an option.

If the command line doesn't include the /NoWindow option, a Realflo application window will be displayed during script execution. A communication dialog will allow user to cancel current operation at any time.

If the command line includes the /NoWindow option then the Realflo application window is not displayed during script execution. The user cannot cancel script execution before it is completed. The application will exit after finishing the last script command, regardless of whether the script file includes the Exit command.

Options

The options command provides for configuration options to be set when writing flow computer configuration. Currently one option, Check if flow computer upgrade is required, is selectable.



Select **Check if Flow Computer upgrade is required** to enable tests of the flow computer version when writing flow computer configuration. Each time a configuration is written to the flow computer a check is made to see if the flow computer version is older than the version available in Realflo. This option is enabled by default.

The **Historic Views** options determine how historic views timestamps are displayed.

Timestamp selects if start times or end times are shown on historic records.

- Select **Show Start Time (time leads data)** to show the start time of the record. This is supported on flow computer 6.70 and later. This is the default value for PEMEX installations.
- Select **Show End Time (time lags data)** to show the end time of the record. This is the default setting for Standard and GOST installations.

Some Flow computers do not support Start Time timestamps. If you have chosen to show start times, and the start time data is not available, you can select what timestamps are shown. These selections are disabled if end times are selected above.

- Select **Show the start time anyway** to show the start time even if there is no data. Dashes will show in the start time column.
- Select **Show the end time** to automatically show the end time for the record.
- Select **Ask me what to do** to have Realflo prompt you if start time data is not supported. This is the default selection.

The **Restrict Realflo Users to reading all alarms and events** option defines how alarms and events are acknowledged.

- Selecting this option restricts all users to only reading all alarms or all events. Reading all alarms or all events does not acknowledge the alarms or events in the flow computer. Use this option to allow only the Host system to acknowledge alarms and events. This is the default selection.
- When this option Is not selected users with **View, Read and Write Data** and **Administrator** account privileges are able to Read New Events and

Read New Alarms. Reading new events and alarms will result in the events and alarms being acknowledged in the flow computer when they are read using Realflo.

Click **OK** to save the settings.

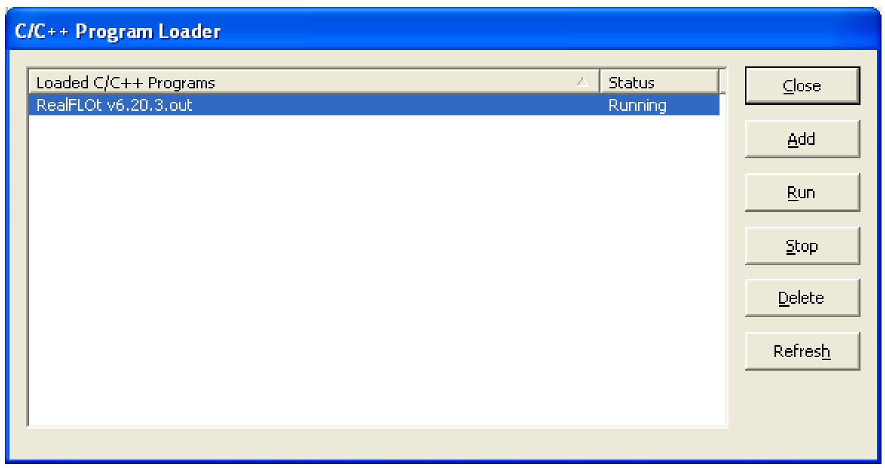
Click **Cancel** to discard changes and close the dialog.

C/C++ Program Loader

The C/C++ Program Loader command provides for downloading multiple C/C++ applications to a SCADAPack 314/330/334, SCADAPack 350 or SCADAPack 4203 controller. Each downloaded program can be individually started, stopped, erased, and loaded.

This command is only available when the SCADAPack 314/330/334, SCADAPack 350, SCADAPack 4203 hardware type is selected from the Setup dialog. The command is greyed out for other hardware types.

When C/C++ Program Loader command is selected, the controller type is polled by Realflo. If the controller type is a SCADAPack 314/330/334, SCADAPack 350, SCADAPack 4203then the C/C++ Program Loader dialog is displayed as shown below.



The dialog displays the C/C++ Programs that are loaded in the SCADAPack 314/330/334, SCADAPack 350, SCADAPack 4203 controller. The status of each program is indicated as **Running** or **Stopped**.

The **Close** button closes the dialog.

The **Add** button writes a new C/C++ program to the controller. Selecting the Add button opens the **Add C/C++ Program** dialog.

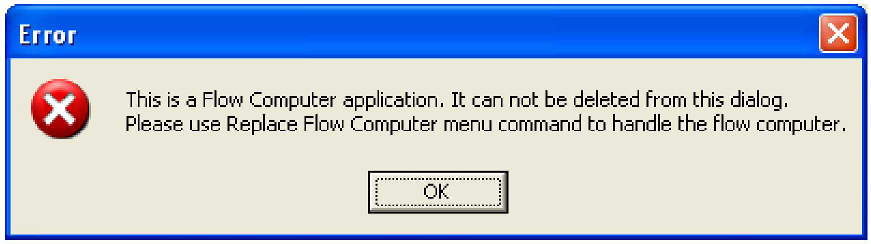
Only one flow computer program may be added to the C/C++ Programs list.

The **Run**, **Stop** and **Delete** buttons apply to the C/C++ Program selected from the list of loaded C/C++ programs. Only one C/C++ Program may be selected from the list at one time. These buttons are disabled when there are no C/C++ Programs loaded.

The **Run** button stops and restarts the selected C/C++ program in the controller.

The **Stop** button stops the selected C/C++ program in the controller.

The **Delete** button stops and erases the selected C/C++ program in the controller. However, if the current selected file is a flow computer, the following error message dialog will be displayed.



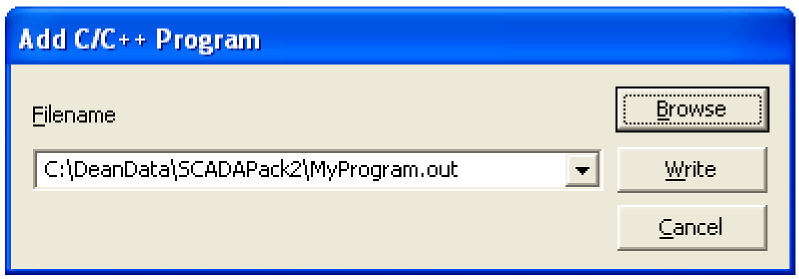
The **Refresh** button refreshes the list of loaded programs and their status.

Click on the column headings to sort the list by that column. Click a second time to reverse the sort order.

Add C/C++ Program Dialog

The Add C++ Program dialog writes a C/C++ Program to the controller.

Only one flow computer program may be added to the C/C++ Programs list.



File Name specifies the C/C++ Program to write to controller. The file name may be selected in a number of ways.

- Click on the **Browse** button to open a standard file open dialog.
- Use the drop-down menu to select the file from a list of previously written files.
- Type the path and file name directly into the edit box.

The **Write** button writes the selected file to the controller. The communication progress dialog box displays information about the write in progress, and allows you to cancel the write. If the file name is loaded already a prompt to replace the file or cancel is displayed.

When using DNP communication between Realflo and the target controller the DNP Application Layer timeout may need to be increased if a large C/C++ application is added. The default Application Layer timeout of 5 seconds may not be long enough.

The **Cancel** button exits the dialog without writing to the controller.

Accounts

The ***Accounts*** command in Realflo defines the security settings for Realflo and access to flow computers. The account information is stored both in **Realflo** and the **flow computer**. One user account, the ADMIN account, is automatically created. Up to 99 additional user accounts may be created.

When a new flow computer file is created, one Administrator level account is created with no PIN. Until the PIN is set or additional accounts are created, Realflo will automatically log on to this account.

The user account name and security level are displayed in the Status Bar of the Realflo display.

Account Information

Each Realflo account consists of the following information.

Item	Description	Limits
User ID	string identifying the account	maximum 8 characters
PIN	PIN used to access flow computer	Integer in range 1 to 65535
Access level	functions user has access to one of:	

- view and read data
- view, read data, and configure flow computer
- administrator (all of above plus administration of accounts)

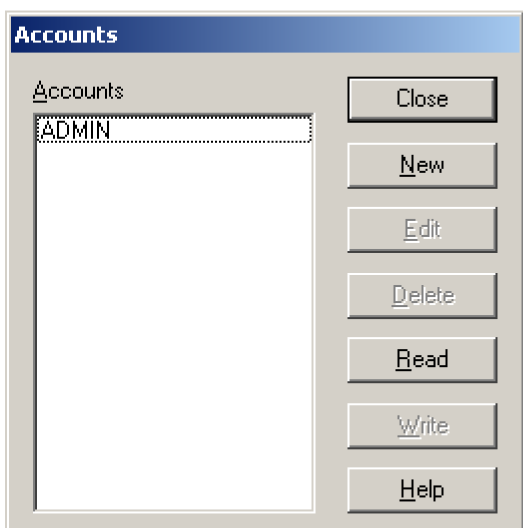
Account information is stored in the flow computer configuration file. PINs are encrypted.

The user needs to log on to an account when a flow computer file is opened.

If the account settings are not changed, then security is effectively disabled.

For security when accounts are created the default ADMIN account should be deleted and the changes written to the flow computer. This allows that only with accounts can access the flow computer.

When the Accounts command is selected the Accounts dialog is displayed as shown below.



The Accounts dialog has the following controls.

The **Accounts** list box displays the user ID for each defined account. The users IDs are listed in alphabetic order.

The **Close** button accepts the changes and closes the dialog. If the account that was active when the dialog was opened has been deleted, the user is logged off.

The **Add** button opens the **Add/Edit Account** dialog. The button is grayed if the maximum number of accounts is reached.

The **Edit** button opens the **Add/Edit Account** dialog. Fields in the dialog are set to the values for the currently selected account in the **Accounts** list box. This button is grayed if no account is selected.

The **Delete** button removes the currently selected account in the **Accounts** list box. This button is grayed if the account selected is the last Administrator level account.

The **Write** button writes the accounts to the flow computer. To write account information to the flow computer, a user needs to be logged on to an Administrator level account that has a corresponding account enabled on the flow computer. This button is grayed until accounts are read from the flow computer using the **Read** button.

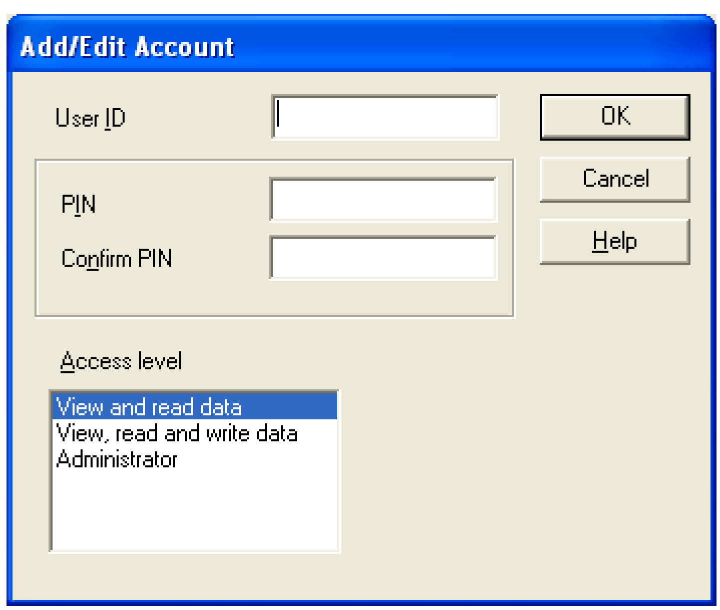
The **Read** button reads accounts from the flow computer. To read account information from the flow computer, a user needs to be logged on to an Administrator level account that has a corresponding account enabled on the flow computer. Account PINs are not stored in the flow computer. Reading an account from the flow computer that does not already exist in Realflo will result in an account with a blank PIN.

The flow computer ID is checked when accounts are written to or read from the flow computer. If the flow computer ID does not match the ID in the dialog Realflo displays the message " The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file."

The **Help** button displays the help for this dialog.

Add/Edit Account Dialog

The Add/Edit Account dialog edits information for an account. This dialog pops up when New or Edit is selected in the Accounts dialog. It has the following controls.



The **User ID** edit-box lists the user ID for the account. Any combination of letters and numbers up to eight characters in length is permitted. User IDs are case sensitive. For example the user ID “ADMIN” is different from “admin”. A corresponding User Number (used by the flow computer) is assigned to each user ID, in increasing order. **The ADMIN account is User Number 1).**

The **PIN** edit box contains the flow computer PIN for the account. This needs to be a number in the range 0 to 65535. The data in this field is masked with asterisks so it cannot be viewed.

The **Confirm PIN** edit box contains a second copy of the flow computer PIN for the account. This needs to be a number in the range 0 to 65535. The data in this field is masked with asterisks so it cannot be viewed.

The **Access Level** dropdown list contains the access level for the account.

View and read data level users can view data in Realflo and read new data from the flow computer. Users can also view any Custom Views assigned this security level. They cannot change the configuration, start or stop the calculations, set the clock, perform calibration or replace the flow computer program.

View, read and write data level users can view data in Realflo, read new data from the flow computer, change the configuration, start or stop the calculations, set the clock and perform calibration. Users can also view and write initial values for any Custom Views assigned this security level. Users with this access level cannot create or edit Accounts or replace the flow computer program. In PEMEX mode user at this level cannot make any changes to the communication settings, Process I/O, Sensor configuration or Store and Forward settings.

Administrator level users can perform the above functions plus administration of accounts. Users can also view, edit and write initial values for any Custom Views assigned this security level. Users with this access level can create or edit Accounts or replace the flow computer program.

The **OK** button accepts the entries and closes the dialog. The **PIN** and **Confirm PIN** fields need to match or a message is shown. Correct the values and press **OK** again.

The **Cancel** button discards the changes and closes the dialog.

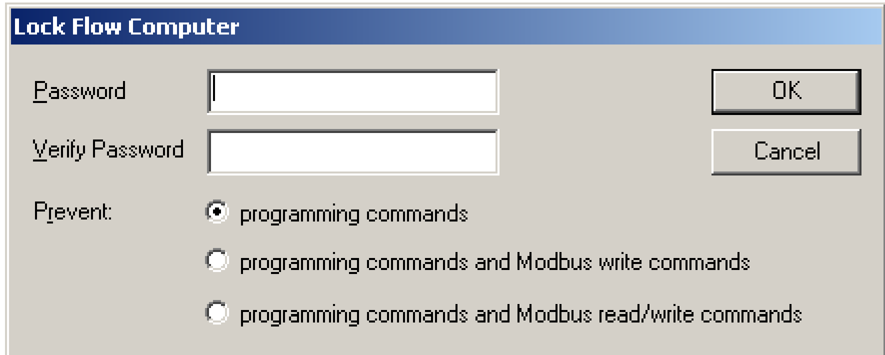
The **Help** button displays the help for this dialog.

Account PINs are not stored in the flow computer. Reading an account from the flow computer that does not already exist in Realflo will result in an account with a blank PIN.

Lock Flow Computer

Locking a flow computer stops unauthorized access. Commands sent to the flow computer when it is locked will be rejected. A flow computer that is unlocked operates without restriction.

The Lock Flow Computer dialog specifies a password to be used to lock the controller and the commands that are locked.



Enter a password in the **Password** edit box. Re-enter the password in the **Verify Password** edit box. Any character string up to eight characters in length may be entered. Typing in these edit boxes is masked. An asterisk is shown for each character typed.

The **Prevent** radio buttons select the commands that are locked.

- Locking the programming commands prevents modifying or viewing the program in the controller. Communication protocols can read and write the I/O database.
- Locking programming and database write commands prevents modifying or viewing the program and prevents writing to the I/O database. Communication protocols can read data from the I/O database, but cannot modify any data.
- Locking programming and database commands prevents modifying or viewing the program and prevents reading and writing the I/O database. Communication protocols cannot read or write the I/O database.

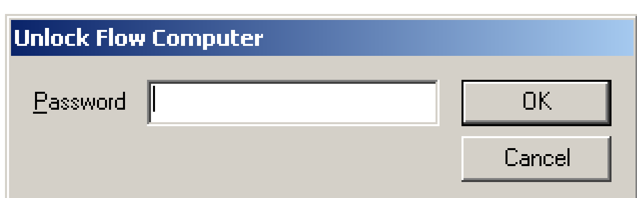
The **OK** button verifies the passwords are the same and sends the lock controller command to the controller. The dialog is closed. If the passwords are not the same an error message is displayed. Control returns to the dialog.

The **Cancel** button closes the dialog without any action.

If the controller is already locked, a message indicating this is shown instead of the dialog.

Unlock Flow Computer

The Unlock Flow Computer dialog prompts the user for a password to be used to unlock the flow computer. If the flow computer is locked, the following dialog is displayed.



- Enter the password that was used to lock the flow computer in the **Password** edit box. Typing in this edit box is masked. An asterisk is shown for each character typed.

The **Cancel** button closes the dialog without any action.

The **OK** button sends the *Unlock Flow Computer* command to the controller. If the password is correct the flow computer will be unlocked. If the password is not correct, the flow computer will remain locked.

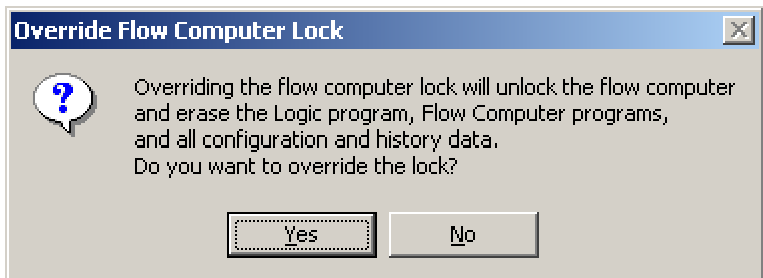
If you forget the controller password, the Override Flow Computer Lock command can be used to unlock the controller. It will erase programs in the controller.

Override Flow Computer Lock

The Override Flow Computer Lock dialog allows the user to unlock a flow computer without knowing the password. This can be used in the event that that the password is forgotten.

To stop unauthorized access to the information in the flow computer, the C and Logic programs are erased.

Selecting the Override Flow Computer Lock command displays the following dialog.



The **Yes** button unlocks the flow computer and erases programs.

The **No** button closes the dialog without any action.

Show Lock Status

The Show Lock Status command displays the flow computer lock state.

It opens a dialog showing one of the following states:

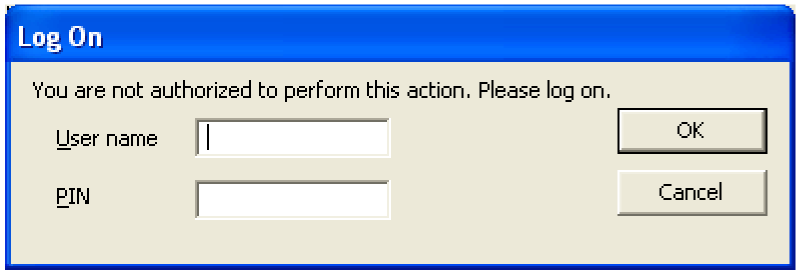
- unlocked
- locked against programming commands
- locked against programming commands and database write
- locked against programming commands and database read/write

The **OK** button closes the dialog.

Maintenance Menu

Log On

Use this command to log on to an account. This command is disabled if the Update Readings command is enabled. You need to enter the PIN for the account. This command is not available if there are no accounts created.



The Log On dialog has the following controls.

- Enter the user ID in the **User name** edit box.
- Enter the PIN number in the **PIN** edit box. Text entered in this edit box is masked (i.e. asterisks are printed instead of the text).

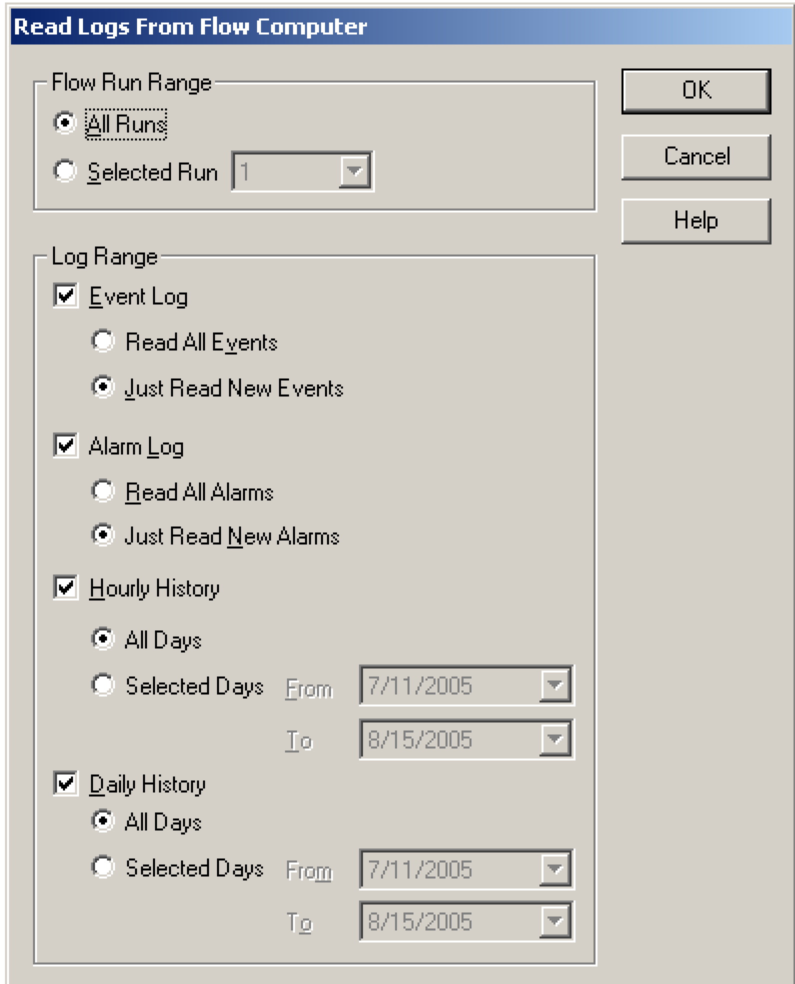
Click on **OK** button to accept the account name and PIN. If the PIN is correct, the user is given access. Otherwise the file is opened, but the user has no access to any data.

The **Cancel** button closes the dialog. No changes are made.

Read Logs/History

Use this command to update the history and event logs with information from the controller. This command is disabled if the Update Readings command is enabled. The Read Logs/History command opens the **Read Logs From Controller** dialog.

The flow computer ID is checked when the Read Logs/History command is selected. If the flow computer ID does not match the ID in the dialog Realflo displays the message " `The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file.`"



The **Flow Run Range** group of controls determines if data for all runs or for a single run is read.

- The **All Runs** radio button selects reading data for all runs.
- The **Selected Run** radio button selects reading from a single run. The drop-down list selects the run to be read.

The **Log Range** group of controls determines what data is read. The controls apply to all runs selected using the **Setup** command.

The **Event Log** check box selects if the event log is read.

- The **Read All Events** radio button selects the reading of all events in the controller. The control is grayed if the Event Log control is not selected.
- Select **Just Read New Events** to read unacknowledged events in the flow computer. If the operator has **View, Read and Write Data** or **Administrator** authorization then the events will be acknowledged after reading the new events. If the events in the log are not acknowledged, the event log will fill with 700 events. Operator activity will be prevented until the events are read and acknowledged. The control is grayed under the following conditions:
    - The event log is not selected.

- The user has **Read and View** account privileges.
- The **Restrict Realflo users to reading all alarms and events** option is selected in the Expert Mode Options menu.

The **Alarm Log** check box selects if the alarm log is read.

- Select **Just Read New Alarms** to read unacknowledged alarms in the flow computer. If the operator has **View, Read and Write Data** or **Administrator** authorization then the alarms will be acknowledged after reading the new events. If the events in the log are not acknowledged, the alarm log will fill with 300 events. Operator activity will be prevented until the alarms are read and acknowledged. The control is grayed under the following conditions:
  - The alarm log is not selected.
  - The user has **Read and View** account privileges.
  - The **Restrict Realflo users to reading all alarms and events** option is selected in the Expert Mode Options menu.

The **Hourly History** check box selects if the hourly history is read.

- The **All Days** radio button selects reading hourly history for all days stored in the controller.
- The **Selected Days** radio button selects reading hourly history for the range of days selected with the From and to drop-down lists. All records are read for the contract days whose first hour is within the date range. All records for the contract day are read, regardless of their calendar date. This may result in records with calendar days outside the range being added to the log. For example, if the contract day is configured to start at 7:00 AM. Reading hourly history for September 23 would return all the records where the first record in a day was between 7:00 on the 23rd to 6:59:59 AM on the 24th.

The **Daily History** check box selects if the daily history is read.

- The **All Days** radio button selects reading hourly history for all days stored in the controller.
- The **Selected Days** radio button selects reading hourly history for the range of days selected with the From and to drop-down lists. All records are read for the contract days whose first record is within the date range. All records for the contract day are read, regardless of their calendar date. This may result in records with calendar days outside the range being added to the log. For example, if the contract day is configured to start at 7:00 AM. Reading daily history for September 23 would return all the daily records whose end time is in the range 7:00 on the 23rd to 6:59:59 AM on the 24th.

The **From** controls contain the oldest previous day for which the hourly or daily history is to be read. The initial value is 35 days before the current day. The control is enabled when the **Hourly History** or **Daily History** checkbox is checked and the **Selected Days** radio button is selected. Change this date to avoid reading data that has previously been read into the log.

The **to** controls contain the recent previous day for which the hourly or daily history is to be read. The initial value is the current day. The allowed range is the same or greater than the value in the **From** control. The control is enabled when the **Hourly History** or **Daily History** checkbox is checked and the **Selected Days** radio button is selected. Change this date when wanting to read older data only. Leaving this date at its default will result in the recent data being read.

The dates are formatted using the **short date style** from the Date page of the Regional Settings in the Control Panel.

The **OK** button reads the selected logs from the controller. If no log is selected, the dialog is closed with no further action.

The **Cancel** button closes the dialog.

The **Help** button invokes the Help engine and displays the help page for this dialog.

Calibration

Use this command to calibrate the temperature sensor, static pressure sensor, and differential pressure sensor or pulse counter input. This command is disabled if the Update Readings command is enabled. The calibration dialogs lead you through the calibration procedure.

When more than one sensor is selected, they are forced and then the calibration cycle will be allowed for each sensor in turn. This allows multiple variable transmitters such as the MVT to be calibrated.

The flow computer ID is checked when the calibration command is selected. If the flow computer ID does not match the ID in the dialog Realflo displays the message “ The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file.”

WARNING
The same input sensor can be used for more than one flow run. When the sensor is calibrated for one run, Realflo only forces the input value for that run. When the sensor is disconnected to do the calibration, the live input to the other run will be disconnected and the value will not be correct. The flow computer does not support forcing of inputs during calibration on more than one run.

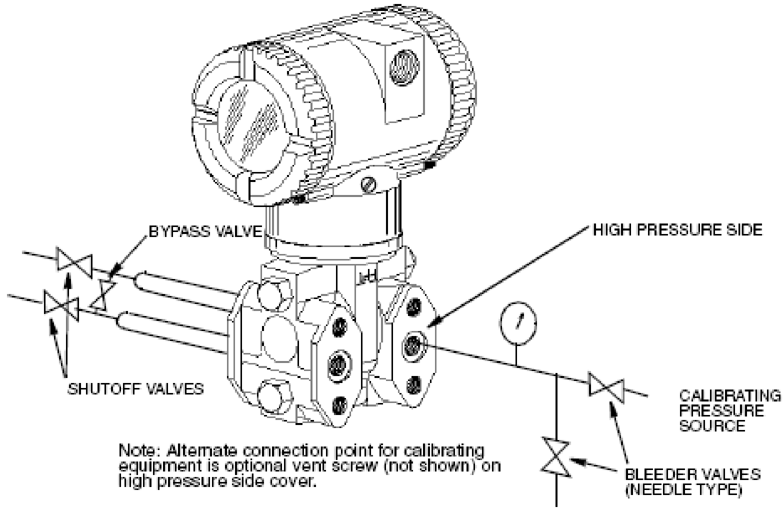
Inputs from an MVT may be used by more than one run. The flow computer supports calibration of an MVT that has inputs used by multiple flow runs.

After the run is selected, the configuration for the run is read from the flow computer. The calibration selection page for the run is then displayed.

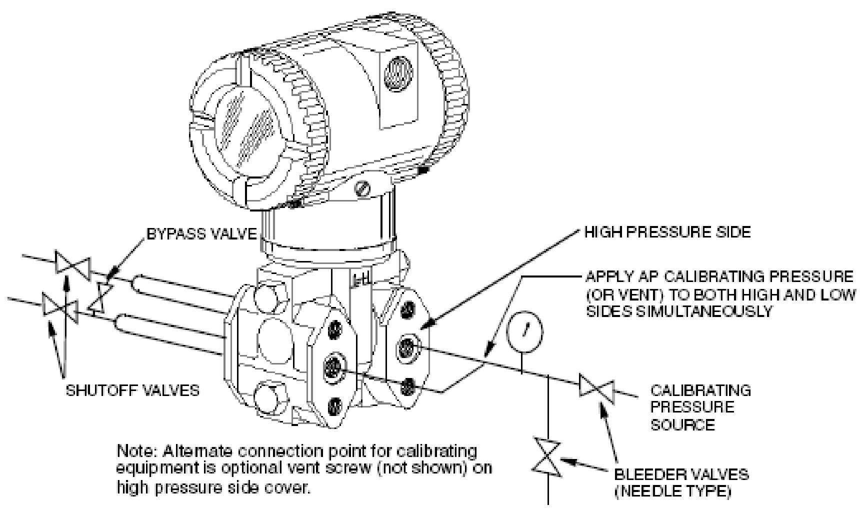
Connections for SCADAPack Sensor Calibration

It should be noted that when an Absolute (Static) Pressure calibration is performed the bypass or cross feed valve on the manifold needs to be open. When performing a Differential Pressure calibration the bypass valve needs to be closed.

Differential Pressure Calibration Connections

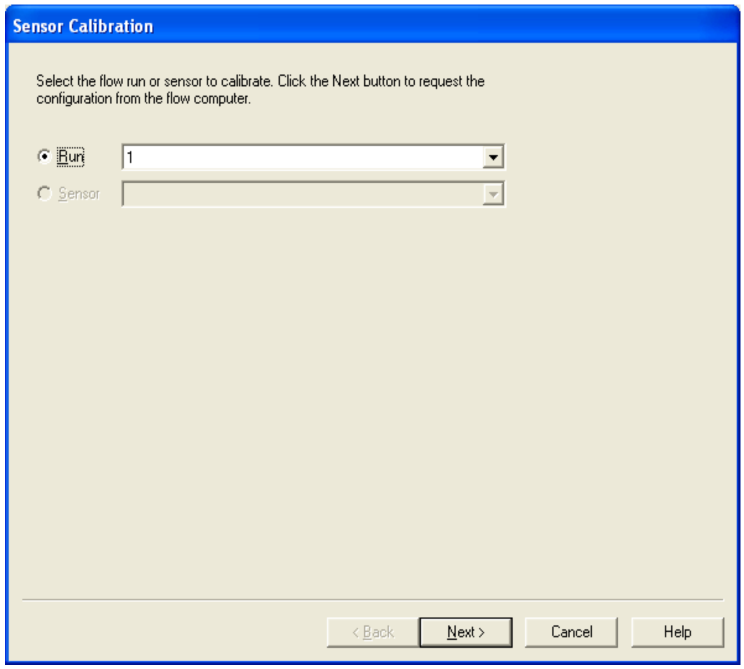


Absolute Pressure Calibration Connections



Sensor Calibration

When the ***Calibration*** command is selected the Sensor Calibration dialog is displayed. The **Run**, or **Sensor** transmitter, to be calibrated is selected from this dialog.



The Sensor Calibration dialog allows the selection meter run or MVT for calibration.

Select the **Run** radio button and then select a meter run to calibrate. Transmitters used for the meter run may be calibrated. This section is disabled if runs are using MVT transmitters.

- Follow the steps in the **Run Calibration Procedure**.

Select **Sensor** radio button and select one of the MVT tags to calibrate a MVT transmitter. The MVT tags that have been configured will be in MVT selection box.

- Follow the steps in the **Sensor Calibration Procedure.**

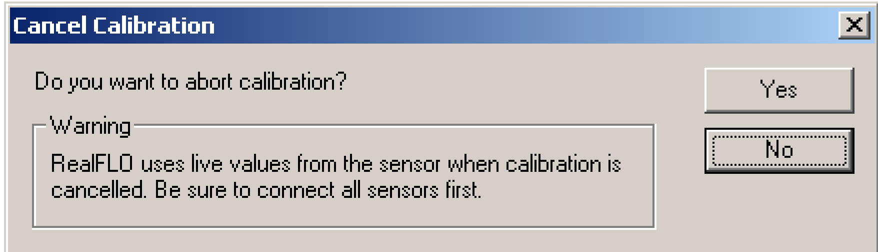
The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The back button is not enabled on the first step since there is no previous step.

The **Next>** button starts the calibration procedure. After the Run, or MVT, is selected, the configuration for the run is read from the flow computer. The Run, or MVT, calibration page for the run is then displayed.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

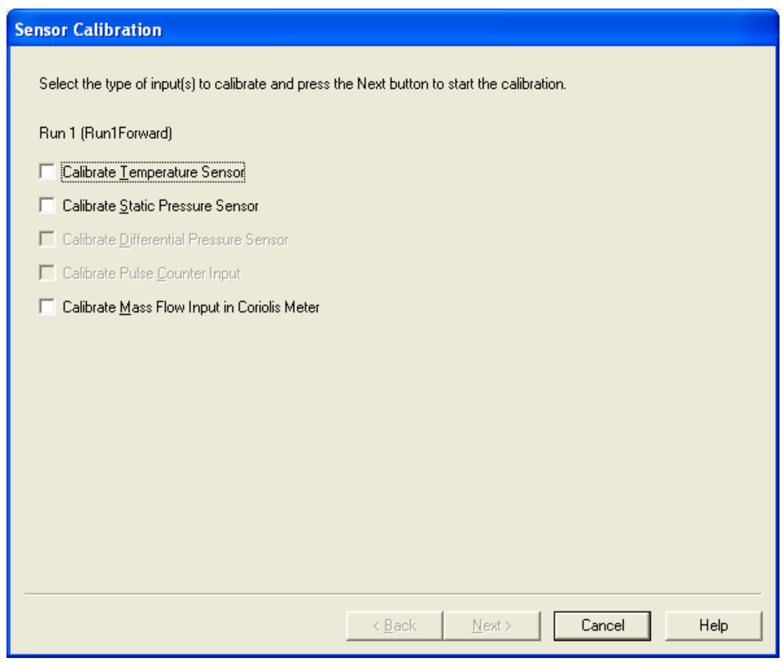
The **Help** button displays the online help file.

Run Calibration Procedure

When the **Run** radio button is selected the Run Calibration dialog is displayed. The transmitters for the run are selected for calibration from this dialog.

Realflo uses live values from the sensor when calibration is cancelled, connect all sensors first.

⚠WARNING
The same input sensor can be used for more than one flow run. When the sensor is calibrated for one run, Realflo only forces the input value for that run. When the sensor is disconnected to do the calibration, the live input to the other run will be disconnected and the value will not be correct. The flow computer does not support forcing of inputs during calibration on more than one run.



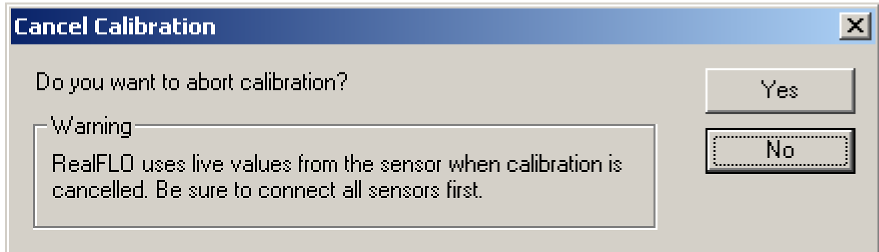
Select the sensors to be calibrated by checking the appropriate boxes. More than one sensor may be selected for calibration.

The **<Back** button is not enabled as this is the initial step.

The **Next>** button completes the selections and opens the Step 1: Force Value dialog.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



WARNING

Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

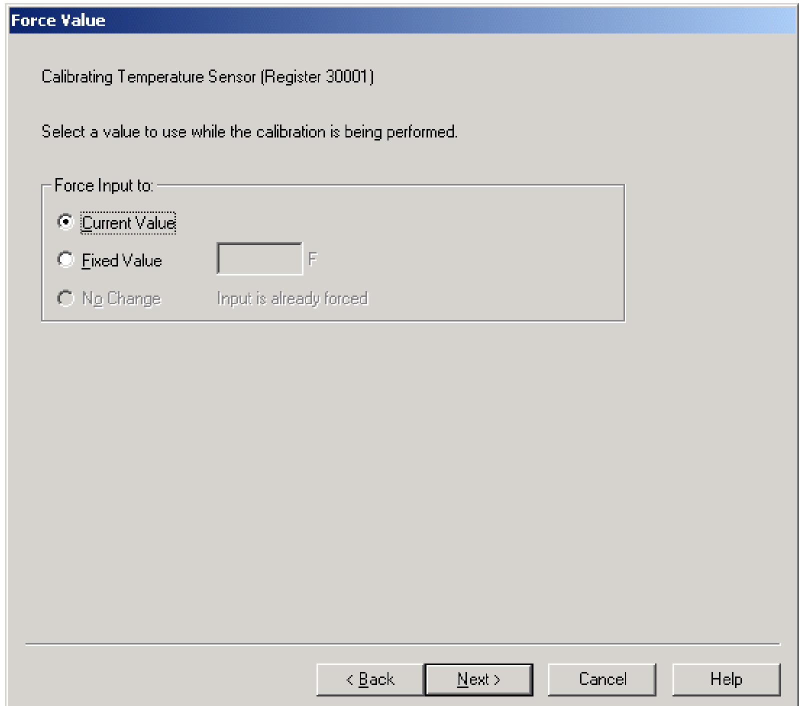
The **Help** button displays the online help file.

Calibration Step 1: Force Value

The flow calculations continue to execute while calibrating sensors. The sensor value needs to be forced to either the current value or a fixed value during calibration. This dialog lets you select the current value of the input or a fixed value of your choice.

If a sensor was forced before starting the execution of a calibration, the sensor will remain in a forced state after the calibration process is completed or even if the calibration process is cancelled before completion.

When more than one sensor is selected, they each need to be forced to a current or fixed value before any of the other steps are performed. A ***Step 1: Force Value*** dialog will be presented for each sensor selected for calibration.



The input register associated with this input is displayed to aid you in determining which input you are calibrating.

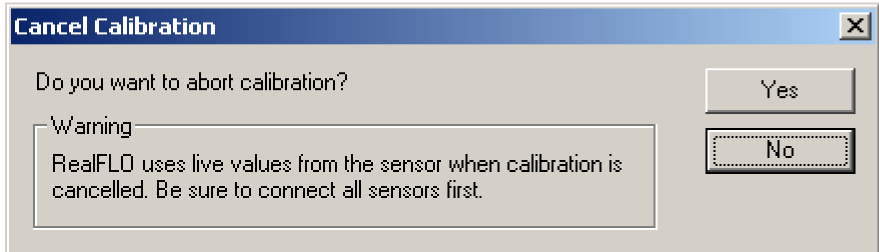
- Check the **Current Value** radio button to use the current value for the sensor.
- Check the **Fixed Value** radio button and enter a value to use for the calibration in the entry box.
- The **No Change** radio button will be selected if the value is currently forced. (You may still select one of the other two radio buttons if desired).

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

When the **Next>** button is pressed Realflo records the start of calibration for the sensor in the event log. The sensor input is forced. The sensor may now be disconnected from the process.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



⚠WARNING

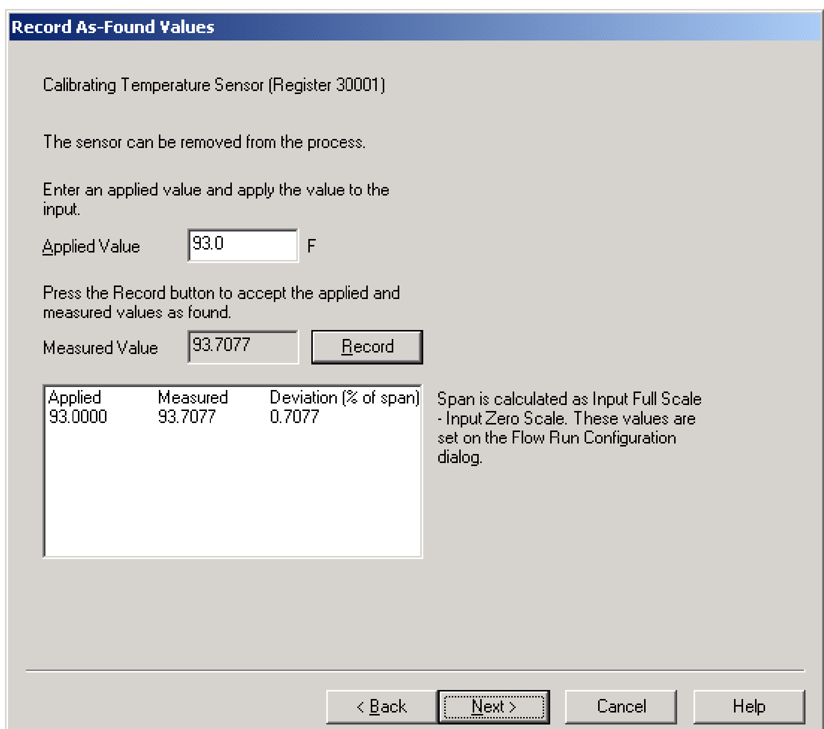
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 2: Record As Found Values

As-found readings indicate how the sensor was calibrated before adjustment. These can be used to correct flow measurement errors resulting from an out of calibration sensor. Follow the procedure your company has set for taking as-found readings. You need to record at least one as-found reading.



To take as-found readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.

- The measured value from the process is shown in the **Measured Value** box. When it has settled, click on the **Record** button to record an as-found reading.

Repeat the process to record additional readings.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

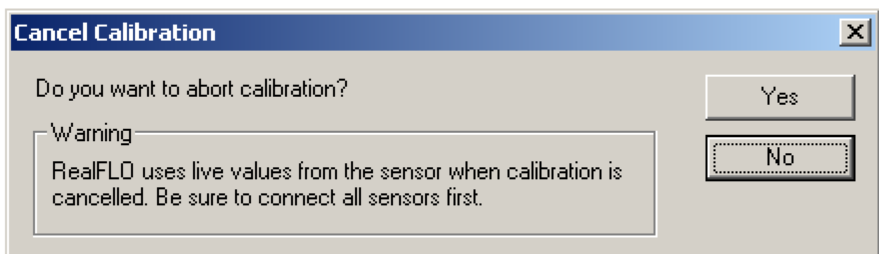
```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The **Next>** button proceeds to the next step.

The **Cancel** button is greyed and an as found reading needs to be recorded.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



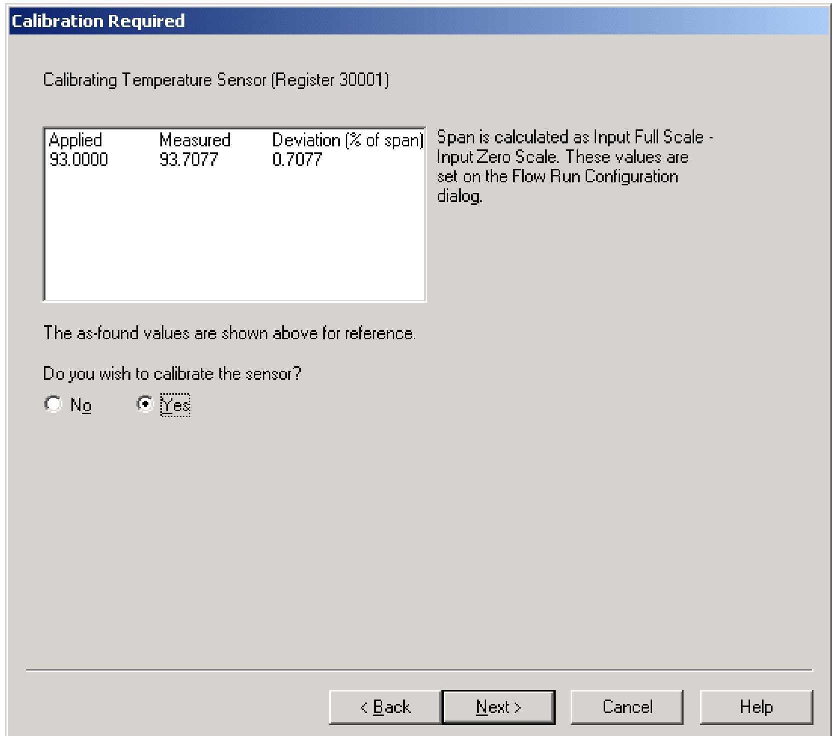
WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 3: Calibration Required

The as-found readings indicate if calibration is required. Examine the list of as-found readings. If the sensor is in need of calibration, select **Yes**. Otherwise select **No**.



As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

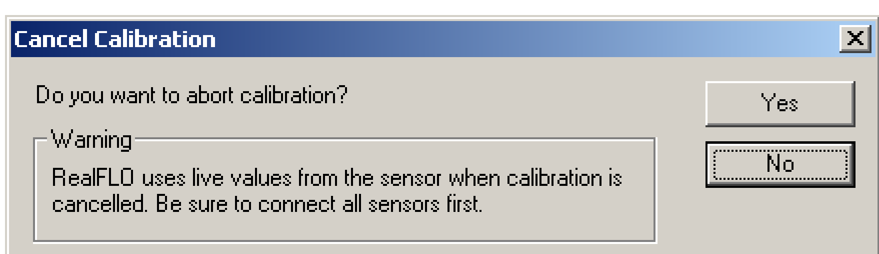
```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The **Next>** button proceeds to the next step.

The **Cancel** button is greyed and an as found reading needs to be recorded.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



WARNING

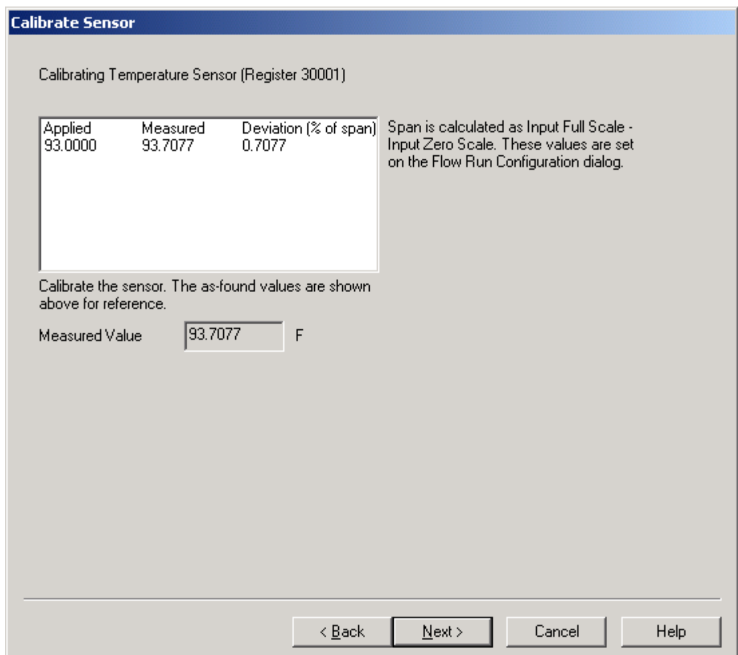
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 4: Calibrate Sensor

This dialog aids you in calibrating a sensor by displaying the measured value from the sensor and the as-found readings.



Follow the procedure your company or the sensor supplier has set to calibrate the sensor. When the sensor calibration is complete, you may wish to check the as-left measurements that will be recorded in the next step. This confirms that you have calibrated the sensor correctly before placing it back in service.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

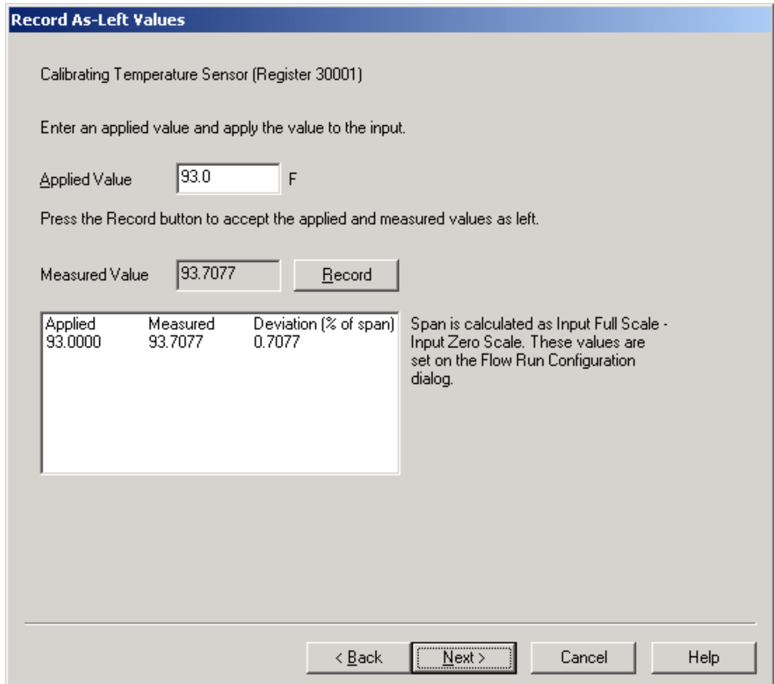
For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

Click on the **Next>** button when the calibration is complete.

Calibration Step 5: Record As Left Values

As-left readings indicate how the sensor was calibrated. These can be used to verify sensor calibration. Follow the procedure your company has set for taking as-left readings. You need to record at least one as-left reading.



To take as-left readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.
- The measured value from the process is shown. When it has settled, click on the **Record** button to record an as-left reading.

Repeat the process to record additional readings.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

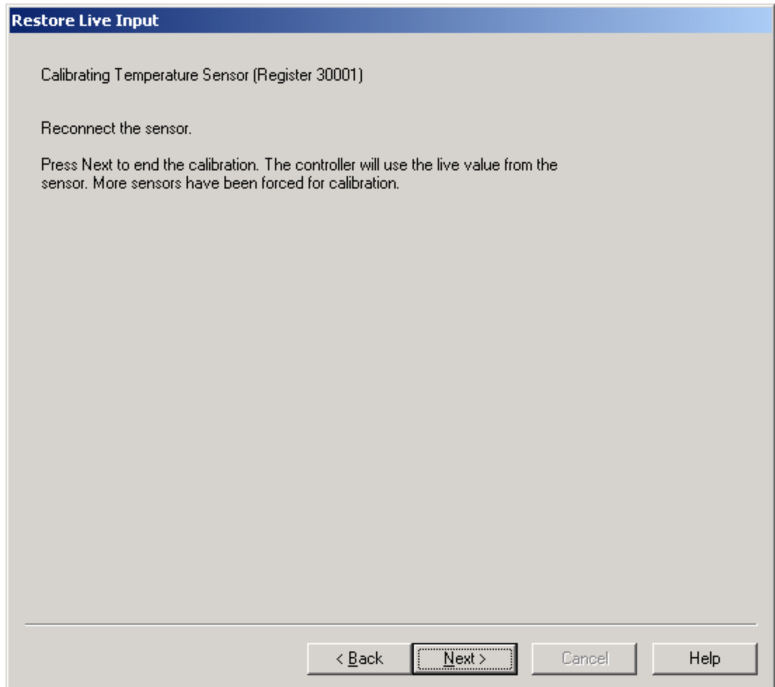
For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

- When required readings are taken, click on the **Next>** button.

Calibration Step 6: Restore Live Input

The sensors need to be reconnected to the process and the input hardware before calibration is complete. Reconnect sensors and verify connections are correct.

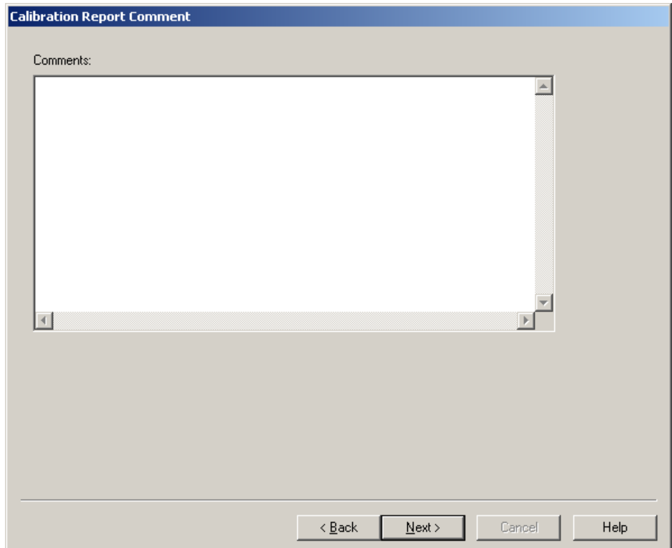


- Click on the **Next** button when the sensor is connected.

WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Calibration Step 7: Calibration Report Comment

Realflo creates, stores, and prints calibration reports for each calibration session performed. Comments may be added to the calibration report using the Calibration Report Comment dialog as shown below.

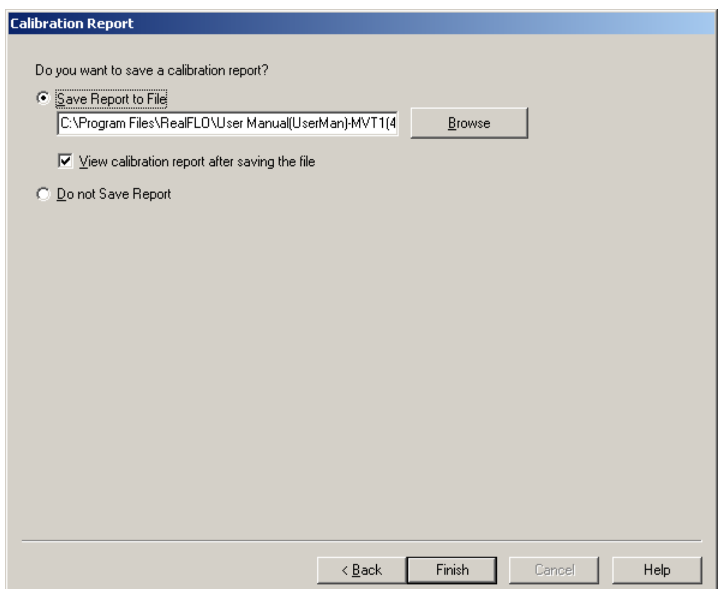


Enter any comments or leave the window blank.

- Click the **Next** button when completed entering comments.

Calibration Step 8: Calibration Report

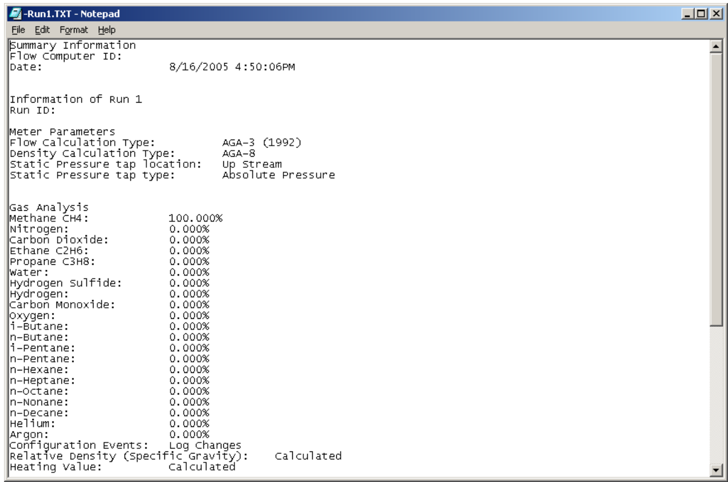
The Calibration Report dialog allows the saving of the calibration report.



- Select **Save Report to File** to save the report.
  - Type the name of the report in the Save Report to File window. The default location and name are specified on the ***Calibration Report Options*** dialog.
  - Select **Browse** to select a different file name.

- Check **View Calibration Report After Saving the File** to view the saved calibration report file. Default is checked.
- Select **Do not Save Report** to skip saving the calibration report.
- Click the Finis button to complete the calibration process.

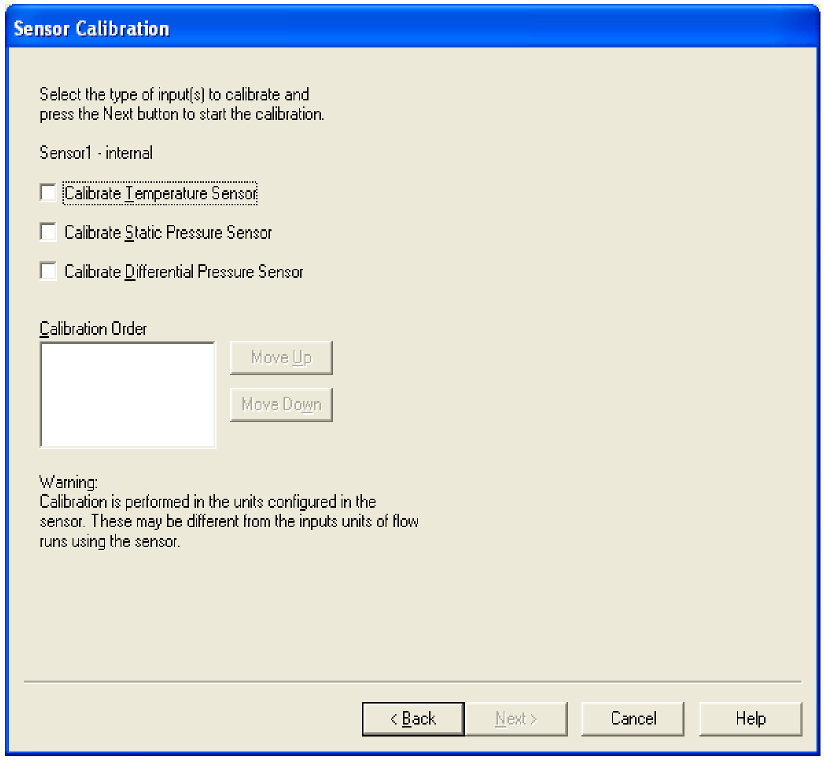
If selected the Calibration report will be displayed as shown below.




```
Summary Information
Flow Computer ID:
Date:                   8/16/2005 4:50:06PM


Information of Run 1
Run ID:

Meter Parameters
Flow Calculation Type:          AGA-3 (1992)
Density Calculation Type:       AGA-8
Static Pressure tap location:   Up Stream
Static Pressure tap type:       Absolute Pressure


Gas Analysis
Methane CH4:            100.000%
Nitrogen:               0.000%
Carbon Dioxide:         0.000%
Ethane C2H6:            0.000%
Propane C3H8:           0.000%
Water:                  0.000%
Hydrogen Sulfide:       0.000%
Hydrogen:               0.000%
Carbon Monoxide:        0.000%
Oxygen:                 0.000%
i-Butane:               0.000%
n-Butane:               0.000%
i-Pentane:              0.000%
n-Pentane:              0.000%
n-Hexane:               0.000%
n-Heptane:              0.000%
n-Octane:               0.000%
n-Nonane:               0.000%
n-Decane:               0.000%
Helium:                 0.000%
Argon:                  0.000%
Configuration Events:   Log Changes
Relative Density (Specific Gravity):    Calculated
Heating Value:          Calculated
```

Sensor Calibration Procedure

When the Sensor radio button is selected in the Sensor Calibration dialog the Sensor Calibration dialog is displayed.



The transmitter number, transmitter tag name, the communication port and the transmitter address associated with this transmitter are displayed to aid you in determining which input you are calibrating.

- Check the **Calibrate Temperature Sensor** check box to select the temperature sensor for calibration. This will add the ***Temperature*** to the Calibration order list box.
- Check the **Calibrate Static Pressure Sensor** check box to select the static pressure sensor for calibration. This will add the ***Static Pressure*** to the Calibration order list box.
- Check the **Calibrate Differential Pressure Sensor** check box to select the differential pressure sensor for calibration. This will add the ***Diff. Pressure*** to the Calibration order list box.

The **Calibration Order** list displays the list of sensors to be calibrated. Sensors are calibrated in order from the top of the list.

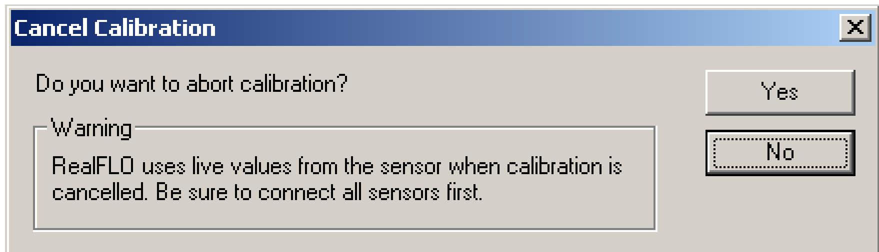
- Select **Move Up** button to move the specified item in the list up. The button is disabled if highlight item is on the top of the list or the list is empty.
- Select **Move Down** button to move the specified item in the list down. The button is disabled if highlight item is on the bottom of the list or the list is empty.

The **<Back** button is not enabled as this is the initial step.

The **<u>N</u>ext>** button completes the selections and opens the Step 1: Force Value dialog.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

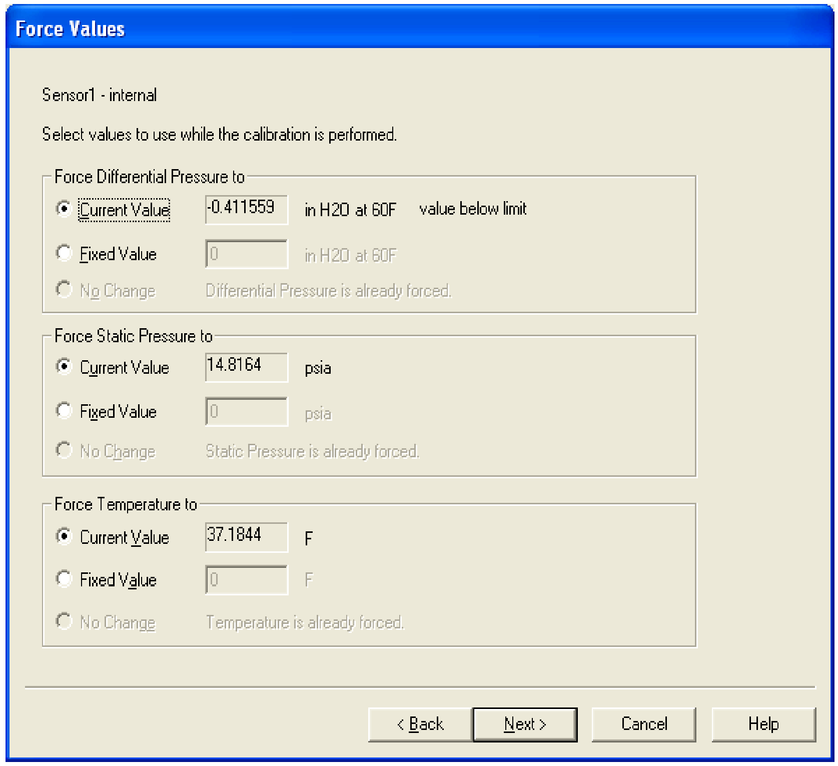
The **Help** button displays the online help file.

Calibration Step 1: Force Value

The flow calculations continue to execute while calibrating sensors. The sensor value needs to be forced to either the current value or a fixed value during calibration. This dialog lets you select the current value of the input or a fixed value of your choice.

If a sensor was forced before starting the execution of a calibration, the sensor will remain in a forced state after the calibration process is completed or even if the calibration process is cancelled before completion.

When more than one sensor is selected, they each need to be forced to a current or fixed value before any of the other steps are performed.



Select the value you wish to use, for each sensor, by clicking the appropriate radio button for each sensor.

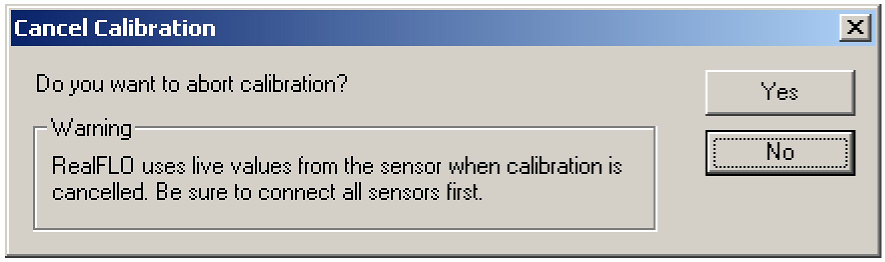
- Check the **Current Value** radio button to use the current value for the sensor.
- Check the **Fixed Value** radio button and enter a value to use for the calibration in the entry box.
- The **No Change** radio button will be selected if the value is currently forced. (Note: You may still select one of the other two radio buttons if desired).

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

When the **Next>** button is pressed Realflo records the start of calibration for the sensor in the event log. The sensor input is forced. The sensor can now be disconnected from the process.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



⚠WARNING

Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

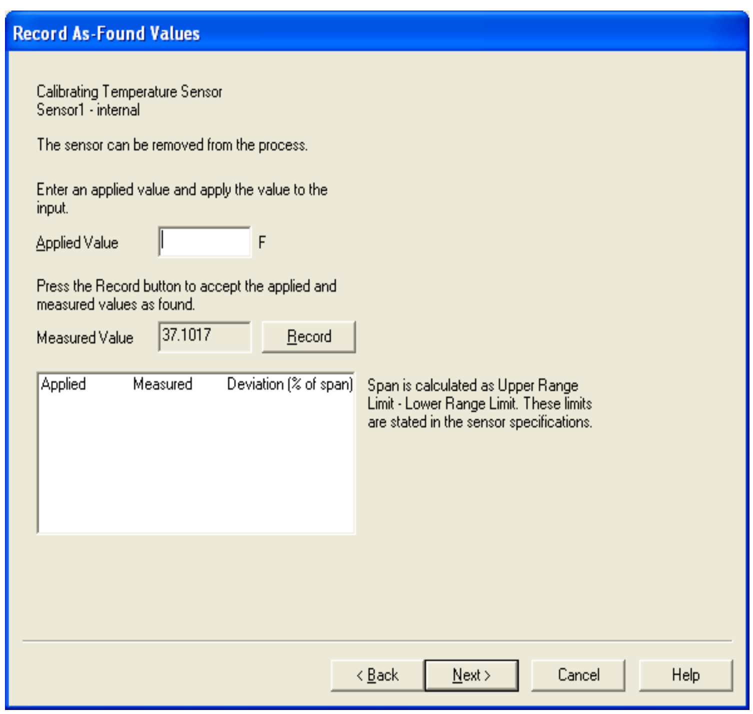
Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 2: Record As- Found Values

As-found readings indicate how the sensor was calibrated before adjustment. These can be used to correct flow measurement errors resulting from an out of calibration sensor. Follow the procedure your company has set for taking as-found readings. You need to record at least one as-found reading.

Realflo will record As Found values to the units type selected for the meter run. If the units type for the meter run and the MVT are not the same then the MVT units are scaled to the meter run units.



To take as-found readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.
- The measured value from the process is shown in the **Measured Value** box. When it has settled, click on the **Record** button to record an as-found reading.

Repeat the process to record additional readings.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Sensor Calibration the **deviation** is calculated as follows. The operating limits are read from the flow computer.

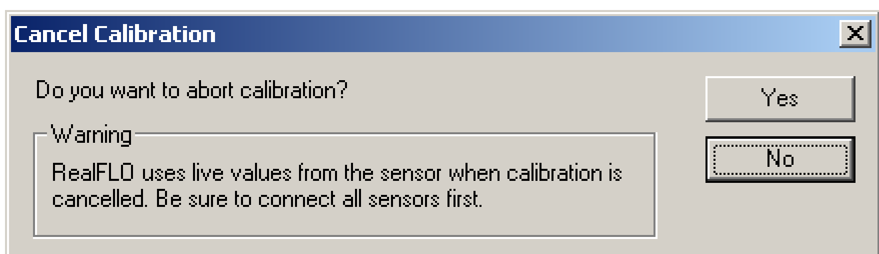
```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The **Next>** button proceeds to the next step.

The **Cancel** button is grayed and an as found reading needs to be recorded.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



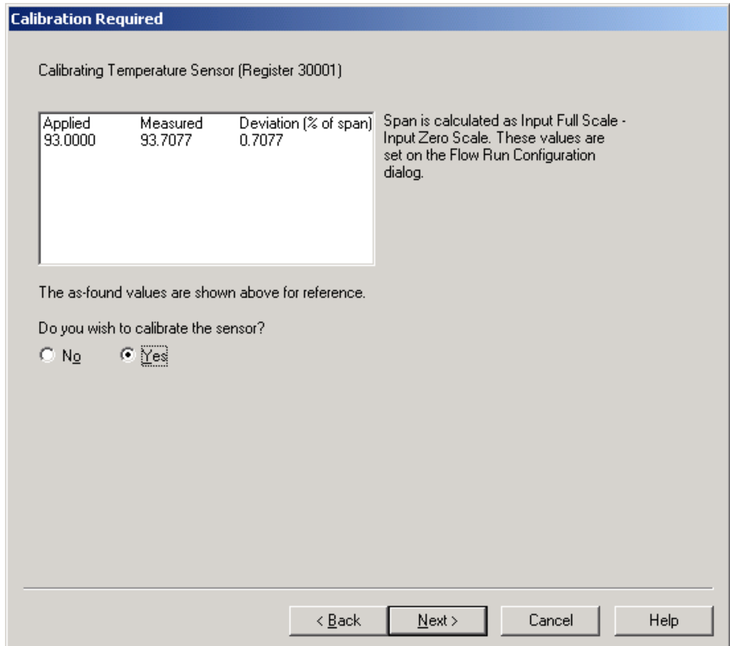
WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 3: Calibration Required

The as-found readings indicate if calibration is required. Examine the list of as-found readings. If the sensor is in need of calibration, select **Yes**. Otherwise select **No**.



As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

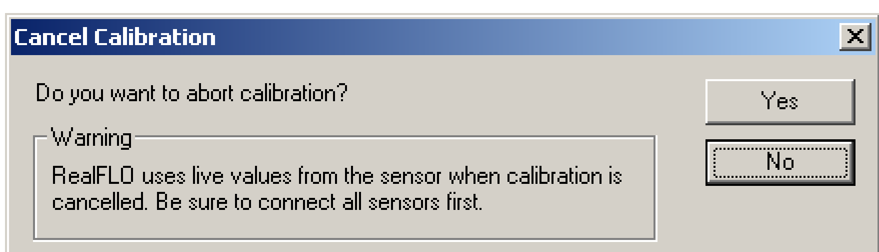
```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The **Next>** button proceeds to the next step.

The **Cancel** button is grayed out and an “as found reading” needs to be recorded.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



WARNING

Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 4: Calibrate SCADAPack 4101, 4202 or 4203

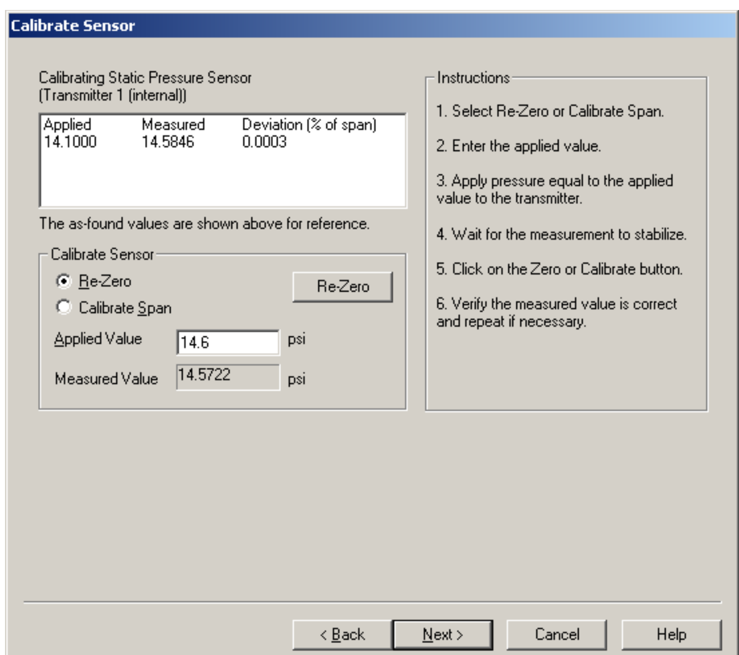
Step four in the calibration procedure varies depending on the type of transmitter being calibrated. Use this section if you are calibrating a SCADAPack 4101, 4202 or 4203 transmitter.

This dialog aids you in calibrating a sensor by displaying the measured value from the sensor and the as-found readings.

Follow the procedure your company or the sensor supplier has set to calibrate the sensor. When the sensor calibration is complete, you may wish to check the as-left measurements that will be recorded in the next step. This confirms that you have calibrated the sensor correctly before placing it back in service.

The Static Pressure can only have a span calibration performed if at least 5% of the rated pressure is applied.

The RTD Zero can only be adjusted +/- 1% of the RTD upper limit, typically 8.5 degrees C, relative to the settings used when a reset sensor command was last issued.



The list box displays the as-found values listed in the list of ***Record As-Found Values*** dialog.

The **Measured Value** displays the measured value from the sensor.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The

measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

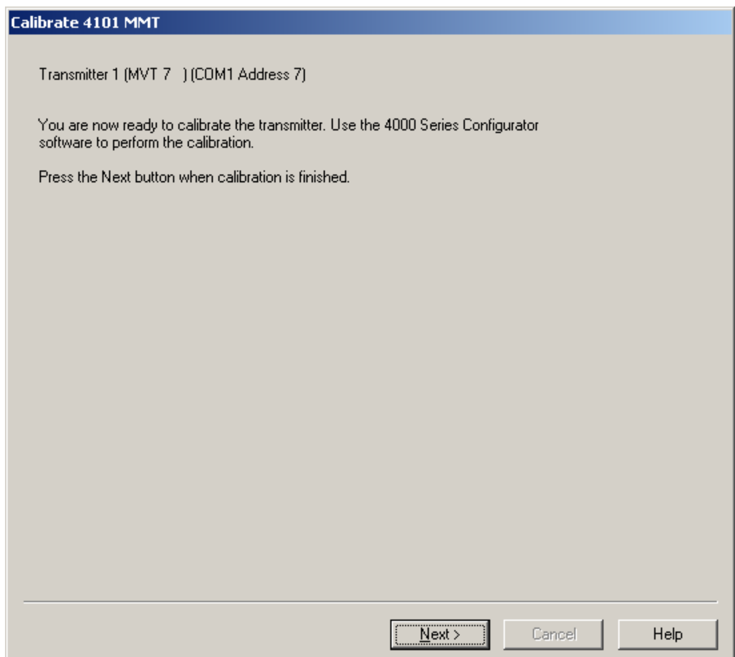
For MVT Calibration the deviation is calculated as follows. The operating limits are read from the flow computer.

```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

Calibration Step 4: Calibrate SCADAPack 4101

Step four in the calibration procedure varies depending on the type of transmitter being calibrated. Use this section if you are calibrating a SCADAPack 4101 transmitter.

The as-found readings, for each sensor, will indicate if calibration is required for the sensor. You are prompted to use the 4000 Configurator application to perform the calibration. The 4000 Configurator software is installed from the Control Microsystems Hardware Documentation CD.



The **Next>** button proceeds to the next step.

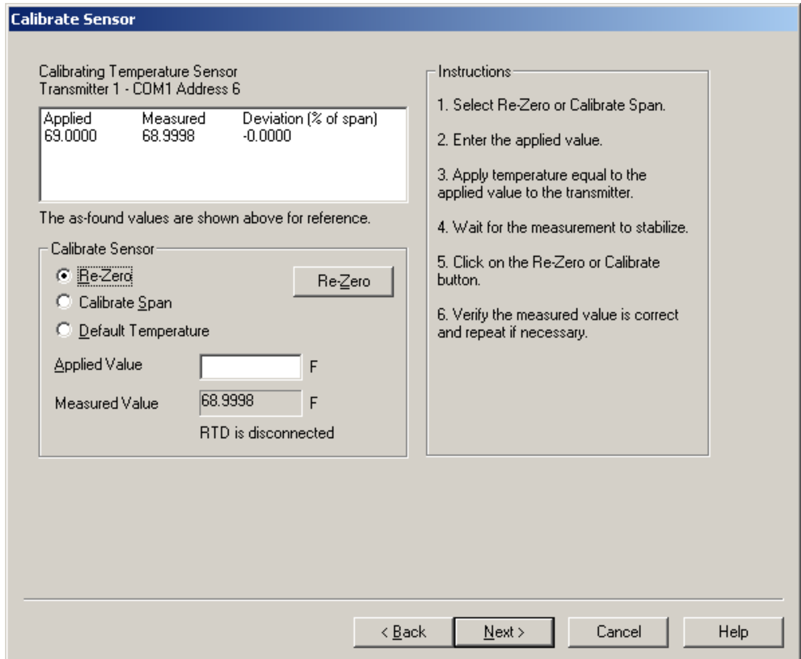
The **Help** button displays the online help file.

Calibration Step 4: Calibrate 3095 Transmitter

Step four in the calibration procedure varies depending on the type of transmitter being calibrated. Use this section if you are calibrating a 3905 transmitter.

This dialog aids you in calibrating a sensor by displaying the measured value from the sensor and the as-found readings.

Follow the procedure your company or the sensor supplier has set to calibrate the sensor. When the sensor calibration is complete, you may wish to check the as-left measurements that will be recorded in the next step. This confirms that you have calibrated the sensor correctly before placing it back in service.



The list box displays the as-found values listed in the list of ***Record As-Found Values*** dialog.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Sensor Calibration the deviation is calculated as follows. The operating limits are read from the flow computer.

```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

The Calibrate Sensor section of the Calibrate Sensor dialog displays the current calibration settings and selectable radio buttons for configuring the sensor calibration.

The Radio buttons enable the changing of the zero and span for the Temperature, Static Pressure and Differential Pressure sensors. For Temperature sensors, an additional radio button allows the user to fix the Temperature value in the event the temperature reading is outside the configured limits.

- Select the **Re-Zero** radio button to enable a new entry in the **Applied Value** field. This field displays the current zero value. The button is labeled **Re-Zero** if the **Re-Zero** radio button is selected. Clicking the **Re-Zero** button writes the zero applied value to the transmitter immediately.
- Select the **Calculate Span** radio button to enable a new entry in the **Applied Value** field. This field displays the current span value. The button is labeled **Calibrate** if the **Calibrate Span** radio button is selected. Clicking the **Calibrate** button writes the span applied value to the transmitter immediately.

When calibrating the temperature sensor you may select the **Default Temperature** radio button to enable a new entry in the **Applied Value** field.

The button is labeled **Set** if the **Default Temperature** radio button is selected. The transmitter returns the fixed temperature value if the RTD isnot working, or if the RTD is not connected. The valid range is –40 to 1200 °F or –40 to 648.89 °C. The default value is 60 °F or 15.56 °C. The new fixed temperature point is written to the transmitter immediately.

The **Measured Value** displays the measured value from the sensor.

Realflo records the points at which MVT calibration was performed in the event log.

Each time the **Re-Zero** button is clicked the following information is recorded.

Event Name	Target Re-zero Temperature
New Value	The applied value entered by the user
Previous Value	The measured value from the flow computer

Each time the **Calibrate** button is clicked the following information is recorded.

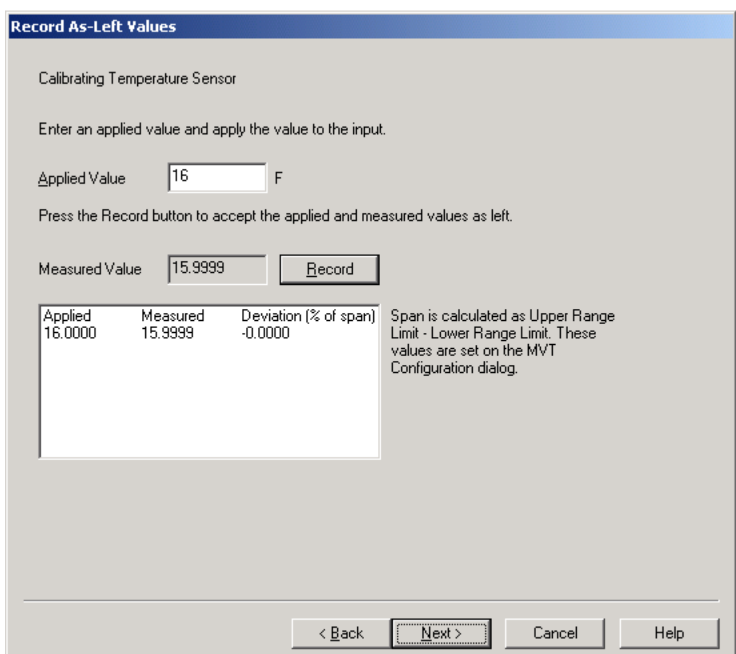
Event Name	Target Temperature Span
New Value	The applied value entered by the user
Previous Value	The measured value from the flow computer

Each time the **Set Default** button is clicked the following information is recorded.

Event Name	Set Default Temperature
New Value	The applied value entered by the user
Previous Value	The measured value from the flow computer

Calibration Step 4: Record As Left Values

As-left readings indicate how the sensor was calibrated. These can be used to verify sensor calibration. Follow the procedure your company has set for taking as-left readings. You need to record at least one as-left reading.



Realflo will record the As Found values to the units type selected for the meter run. If the units type for the meter run and the transmitter are not the same then the transmitter units are scaled to the meter run units.

To take as-left readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.
- The measured value from the process is shown. When it has settled, click on the **Record** button to record an as-left reading.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Sensor Calibration the deviation is calculated as follows. The operating limits are read from the flow computer.

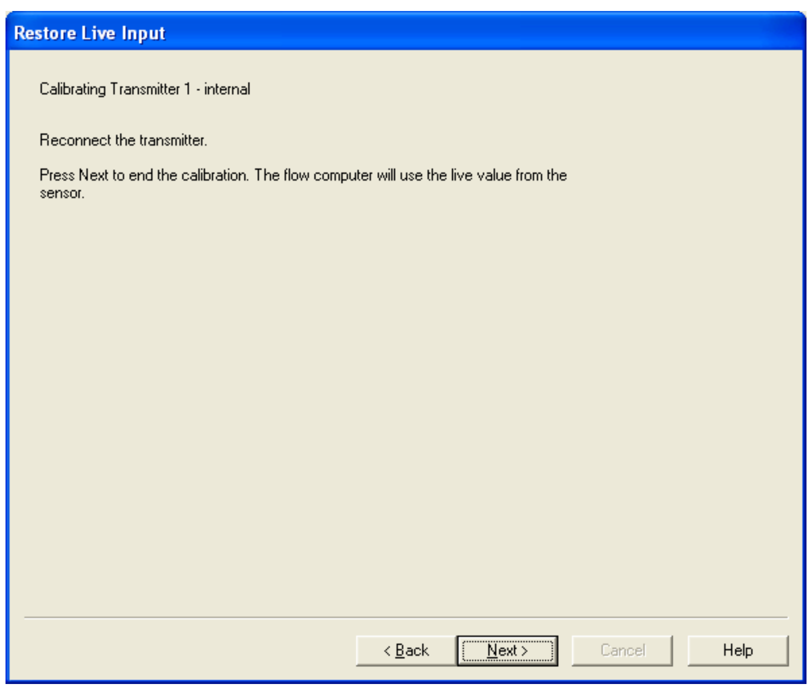
```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

Repeat the process to record additional readings.

- When the required readings are taken, click on the **Next>** button.

Calibration Step 5: Restore Live Input

The sensors need to be reconnected to the process and the input hardware before calibration is complete. Reconnect sensors and verify connections are correct.



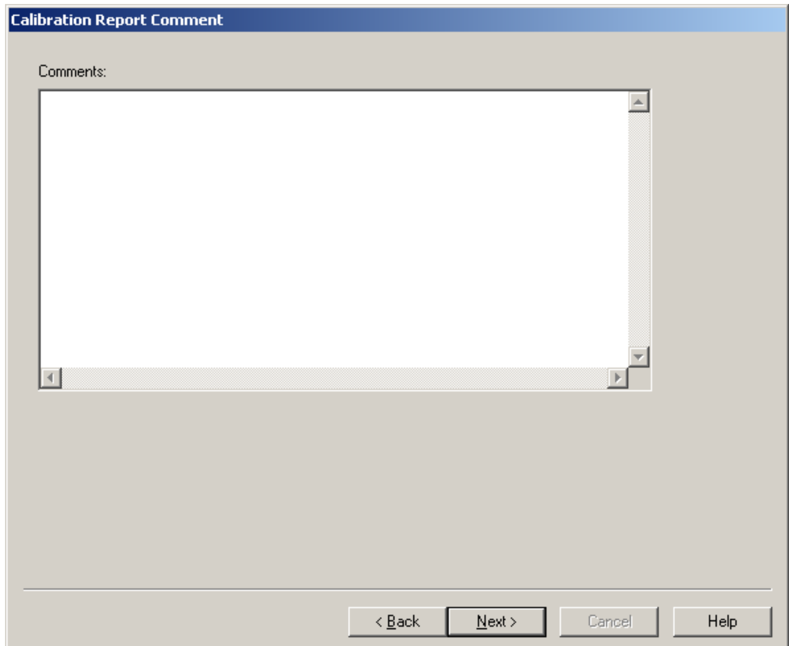
- Click on the **Finish** button when the sensor is connected.

WARNING

The live value from all sensors is used as soon as the Finish button is clicked. Be sure to connect all sensors first.

Calibration Step 6: Calibration Report Comment

Realflo creates, stores, and prints calibration reports for each calibration session performed. Comments may be added to the calibration report using the Calibration Report Comment dialog as shown below.

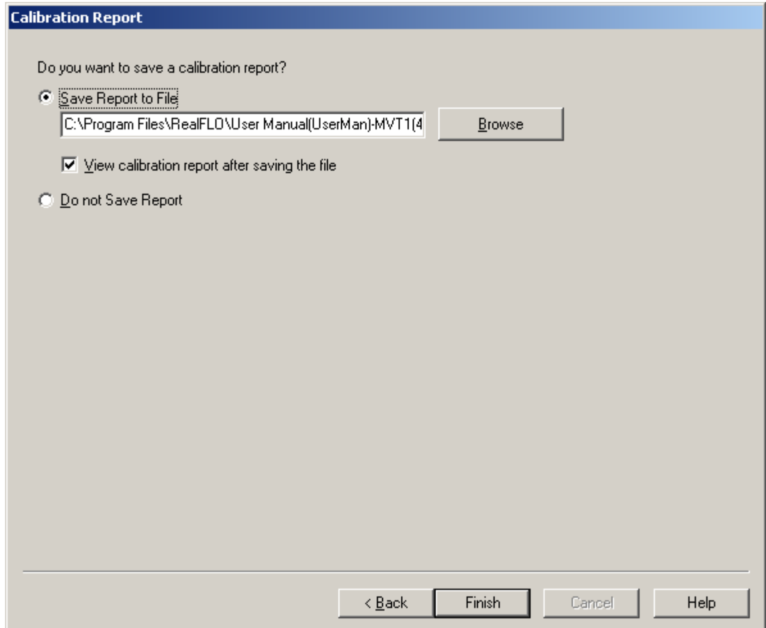


Enter any comments or leave the window blank.

- Click the **Next** button when completed entering comments.

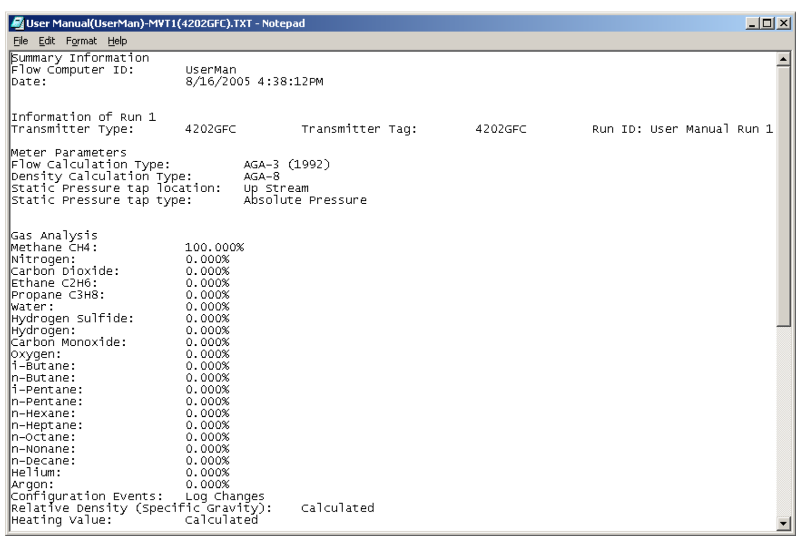
Calibration Step 7: Calibration Report

The Calibration Report dialog allows the saving of the calibration report.



- Select **Save Report to File** to save the report.
- Type the name of the report in the Save Report to File window. The default location and name are specified on the ***Calibration Report Options*** dialog.
- Select **Browse** to select a different file name.
- Check **View Calibration Report After Saving the File** to view the saved calibration report file. Default is checked.
- Select **Do not Save Report** to skip saving the calibration report.
- Click the Finis button to complete the calibration process.

If selected the Calibration report will be displayed as shown below.



Recovering From a PC Crash During Calibration

If power to the PC is disconnected or another event prevents the completion of the calibration procedure, the flow computer is left in calibration mode. The sensor input is left at the forced value. This needs to be corrected or the proper flow measurement will not be made.

To recover, simply restart the calibration.

- From the **Flow Computer** menu, select **Calibrate**.

Follow the on-screen instructions. You may have repeat steps already performed, depending on when the crash occurred.

Recovering From a Power Loss During Calibration

If power is lost to the flow computer during calibration, the calibration is aborted. The flow computer uses the live inputs from the sensors when power is restored.

If you were part way through calibration when the power was lost, you will have to restart the calibration. If possible, restore the sensor to an operating state before restoring power to the flow computer.

Replacing a Sensor

When a sensor is not working it needs to be replaced. If you have a working sensor you can replace it immediately. Replacing a sensor is similar to calibration.

At the As-Found stage it will be necessary to take at least one reading. If possible take enough readings to show how the sensor has stopped working. This may make it possible to correct previous flow readings.

- Answer **Yes** when asked if you want to calibrate the sensor.

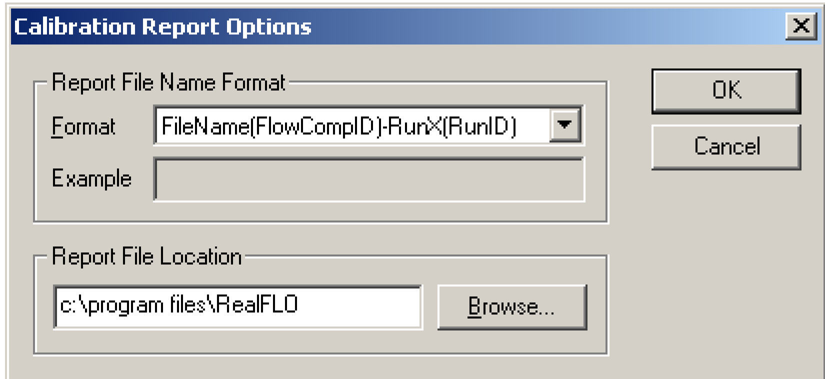
During the calibration step, remove the sensor and replace it with a working sensor.

Take the same As-Left readings as you would for calibration.

If a working sensor is not available, it may be possible to continue measuring flow by forcing a value for the sensor. Consult your company's procedures before attempting this. Forcing of input registers can be done using Telepace (see the Telepace manual for details).

Calibration Report Options

The calibration report options command specifies where the calibration report is stored when the Calibration Report Options dialog is displayed.



Realflo suggests report file names.

The **Format** window selects the name format. The valid values are listed below. The default is to include all information.

- file name (Flow Computer ID) - Run# (run ID)
- file name (Flow Computer ID) - Run#
- file name (Flow Computer ID) - run ID
- file name - Run# (run ID)
- file name - Run#
- file name - run ID
- Flow Computer ID - Run# (run ID)
- Flow Computer ID - Run#
- Flow Computer ID - run ID
- Run# (run ID)
- run ID

The **Example** control shows the file name that will be suggested for the current file. The text Calibration Report is appended to any suggestions.

The **Report File Location** window is used to select where reports are stored:

- Type the folder where reports are to be stored.
- Click **Browse** to select a folder.

These options are stored in the registry and apply to any files opened in Realflo.

- The default file name is file name (Flow Computer ID) - Run# (run ID)
- The default location when Realflo is first run is the Realflo installation folder.

Change Orifice Plate

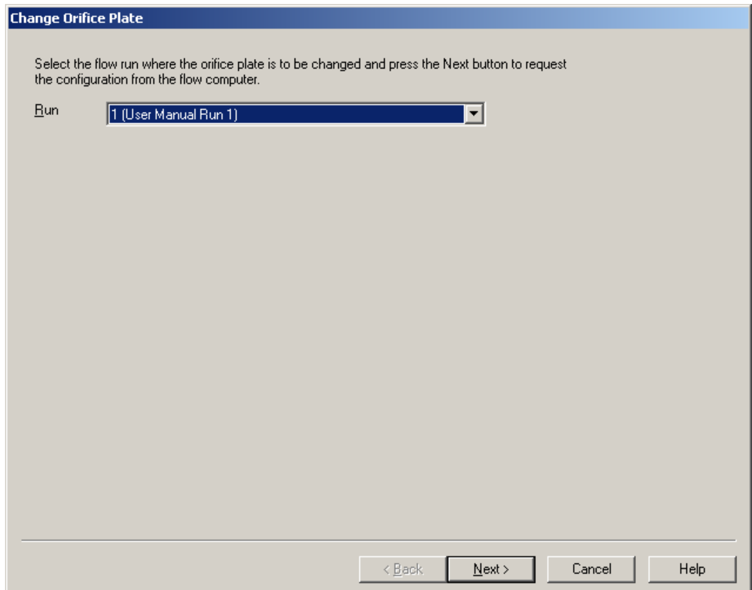
The Change Orifice Plate command allows the orifice plate to be changed for AGA-3 meter runs. This command supports Dual Chamber Orifice fittings and Singe Chamber Orifice fittings.

When selected this command opens the Orifice Plate Change wizard is started and will prompt you through the plate change procedure.

The flow computer ID is checked when the Change Orifice Plate command is selected. If the flow computer ID does not match the ID Realflo displays the message “ The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file.” The command is aborted.

Select Meter Run

When the Change Orifice command is selected the Change Orifice Plate dialog is displayed.

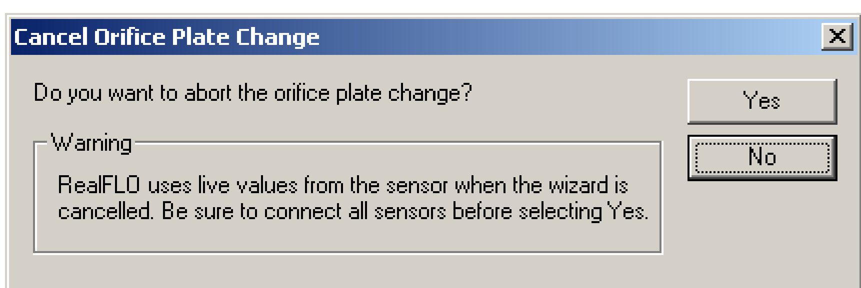


The **Run** dropdown selection displays the runs using AGA –3 flow calculations. Select the run to change or inspect the orifice plate.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Next>** button completes the run selection and the wizard moves to the next step. This button is grayed out if there are no flow runs configured to use the AGA-3 flow calculation.

The **Cancel** button aborts the plate change and displays the following message.



- Click **Yes** to abort the calibration.

- Click **No** to continue with the plate change. The default button is No.

⚠WARNING

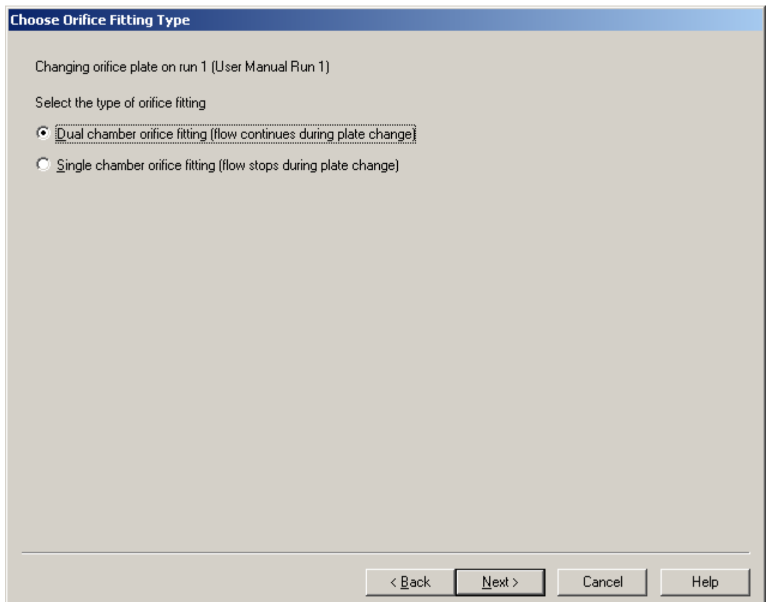
Realflo uses live values from the sensor when the plate change is cancelled. Be sure to connect all sensors first.

Realflo does not erase any events from the flow computer when the plate change is cancelled. Realflo restores live values (ends forcing) when Cancel is clicked.

The **Help** button displays the online help file.

Choose Orifice Fitting Type Step

This page allows the users to select the type of orifice fitting.



Select **Dual Chamber Orifice Fitting** if a dual chamber fitting is present. Flow accumulation with estimated values will continue during the plate change.

Select **Singe Chamber Orifice Fitting** if a single chamber fitting is present. Flow accumulation will stop during the plate change.

The **Next** button moves to the next step.

- The next step is described in the section **Dual Chamber Orifice** if a dual chamber fitting is selected.
- The next step is described in the section **Single Chamber Orifice** if a single chamber fitting is selected.

The **Cancel** button closes the dialog and stops the plate change procedure.

The **Help** button displays the online Help file.

Dual Chamber Orifice

A dual chamber orifice allows the user to change, or inspect, the orifice plate without stopping the flow. These are generally large custody transfer sites where the orifice fitting is bypassed during the change or inspection procedure.

The Change Orifice Plate Command forces the Static Pressure, Differential Pressure and Temperature inputs to a fixed value during the orifice plate change or inspection procedure. This command is disabled if the Update Readings command is enabled. The flow is estimated during the procedure using the fixed values.

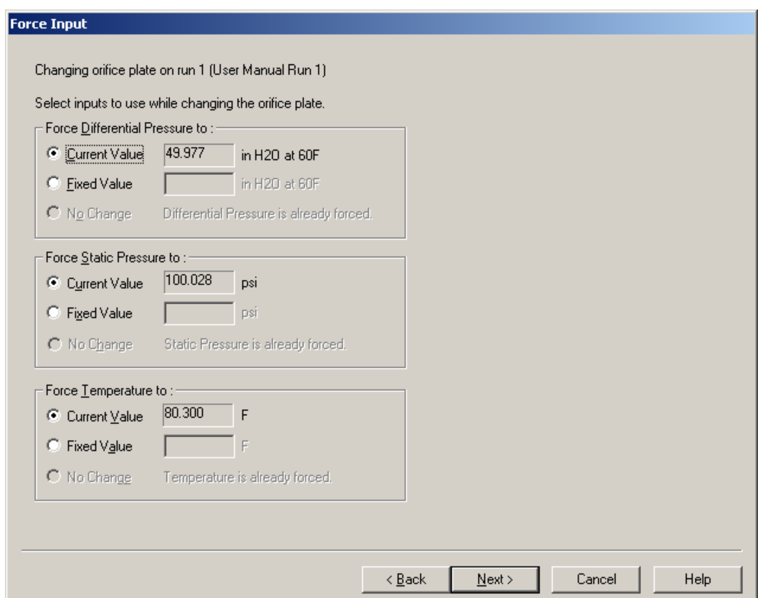
This command allows a user to place a flow run into estimation mode to allow an orifice plate to be changed or inspected. Changing the orifice plate involves the following steps.

- Set the estimated flow to be used during the orifice plate change by forcing inputs to fixed values.
- Change the orifice size.
- Complete the orifice plate change and resume normal flow measurement.

The Flow Computer ID is checked when the Change Orifice Plate command is selected. If the Flow Computer ID does not match the ID Realflo displays the message “ The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file.” The command is aborted.

Force Input Step

This step forces the flow run inputs. An estimated flow will be calculated while the plate change is in progress. The current values are updated every second.



Select the value you wish to use, for each sensor, by clicking the appropriate radio button for each sensor.

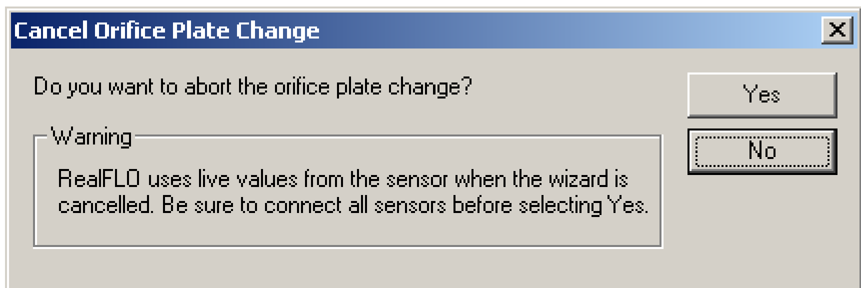
- Check the **Current Value** radio button to use the current value for the sensor.
- Check the **Fixed Value** radio button and enter a value to use for the calibration in the entry box.

If an input on a run is not currently forced, the default value configured for the Values for Sensor Fail field on the Configuration Tool Bar > Run *n* > Inputs tab needs to be entered for the Fixed Value The default value to use when the Value on Sensor Fail option on the Inputs tab is set to Use Default Value field.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Next>** button completes the force inputs step and the wizard moves to the next step. Realflo records the start of the plate change procedure in the event log and forces the sensor inputs.

The **Cancel** button aborts the plate change and displays the following message.



- Click **Yes** to abort the calibration.
- Click **No** to continue with the plate change. The default button is No.

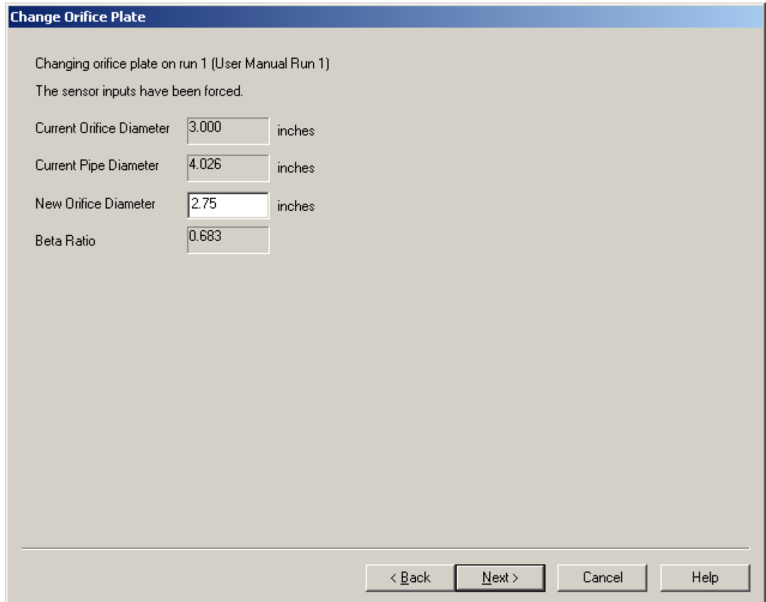
⚠WARNING
Realflo uses live values from the sensor when the plate change is cancelled. Be sure to connect all sensors first.

Realflo does not erase any events from the flow computer when the plate change is cancelled. Realflo restores live values (ends forcing) when Cancel is clicked.

The **Help** button displays the online help file.

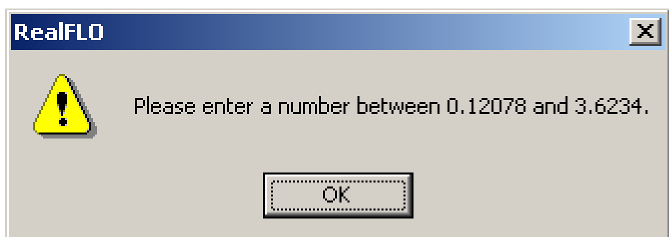
Change Orifice Plate Step

The orifice plate can now be changed. The forced inputs are used while the change is in progress. This dialog allows you to enter the new orifice plate diameter.



The **Current Orifice Diameter** and **Current Pipe Diameter** are displayed for reference.

Enter the new orifice size in the **New Orifice Diameter** entry box. If the diameter is not valid, Realflo displays the following a message box.



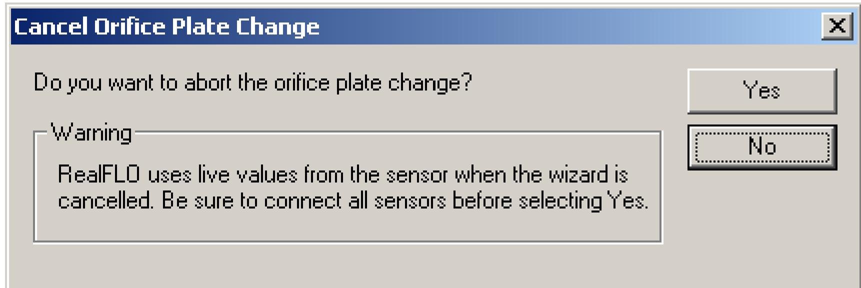
You need to enter a valid orifice diameter. Click the OK button to return to the Change Orifice dialog.

The **Beta Ratio** is calculated and displayed for orifice diameter changes.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Next>** button completes the change orifice step and the wizard moves to the last step.

The **Cancel** button aborts the plate change and displays the following message.



- Click **Yes** to abort the calibration.
- Click **No** to continue with the plate change. The default button is No.

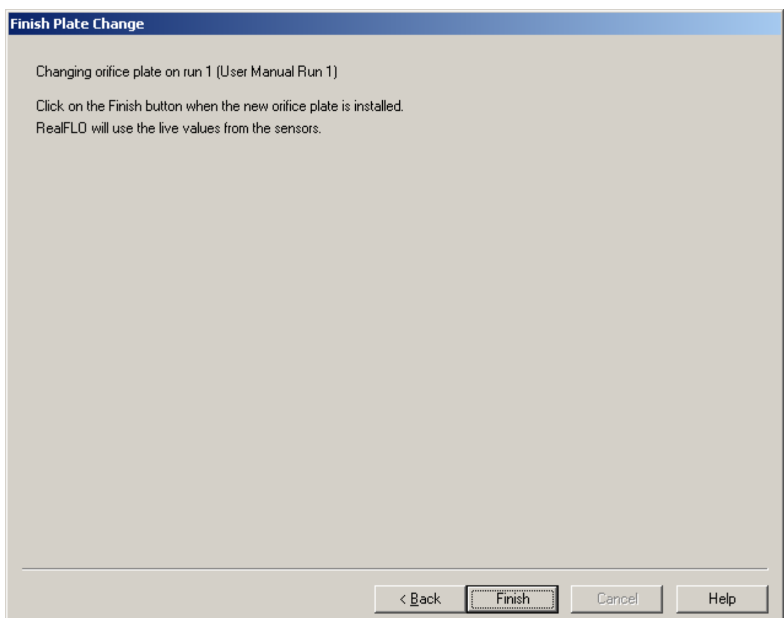
⚠ WARNING
Realflo uses live values from the sensor when the plate change is cancelled. Be sure to connect all sensors first.

Realflo does not erase any events from the flow computer when the plate change is cancelled. Realflo restores live values (ends forcing) when Cancel is clicked.

The **Help** button displays the online help file.

Complete Orifice Plate Change

The Finish Plate Change is the last step in the Plate Change wizard.



The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Finish** button completes the orifice plate change wizard and closes the dialog. Realflo restores the sensor live values

The **Help** button displays the online help file.

Single Chamber Orifice

A single chamber orifice requires the flow be stopped while an orifice plate is changed.

The Change Orifice Plate command prompts the user to stop the flow before changing the plate and start the flow after changing the plate.

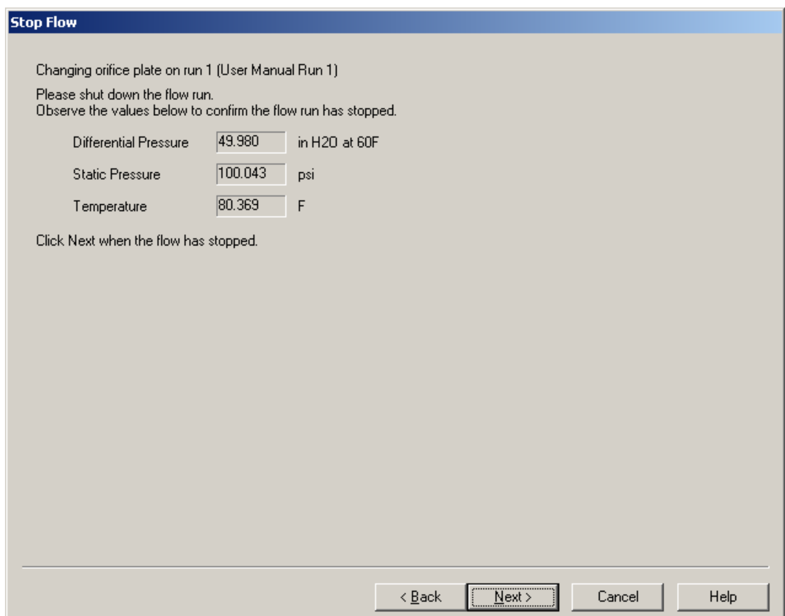
Changing the orifice plate involves the following steps.

- Confirm that flow has stopped.
- Change the orifice size.
- Complete the orifice plate change.

The Flow Computer ID is checked when the Change Orifice Plate command is selected. If the Flow Computer ID does not match the ID Realflo displays the message “ The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file.” The command is aborted.

Stop Flow Step

This step stops the flow run. The current inputs can be monitored while the flow is stopped.



The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

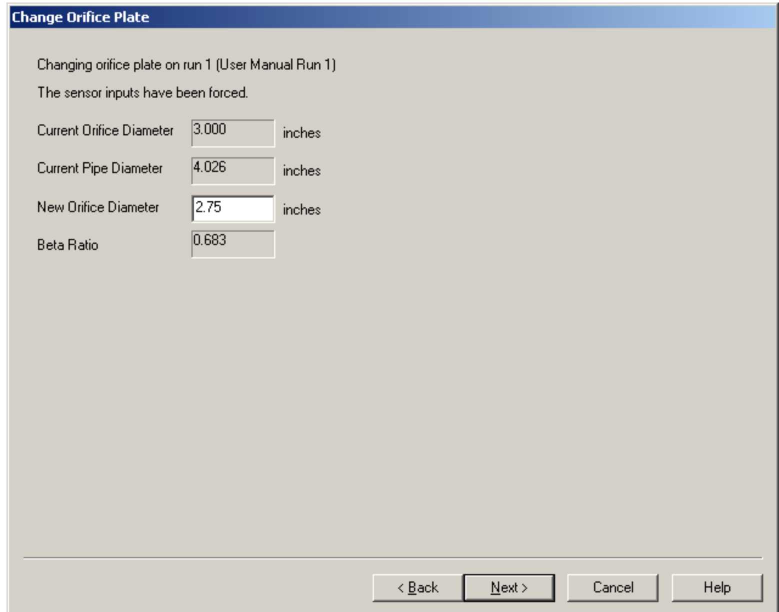
The **Next>** button completes the Stop Flow step and the wizard moves to the next step. Realflo records the start of the plate change procedure in the event log and forces the sensor inputs.

The **Cancel** button aborts the plate change and closes the wizard.

The **Help** button displays the online help file.

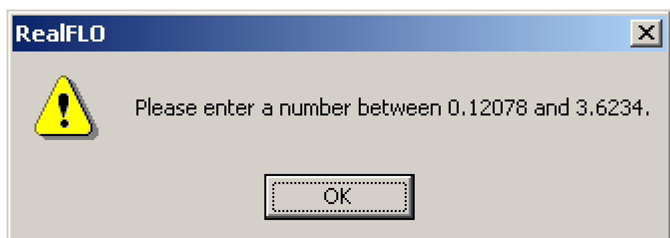
Change Orifice Plate Step

The orifice plate can now be changed. The forced inputs are used while the change is in progress. This dialog allows you to enter the new orifice plate diameter.



The **Current Orifice Diameter** and **Current Pipe Diameter** are displayed for reference.

Enter the new orifice size in the **New Orifice Diameter** entry box. If the diameter is not valid, Realflo displays the following a message box.



You need to enter a valid orifice diameter. Click the OK button to return to the Change Orifice dialog.

The **Beta Ratio** is calculated and displayed for orifice diameter changes.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up.

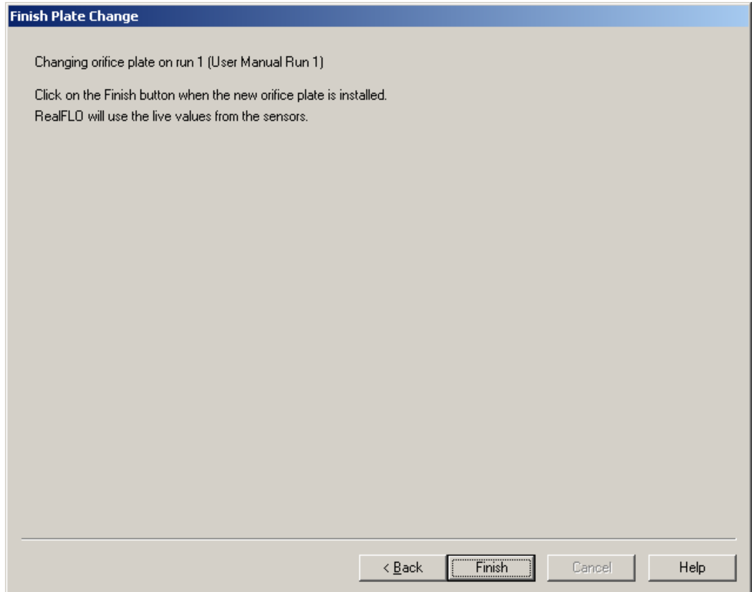
The **Next>** button completes the change orifice step and the wizard moves to the last step.

The **Cancel** button aborts the plate change and closes the wizard.

The **Help** button displays the online help file.

Complete Orifice Plate Change

The Finish Plate Change is the last step in the Plate Change wizard.



The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up.

The **Finish** button completes the orifice plate change wizard and closes the dialog. Realflo restores the sensor live values

The **Help** button displays the online help file.

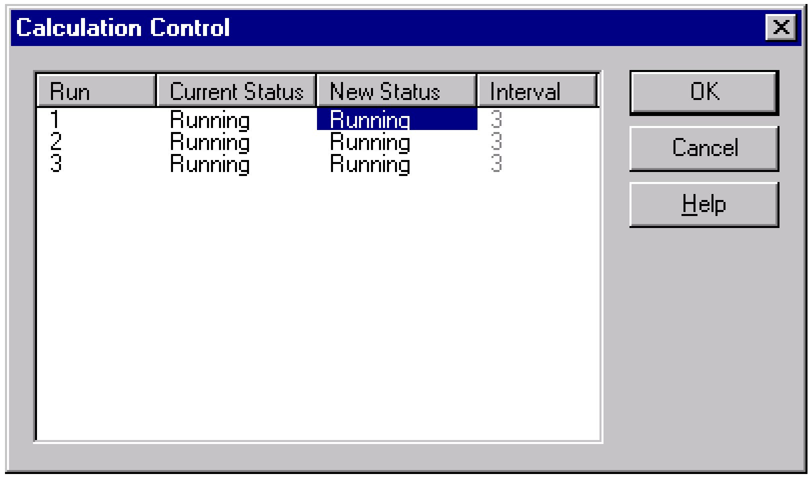
Calculation Control

This command is used to control the execution of flow calculations for all meter runs in the controller. This command is disabled if the Update Readings command is enabled. The flow calculation for each selected meter run may be running or stopped.

When the Calculation Control dialog is opened, the current state of the flow calculation is read from the controller.

The flow computer ID is checked when the Calculation Control dialog is opened. If the flow computer ID does not match the ID in the dialog Realflo displays the message "`The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file.`"

When the dialog is opened, the current state of every runs is read from the controller. The dialog displays a table containing four columns.



The **Run** column displays each run configured in Realflo.

The **Current Status** column displays the flow calculation state of each run.

- Running indicates the flow calculation is executing.
- Stopped indicates the flow calculation is not executing.
- Not Set indicates the run state is not known.

The **New Status** column displays the state of the flow calculation for each run. To change the state of the flow calculation, click on the cell or move the cursor to the cell with the arrow keys and press the space bar. The setting changes as follows:

- Running changes to Stopped
- Stopped changes to Running
- Not set changes to Running

The **Interval** column displays the time between calculations for the run. This value cannot be changed.

The **OK** button accepts the changes and writes them to the controller. When there are no changes, nothing is written to the controller.

The **Cancel** button closes the dialog.

The **Help** button displays the help page for this dialog.

Update Readings

This command is used to control updating of the Current Readings view. This command is disabled if the Update Readings command is enabled. When this command is selected readings are continuously updated from the flow computer. A check mark is shown next to the command when readings are updating.

The flow computer ID is checked when the Update Readings command is selected. If the flow computer ID does not match the ID in the dialog Realflo displays the message "`The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file`."

The Current Readings view is updated continuously until the Update Readings command is selected again.

Update Readings Once

This command is used to control updating of the Current Readings view. When this command is selected readings are updated once from the flow computer.

The flow computer ID is checked when the Update Readings Once command is selected. If the flow computer ID does not match the ID in the dialog Realflo displays the message “ `The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file`.”

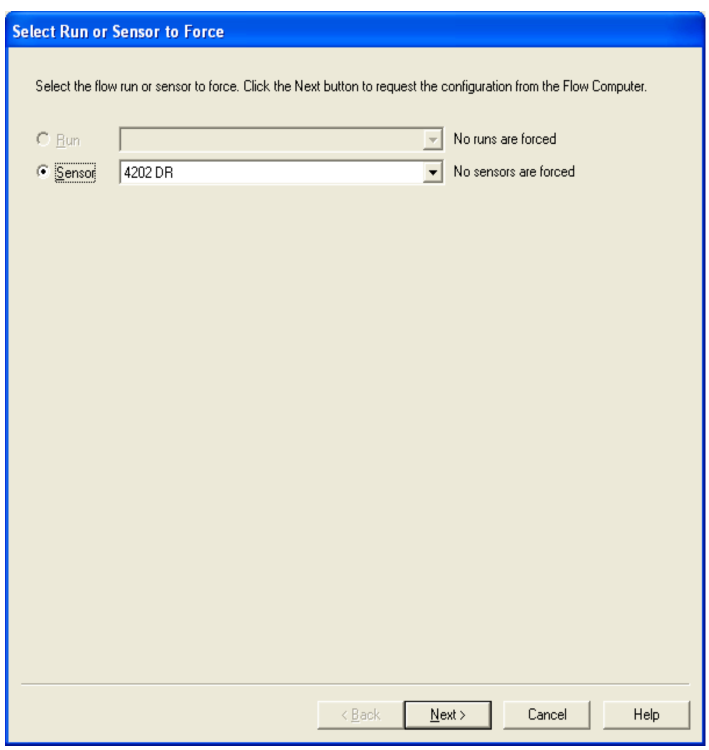
The Current Readings view is updated once each time the Update Readings Once command is selected.

Force Inputs

The Force Sensor command allows forcing and unforcing of the value of the temperature sensor, static pressure sensor, differential pressure sensor, or pulse counter input. When selected the command opens the Force Sensor wizard. Flow calculations continue to execute while sensors are forced.

The flow computer ID is checked when the Force Inputs command is selected. If the flow computer ID does not match the ID in the dialog Realflo displays the message “ The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file.”

When the Force Inputs command is selected the Select Run or Transmitter to Force dialog is opened as shown below.



Select **Run** to force the sensor inputs for a flow run using analog or pulse sensors. Select the run to be forced from the dropdown list. The Run controls are disabled if there are no runs using analog or pulse sensors.

See the section **Force Run Inputs** below for information on forcing Run inputs.

Select **Sensor** to force the inputs from a transmitter. Select the transmitter to be forced from the dropdown list beside it. See the section **Force Transmitter Sensor Inputs** below for information on forcing transmitter inputs.

The **Back** button is disabled, as this is the first step in the wizard.

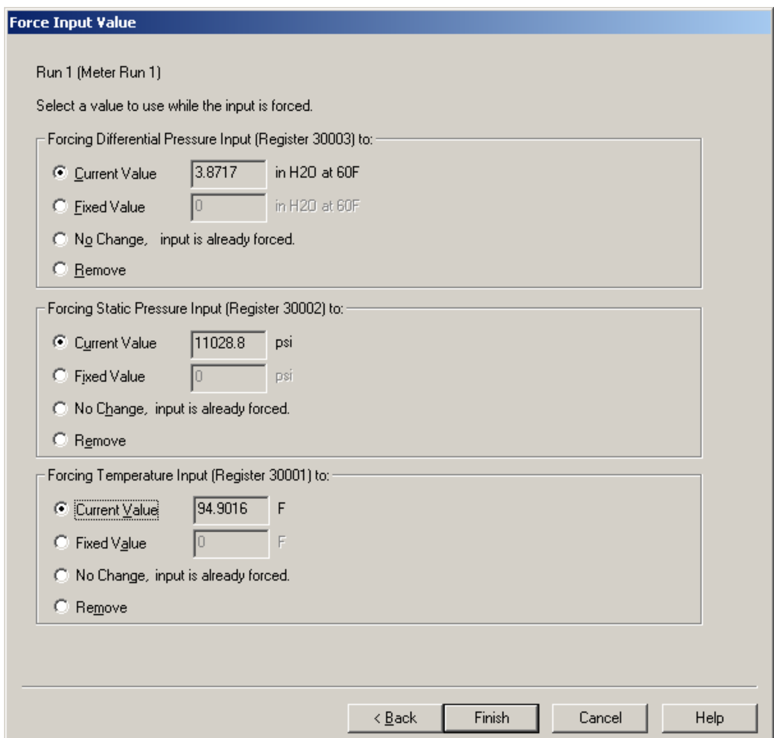
The **Next** starts the force procedure.

The **Cancel** closes the wizard.

The **Help** displays the online help file.

Force Run Inputs

When the Force Run is selected the Force Input Values dialog is displayed as shown below. The Force Input Values step selects the analog inputs of a flow run which will be forced or unforced. It displays the inputs that can be forced



.

The Force Input Value dialog contains sections for Force Differential Pressure Input, Force Static Pressure Input and Force Temperature Input. When AGA-7 calculation type is used the dialog contains a section for Force Pulse Counter Input instead of Force Differential Pressure Input.

For each input the following parameters are available:

- Select **Current Value** to use the current value for the sensor. The current value is shown beside the control and updates continuously.

- Select **Fixed Value** to use a fixed value. Type the value in the edit box.
- Select **No Change, input is already forced** to leave the input in its current state. This is selected by default if the value is already forced. This is disabled if the input is not forced.
- Select **Remove** to remove the existing forcing. This button is disabled if the input is not forced.

If an input on a run is not currently forced, the default value configured for the Values for Sensor Fail field on the Configuration Tool Bar > Run *n* > Inputs tab needs to be entered for the Fixed Value The default value to use when the Value on Sensor Fail option on the Inputs tab is set to Use Default Value field.

The **Back** button moves back to the Select Run or Transmitter to Force step. Backing up does not erase the events from the flow computer event log or remove forcing from inputs previously processed.

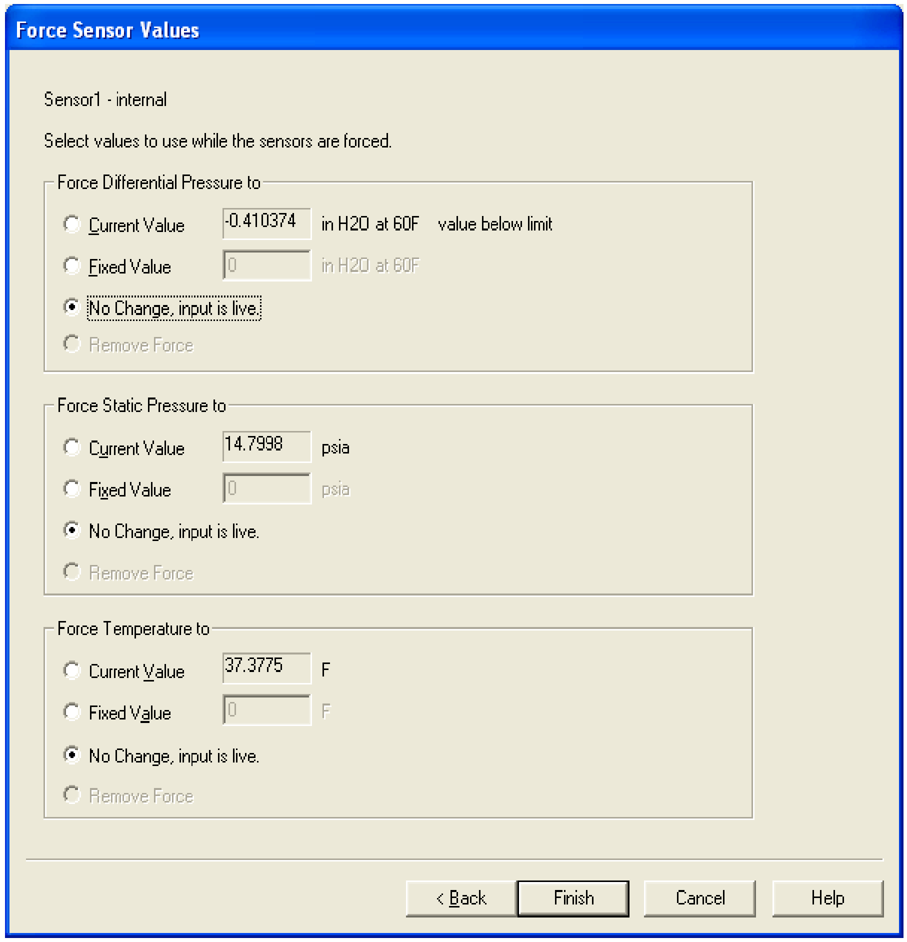
The **Finish** button completes the Force Input Value process and closes the dialog.

The **Cancel** button closes the wizard. This does not undo any changes. Any input that is already forced will remain forced.

The **Help** displays the online help file.

Force Transmitter Sensor Inputs

This step shows the selected transmitter inputs. The inputs can be forced to the current value or a fixed value, left as it is, or the forcing can be removed. The transmitter number, transmitter tag name, the communication port and the transmitter address associated with this transmitter are displayed to aid you in determining which input you are forcing.



The Sensor Values dialog contains sections for Force Differential Pressure, Force Static Pressure and Force Temperature.

For each input the following parameters are available:

- Select **Current Value** to use the current value for the sensor. The current value is shown beside the control and updates continuously.
- Select **Fixed Value** to use a fixed value. Type the value in the edit box.
- Select **No Change, input is already forced** to leave the input in its current state. This is selected by default if the value is already forced. This is disabled if the input is not forced.
- Select **Remove Force** to remove the existing forcing. This button is disabled if the input is not forced.

The **Back** button moves back to the Select Run or Transmitter to Force step.

Backing up does not erase events from the flow computer event log, or remove forcing from inputs previously processed.

The **Finish** button completes the Force Input Value process and closes the dialog.

The **Cancel** button closes the wizard. This does not undo any changes. Any input that is already forced will remain forced.

The **Help** displays the online help file.

The same transmitter can be used for more than one flow run. Realflo forces the value for each run.

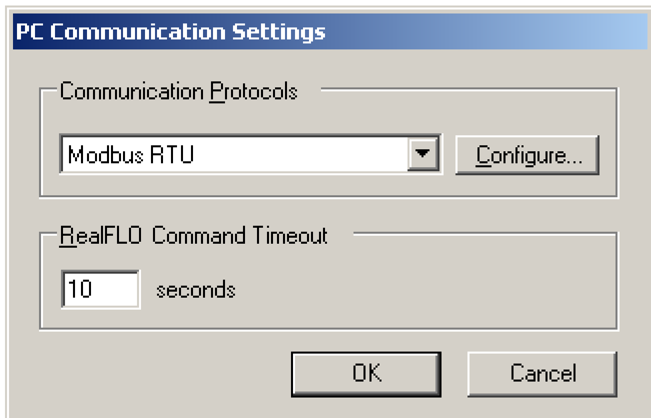
Communication Menu

The Communication menu contains the commands for configuring the communication between the flow computer and Realflo.

PC Communications Settings Command

The PC Communication Settings command defines the communication protocol and communication link to communicate between the personal computer (PC) and SCADAPack or 4202 controller.

When the command is select the Communication Protocols Configuration dialog is displayed as shown below.



The **Communication Protocols** dropdown list box presents available communication protocols. The default protocol is Modbus RTU. Click the dropdown list icon at the right of the window to display a list of available communication protocols.

- ClearSCADA
- DNP
- DNP/TCP
- DNP/UDP
- Modbus ASCII
- Modbus ASCII in TCP
- Modbus ASCII in UDP
- [Modbus RTU]
- Modbus RTU in TCP
- Modbus RTU in UDP
- Modbus/TCP
- Modbus/UDP
- Modbus/USB
- SCADAServer

The **Configure** button opens configuration dialog for the selected communication protocol.

The **Realflo Command Timeout** edit box sets the length of time, in seconds, to wait for a response to a Realflo command. The valid range is 3 to 60 seconds and the default value is 10.

Clicking the **OK** button will make the selected protocol the active one.

Clicking the **Cancel** button abandons any and any changes made via this dialog.

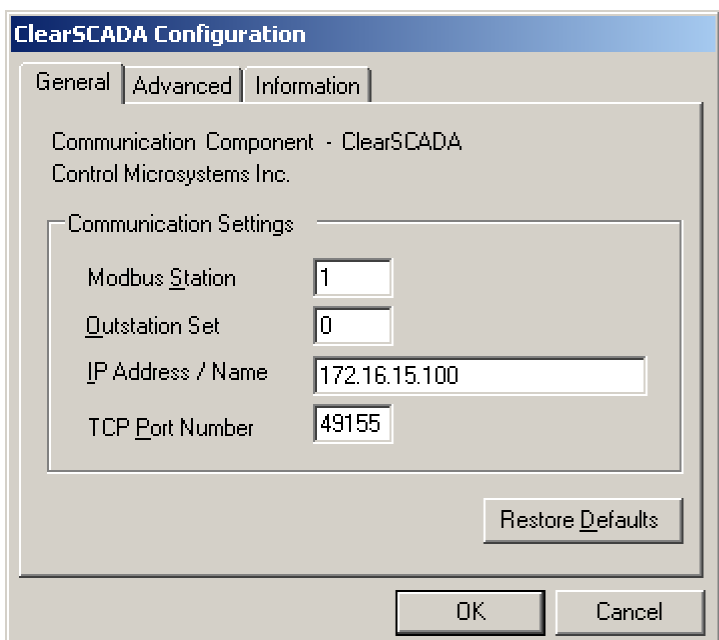
ClearSCADA

The ClearSCADA protocol driver is used for communicating with a local or remote ClearSCADA server. The ClearSCADA server will then, in turn, communicate with devices as per its configuration. The ClearSCADA protocol driver communicates with the ClearSCADA server using a TCP connection.

- To configure a ClearSCADA protocol connection, highlight **ClearSCADA** in the Communication Protocols window and click the **Configure** button. The ClearSCADA Configuration window is displayed.
- To select a configured ClearSCADA protocol connection, highlight **ClearSCADA** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

When ClearSCADA protocol is selected for configuration the ClearSCADA Configuration dialog is opened with the General tab selected as shown below.



The General tab component information section contains the name of Communication Component and the author, Control Microsystems.

The **Communications Settings** grouping contains details necessary to establish communication to a device through a local or remote ClearSCADA installation.

The **Modbus Station** entry specifies the station address of the target device. Valid values are 1 to 65534.

The **Outstation Set** entry specifies the ClearSCADA outstation set to which the target device is attached. The valid range is 0 to 65535. The default value is 0.

The **IP Address / Name** entry specifies the Ethernet IP address in dotted quad notation, or a DNS host name that can be resolved to an IP address, of the PC where the ClearSCADA server is installed. The following IP addresses are not supported and will be rejected:

0.0.0.0 through 0.255.255.255

127.0.0.0 through 127.255.255.255 (except 127.0.0.1)

224.0.0.0 through 224.255.255.255

255.0.0.0 through 255.255.255.255.

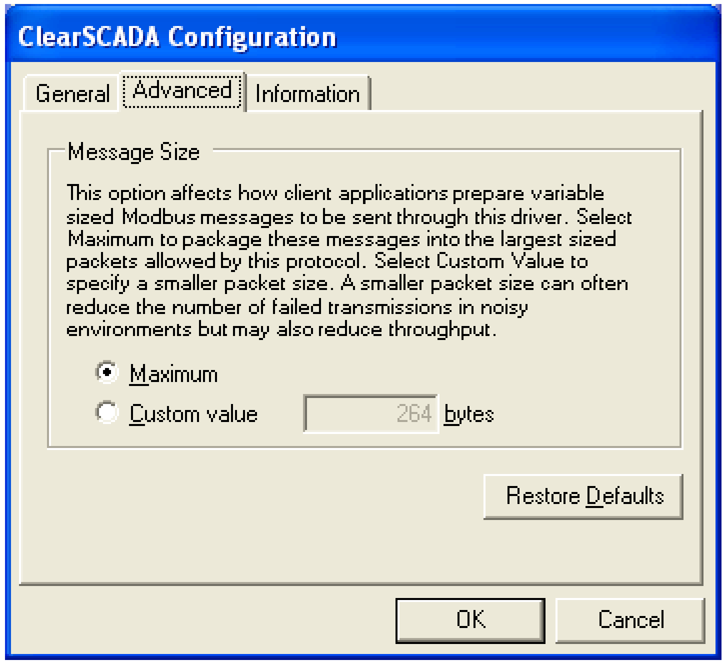
The **TCP Port Number** entry specifies the TCP port on the **ClearSCADA** server. The valid range is 0 to 65535. The default value is 49155

- Click **Restore Defaults** to restore default values to fields on this page, except for the **IP Address / Name** field. The contents of this field will remain unchanged.

Advanced Parameters

Advanced parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.

The protocol that ClearSCADA uses to communicate with the remote SCADAPack controller needs to be taken into account when determining the message size. In ClearSCADA the Modbus tab in the Channel object sets the maximum packet size ClearSCADA uses when communicating with the remote SCADAPack controller.



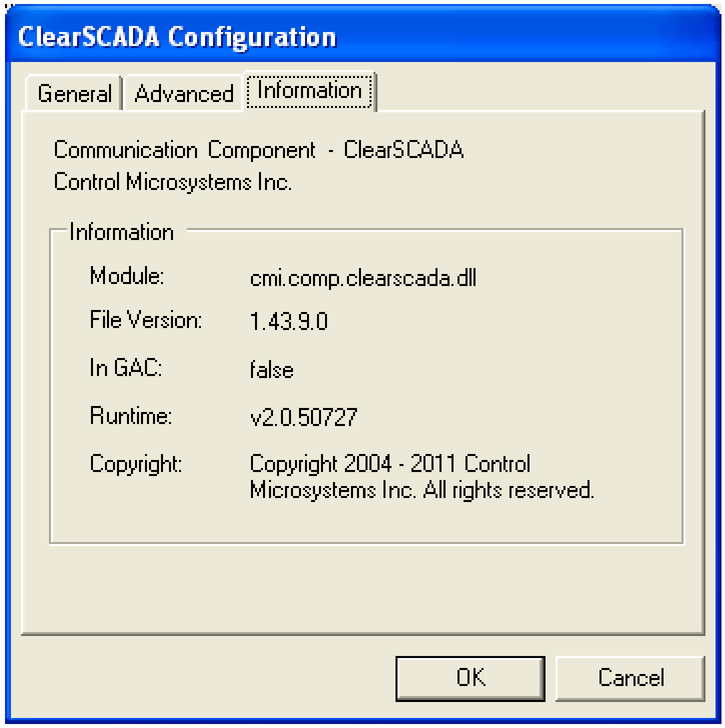
The **Maximum** selection indicates that the host application is to package messages using the maximum size allowable by the protocol.

The **Custom Value** selection specifies a custom value for the message size. This value will indicate to the host application to package messages to be no larger than what is specified, if it is possible. Valid values are 2 to 264. The default value is 264.

- Click **Restore Defaults** to restore default values to fields on this page.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

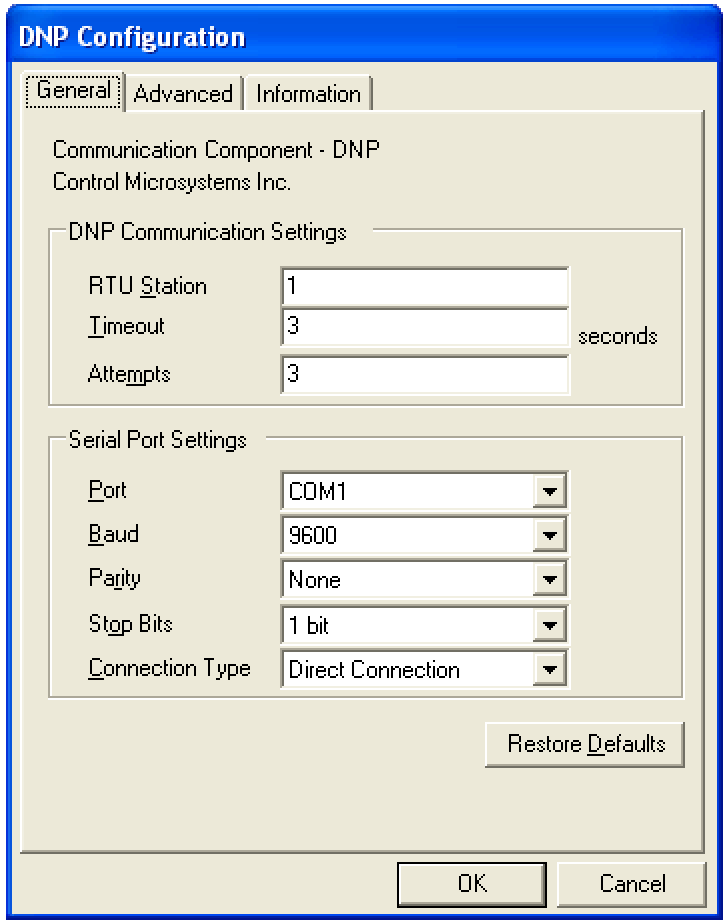
DNP

The DNP protocol driver is used to communicate over a serial DNP network to SCADAPack controllers configured for DNP communication.

- To configure a DNP protocol connection, highlight **DNP** in the Communication Protocols window and click the **Configure** button. The DNP Configuration window is displayed.
- To select a configured DNP protocol connection, highlight **DNP** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

When DNP is selected for configuration the DNP Configuration dialog is opened with the General tab selected as shown below.



The General tab component information section contains the name of Communication Component and the author, Control Microsystems.

The **DNP Communication Settings** logical grouping contains DNP specific communication settings including the DNP Station address, the timeout interval as well as the number of attempts.

The **RTU Station** parameter sets the target **DNP** station number. Valid entries are 0 to 65519. The default address is 1.

The **Timeout** parameter sets the length of time, in seconds, to wait for a response from the controller before retrying (see Attempts). Valid entries are 1 to 255. The default is 3.

The **Attempts** parameter sets number of times to send a command to the controller before giving up and reporting this to the host application. Valid entries are 1 to 20. The default is 3.

This **Serial Port Settings** grouping contains details directly related to the PC's communication port including the port number, the baud rate, parity, and stop bit settings.

The **Port** parameter specifies the PC serial port to use. The DNP driver determines what serial ports are available on the PC and presents these in the drop-down menu list. The available serial ports list will include any USB to serial converters used on the PC. The default value is the first existing port found by the driver.

The **Baud** parameter specifies the baud rate to use for communication. The menu list displays selections for 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, and 57600. The default value is 9600.

The **Parity** parameter specifies the type of parity to use for communication. The menu list displays selections for none, odd and even parity. The default value is None.

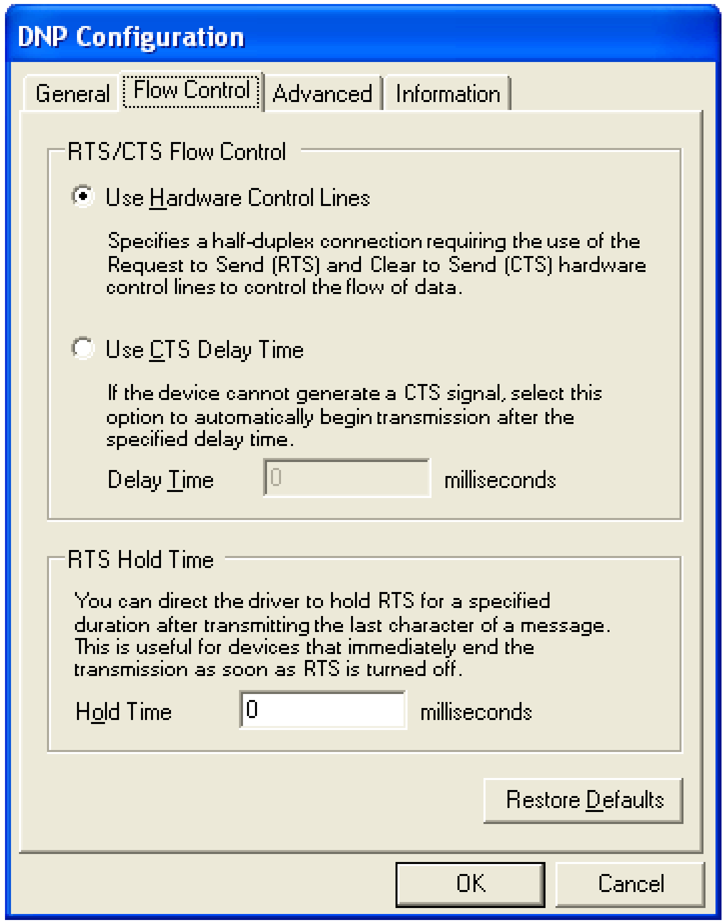
The **Stop Bits** parameter specifies the number of stop bits to use for communication. The menu list displays selections for 1 and 2 stop bits. The default value is 1 bit.

The **Connection Type** parameter specifies the serial connection type. The DNP driver supports direct serial connection with no flow control, Request-to-send (RTS) and clear-to-send (CTS) flow control and PSTN dial-up connections. The menu list displays selections for Direct Connection, RTS/CTS Flow Control and Dial Up Connection. The default selection is Direct Connection.

- Select **Direct Connection** for RS-232 for RS-485 connections not requiring the hardware control lines on the serial ports.
- Select **RTS/CTS Flow Control** to communicate over radio or leased-line networks using modems that require RTS/CTS handshaking. Selecting RTS/CTS Flow Control adds a new tab, Flow Control, to the DNP Configuration dialog. Refer to the Flow Control Parameters section below for configuration details.
- Select **Dial Up Connection** to communication over dial up modems. Selecting Dial Up Connection adds a new tab, Dial Up, to the DNP Configuration dialog. Refer to the Dial Up Parameters section below for configuration details.
- Click **Restore Defaults** to restore default values to fields on this page.

Flow Control Parameters

Flow Control parameters are used to configure how RTS and CTS control is used. When RTS/CTS Flow Control is selected for Connection Type the Flow Control tab is added to the DNP Configuration dialog. When the Flow Control tab heading is clicked the Flow Control dialog is opened as shown below.



RTS/CTS Flow Control

The **RTS/CTS Flow Control** grouping contains two mutually exclusive options, Use Hardware Control Lines and Use CTS Delay Time. These options enable the driver to communicate over radio or leased-line networks using modems that require RTS/CTS handshaking.

The **Use Hardware Control Lines** option specifies a half-duplex connection requiring the use of the Request to Send (RTS) and Clear to Send (CTS) hardware control lines to control the flow of data. This selection is used with radios and dedicated telephone line modems. The driver turns on the RTS signal when it wants to transmit data. The modem or other device then turns on CTS when it is ready to transmit. The driver transmits the data, and then turns off the RTS signal. This selection is mutually exclusive of the Use CTS Delay Time selection described below. This is the default selection.

The **Use CTS Delay Time** option is selected if the device cannot generate a CTS signal. The driver will assert RTS then wait the specified Delay Time, in milliseconds, before proceeding. This option is mutually exclusive with the Use Hardware Control Lines selection described above.

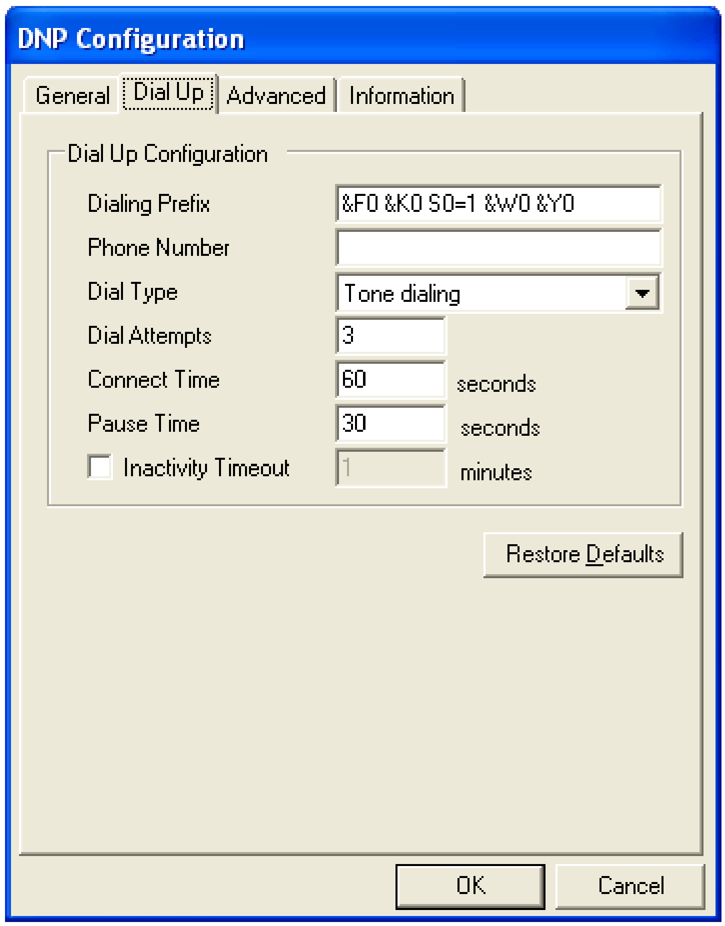
The **Delay Time** parameter sets the time in milliseconds that the driver will wait after asserting RTS before proceeding. The value of this field needs to be smaller than the Time Out value set in the General parameters dialog. For example, if the Timeout value is set to 3 seconds, the CTS Delay Time can be set to 2999 milliseconds or less. The minimum value for this field is 0 milliseconds. The value is initially set to 0 by default.

The **Hold Time** parameter specifies the time, in milliseconds, that the driver will hold RTS after the last character is transmitted. This is useful for devices that immediately end transmission when RTS is turned off. The value of this field needs to be smaller than the Time Out value set in the General parameters dialog. For example, if the Timeout value is set to 3 seconds, the CTS Delay Time can be set to 2999 milliseconds or less. The minimum value for this field is 0 milliseconds. The value is initially set to 0 by default.

- Click **Restore Defaults** to restore default values to fields on this page.

Dial Up Parameters

Dial Up parameters are used to configure a dial up connection. When Dial Up is selected for Connection Type the Dial Up tab is added to the DNP Configuration dialog. When the Dial Up tab heading is clicked the Dial Up dialog is opened as shown below.



The **Dialing Prefix** parameter specifies the commands sent to the modem before dialing. A maximum of 32 characters can be entered. Any character is valid. The default value is "&F0 &K0 S0=1 &W0 &Y0".

The **Phone Number** parameter specifies the telephone number of the remote controller. A maximum of 32 characters can be entered. Any character is valid. This field's default value is blank.

The **Dial Type** parameter specifies the dialing type. Valid values are Pulse and Tone. The default value is Tone.

The **Dial Attempts** parameter specifies how many dialing attempts will be made. Valid values are 1 to 10. The default value is 1.

The **Connect Time** parameter specifies the amount of time in seconds the modem will wait for a connection. Valid values are 6 to 300. The default value is 60.

The **Pause Time** parameter specifies the time in seconds between dialing attempts. Valid values are 6 to 600. The default value is 30.

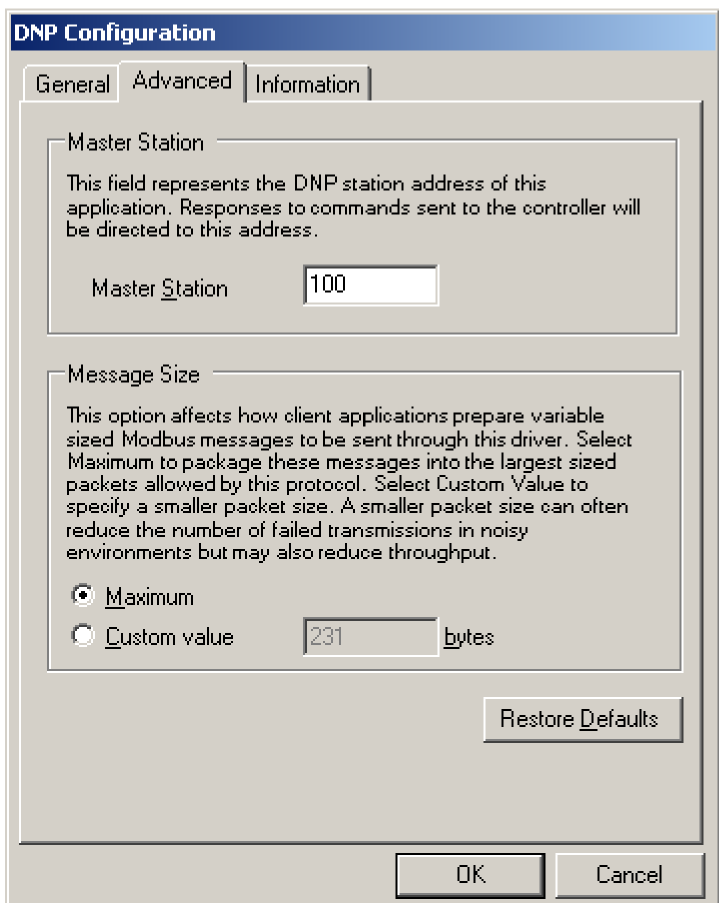
Check the **Inactivity Timeout** check box to automatically terminate the dialup connection after a period of inactivity. The Inactivity Time edit box is enabled only if this option is checked. The default state is checked.

Enter the inactivity period, in minutes, in the **Inactivity Timeout** box. The dialup connection will be terminated automatically after the specified number of minutes of inactivity has lapsed. This option is only active if the Inactivity Timeout box is checked. Valid values are from 1 to 30 minutes. The default value is 1.

- Click **Restore Defaults** to restore default values to fields on this page, except for the Phone Number field. The content of this field will remain unchanged.

Advanced Parameters

DNP Configuration Advanced parameters set the DNP master station address and message size control. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.



The **Master Station** parameter is the DNP station address assumed by this communication component. When this driver sends out commands, responses from the controller will be directed to this address. The default value is 100.

The **Message Size** grouping parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput.

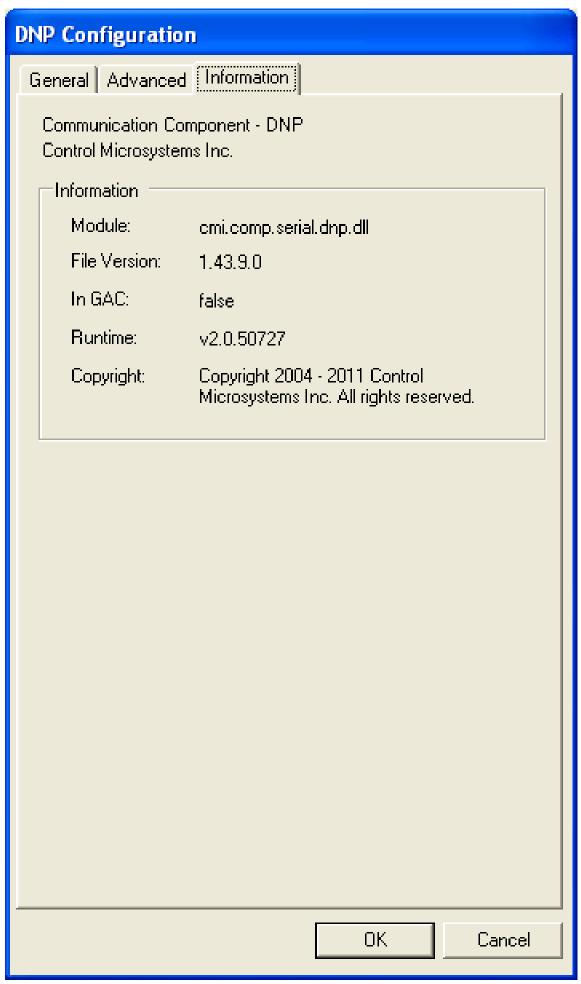
The **Maximum** selection indicates that the host application is to package messages using the maximum size allowable by the protocol.

The **Custom Value** selection specifies a custom value for the message size. This value indicates to the host application to package messages to be no larger than what is specified, if it is possible. Valid values are 2 to 231. The default value is 231.

- Click **Restore Defaults** to restore default values to fields on this page.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

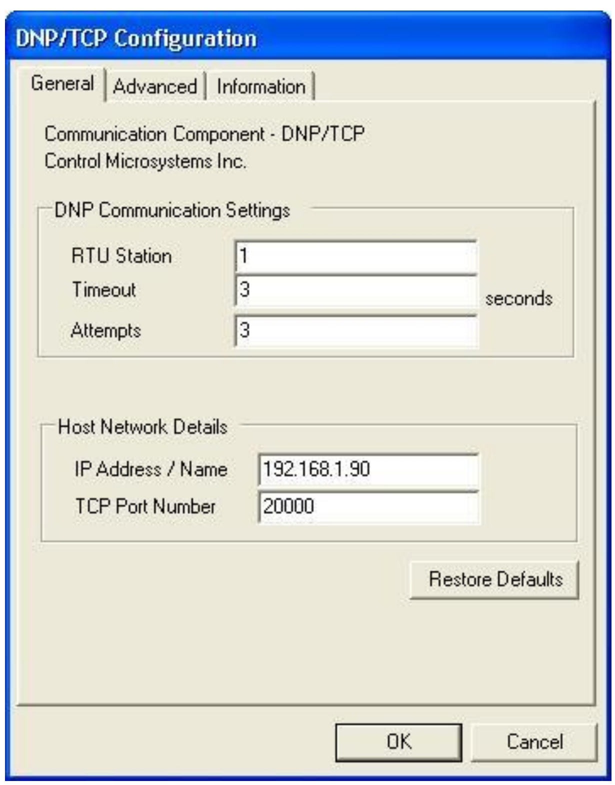
DNP/TCP

The DNP/TCP protocol driver is used to communicate over an Ethernet DNP network to SCADAPack controllers configured for DNP/TCP communication.

- To configure a DNP/TCP protocol connection, highlight **DNP/TCP** in the Communication Protocols window and click the **Configure** button. The DNP/TCP Configuration window is displayed.
- To select a configured DNP/TCP protocol connection, highlight **DNP/TCP** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Page

When DNP/TCP protocol is selected for configuration the DNP/TCP Configuration dialog is opened with the General tab selected as shown below.



The **DNP Communication Settings** grouping contains DNP specific communication settings including the DNP Station address, the timeout interval as well as the number of attempts.

The **RTU Station** parameter specifies the DNP station number of the target device. The valid range is 0 to 65519. The default is station 1.

The **Timeout** parameter specifies the length of time, in seconds, to wait for a response from the controller before retrying (see Attempts). Valid values are 1 to 255. The default value is 3 seconds.

The **Attempts** parameter specifies the number of times to send a command to the controller before giving up and reporting this to the host application. Valid values are 1 to 20. The default value is 3 attempts.

The **Host Network Details** grouping contains information about the IP network including the target's IP address or name, and the TCP port number on which it is listening. More details on these below.

IP Address / Name

The IP Address / Name parameter specifies the Ethernet IP address of the target RTU, or a DNS name that can be resolved to an IP address. The default value is blank. The following IP addresses are not supported and will be rejected:

0.0.0.0 through 0.255.255.255

127.0.0.0 through 127.255.255.255 (except 127.0.0.1)

224.0.0.0 through 224.255.255.255

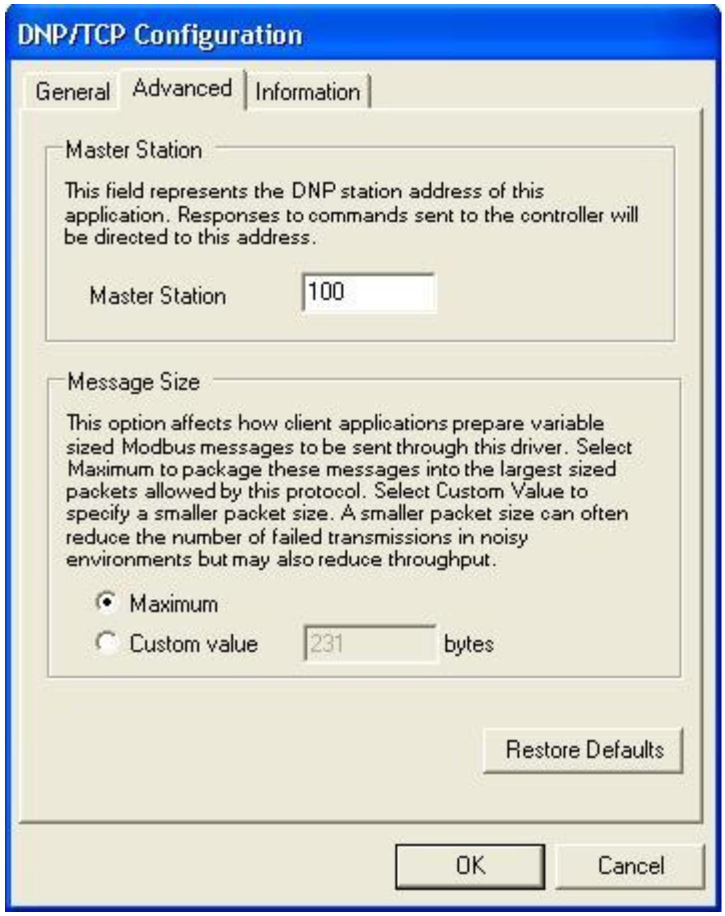
255.0.0.0 through 255.255.255.255.

The **TCP Port No.** field specifies the TCP port of the remote device. Valid values are 0 to 65535. The default value is 20000.

- Click **Restore Defaults** to restore default values to fields on this page, except for the IP Address / Name field. The content of this field will remain unchanged.

Advanced Page

Advanced parameters are used to set the Master Station address and control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.



The **Master Station** parameter specifies the DNP station address of the Realflo application. When Realflo sends out commands, responses from the target controller will be directed to this address. The valid range is 0 to 65519, except that this value cannot be the same as the target RTU Station number. The default value is 100.

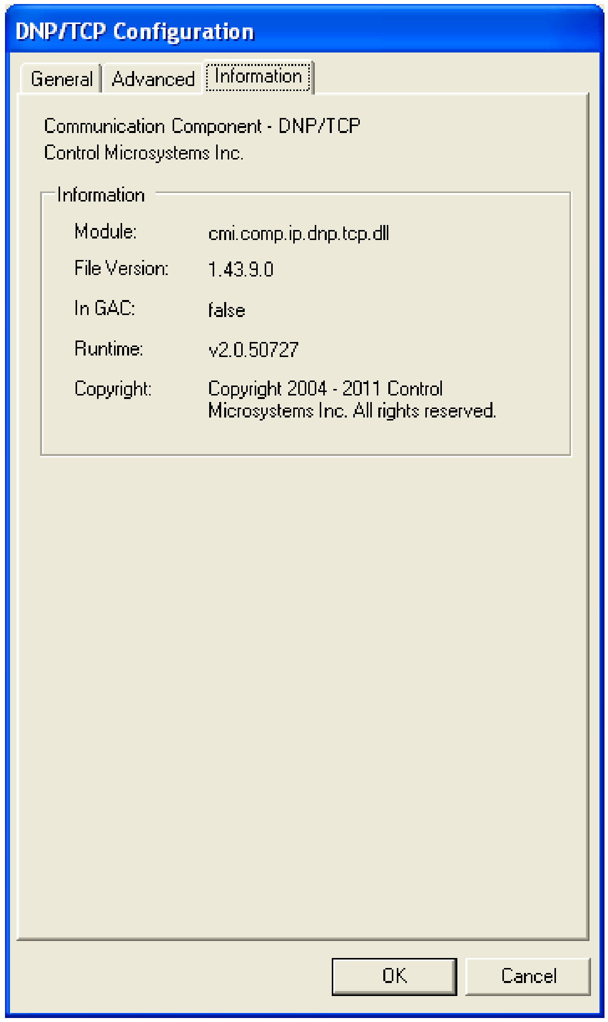
The **Maximum** selection indicates that you want the host application to package messages using the maximum size allowable by the protocol.

The **Custom value** selection specifies a custom value for message size. This value indicates to the host application to package messages to be no larger than what is specified if possible. The valid range for the Custom value field is from 2 to 231. *Maximum* is selected by default.

- Click **Restore Defaults** to restore default values to fields on this page.

Information Page

The Information page displays detailed driver information. When the Information tab is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

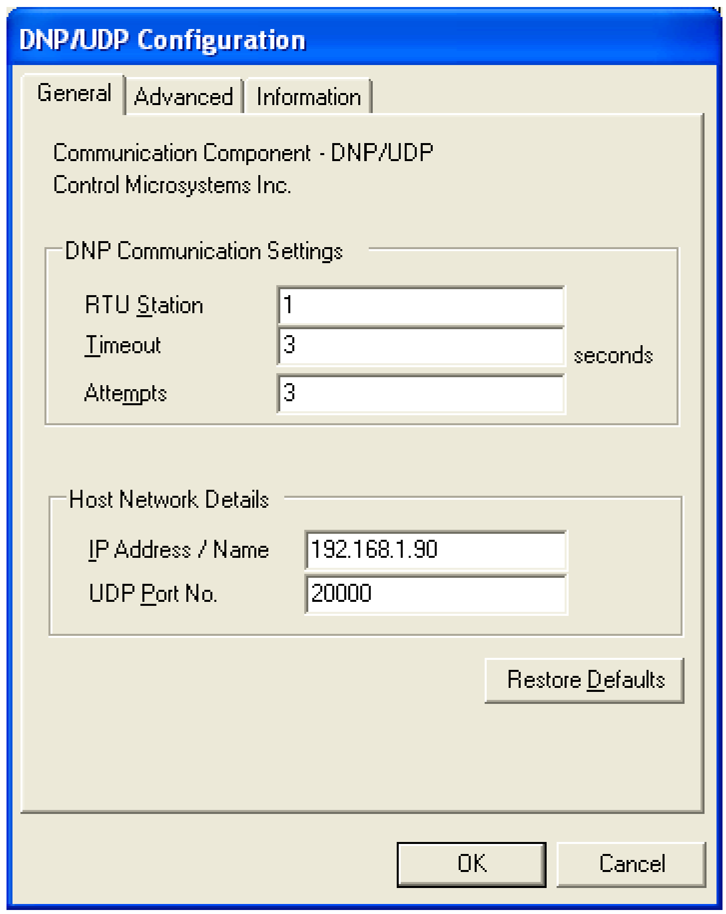
DNP/UDP

The DNP/UDP protocol driver is used to communicate over an Ethernet DNP network to SCADAPack controllers configured for DNP/UDP communication.

- To configure a DNP/UDP protocol connection, highlight **DNP/UDP** in the Communication Protocols window and click the **Configure** button. The DNP/UDP Configuration window is displayed.
- To select a configured DNP/UDP protocol connection, highlight **DNP/UDP** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Page

When DNP/UDP protocol is selected for configuration the DNP/UDP Configuration dialog is opened with the General tab selected as shown below.



The **DNP Communication Settings** grouping contains DNP specific communication settings including the DNP Station address, the timeout interval as well as the number of attempts.

The **RTU Station** parameter specifies the DNP station number of the target device. The valid range is 0 to 65519. The default is station 1.

The **Timeout** parameter specifies the length of time, in seconds, to wait for a response from the controller before retrying (see Attempts). Valid values are 1 to 255. The default value is 3 seconds.

The **Attempts** parameter specifies the number of times to send a command to the controller before giving up and reporting this to the host application. Valid values are 1 to 20. The default value is 3 attempts.

The **Host Network Details** grouping contains information about the IP network including the target's IP address or name, and the UDP port number on which it is listening. More details on these below.

IP Address / Name

The IP Address / Name parameter specifies the Ethernet IP address of the target RTU, or a DNS name that can be resolved to an IP address. The default value is blank. The following IP addresses are not supported and will be rejected:

0.0.0.0 through 0.255.255.255

127.0.0.0 through 127.255.255.255 (except 127.0.0.1)

224.0.0.0 through 224.255.255.255

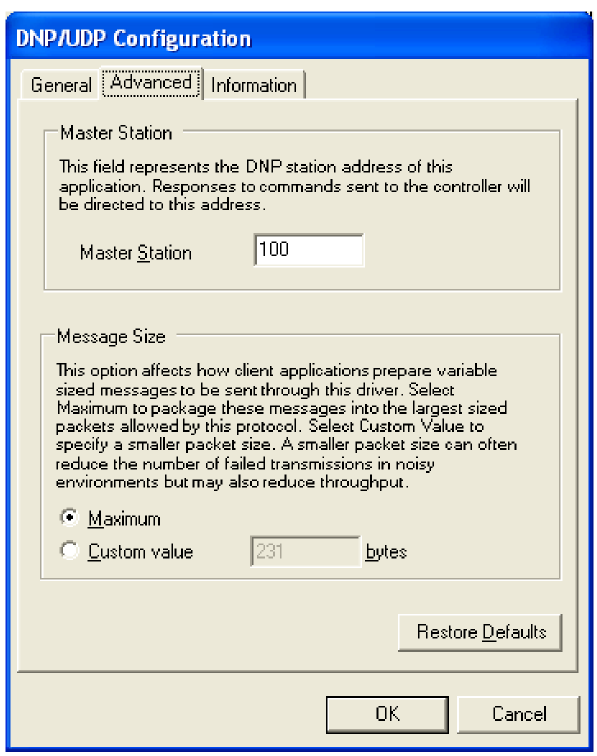
255.0.0.0 through 255.255.255.255.

The **UDP Port No.** field specifies the UDP port of the remote device. Valid values are 0 to 65534. The default value is 20000.

- Click **Restore Defaults** to restore default values to fields on this page, except for the IP Address / Name field. The content of this field will remain unchanged.

Advanced Page

Advanced parameters are used to set the Master Station address and control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.



The **Master Station** parameter specifies the DNP station address of the Realflo application. When Realflo sends out commands, responses from the target controller will be directed to this address. The valid range is 0 to 65519, except that this value cannot be the same as the target RTU Station number. The default value is 100.

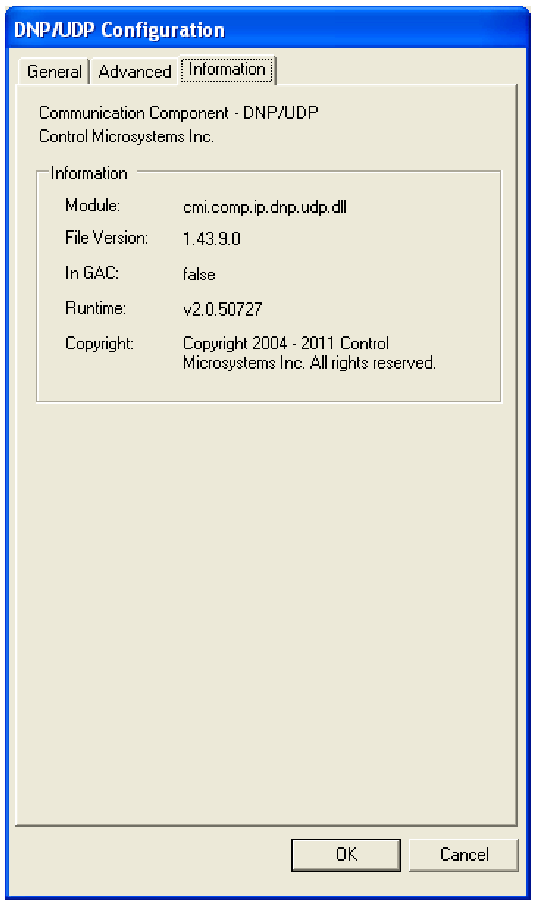
The **Maximum** selection indicates that you want the host application to package messages using the maximum size allowable by the protocol.

The **Custom value** selection specifies a custom value for message size. This value indicates to the host application to package messages to be no larger than what is specified if possible. The valid range for the Custom value field is from 2 to 231. *Maximum* is selected by default.

- Click **Restore Defaults** to restore default values to fields on this page

Information Page

The Information page displays detailed driver information. When the Information tab is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

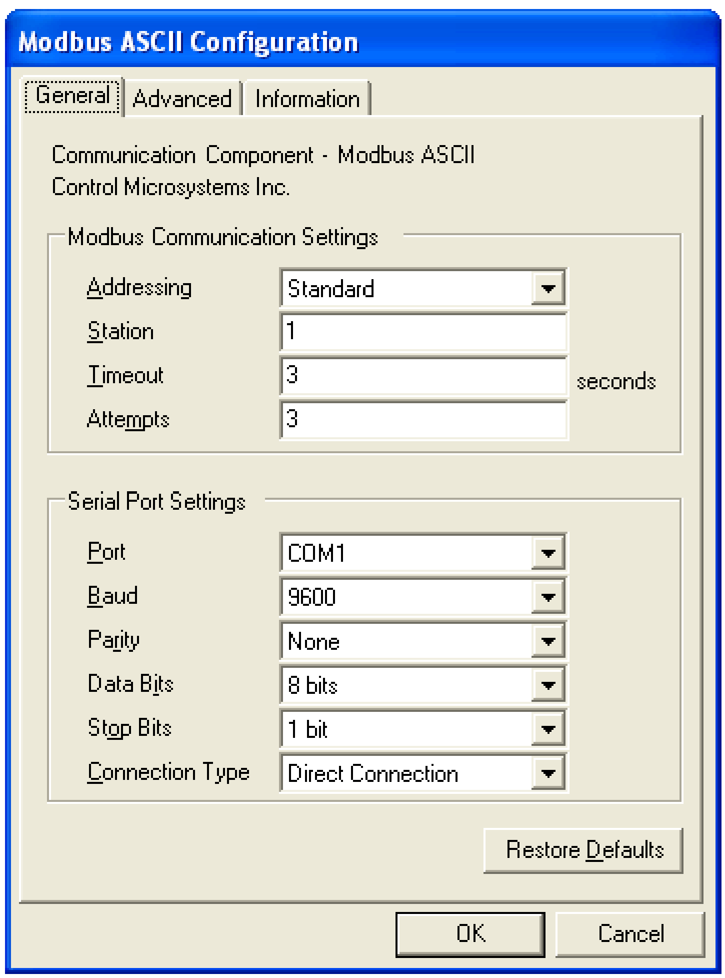
Modbus ASCII

The Modbus ASCII protocol driver is used to communicate over a serial network, using Modbus ASCII framing, to SCADAPack controllers configured for Modbus ASCII protocol.

- To configure a Modbus ASCII protocol connection, highlight **Modbus ASCII** in the Communication Protocols window and click the **Configure** button. The Modbus ASCII Configuration window is displayed.
- To select a configured Modbus ASCII protocol connection, highlight **Modbus ASCII** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

When Modbus ASCII is selected for configuration the Modbus ASCII Configuration dialog is opened with the General tab selected as shown below.



The **Modbus Communication Settings** grouping contains Modbus specific communication settings including the addressing mode, the station address, the timeout interval as well as the number of attempts.

The **Addressing** parameter selects standard or extended Modbus addressing. Standard addressing allows 255 stations and is compatible with standard Modbus devices. Extended addressing allows 65534 stations, with stations 1 to 254 compatible with standard Modbus devices. The default is Standard.

The **Station** parameter sets the target station number. The valid range is 1 to 255 if standard addressing is used, and 1 to 65534 if extended addressing is used. The default is 1.

The **Timeout** parameter sets the length of time, in seconds, to wait for a response from the controller before retrying (see Attempts). Valid entries are 1 to 255. The default is 3.

The **Attempts** parameter sets number of times to send a command to the controller before giving up and reporting this to the host application. Valid entries are 1 to 20. The default is 3.

This **Serial Port Settings** grouping contains details directly related to the PC's communication port including the port number, the baud rate, parity, and stop bit settings.

The **Port** parameter specifies the PC serial port to use. The DNP driver determines what serial ports are available on the PC and presents these in the drop-down menu list. The available serial ports list will include any USB to serial converters used on the PC. The default value is the first existing port found by the driver.

The **Baud** parameter specifies the baud rate to use for communication. The menu list displays selections for 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, and 57600. The default value is 9600.

The **Parity** parameter specifies the type of parity to use for communication. The menu list displays selections for none, odd and even parity. The default value is None.

The **Data Bits** parameter specifies the number of data bits contained in the character frame. Valid values are for this field is 7 and 8 bits. The default value is 8 bits.

The **Stop Bits** parameter specifies the number of stop bits to use for communication. The menu list displays selections for 1 and 2 stop bits. The default value is 1 bit.

The **Connection Type** parameter specifies the serial connection type. The Modbus ASCII driver supports direct serial connection with no flow control, Request-to-send (RTS) and clear-to-send (CTS) flow control and PSTN dial-up connections. The menu list displays selections for Direct Connection, RTS/CTS Flow Control and Dial Up Connection. The default selection is Direct Connection.

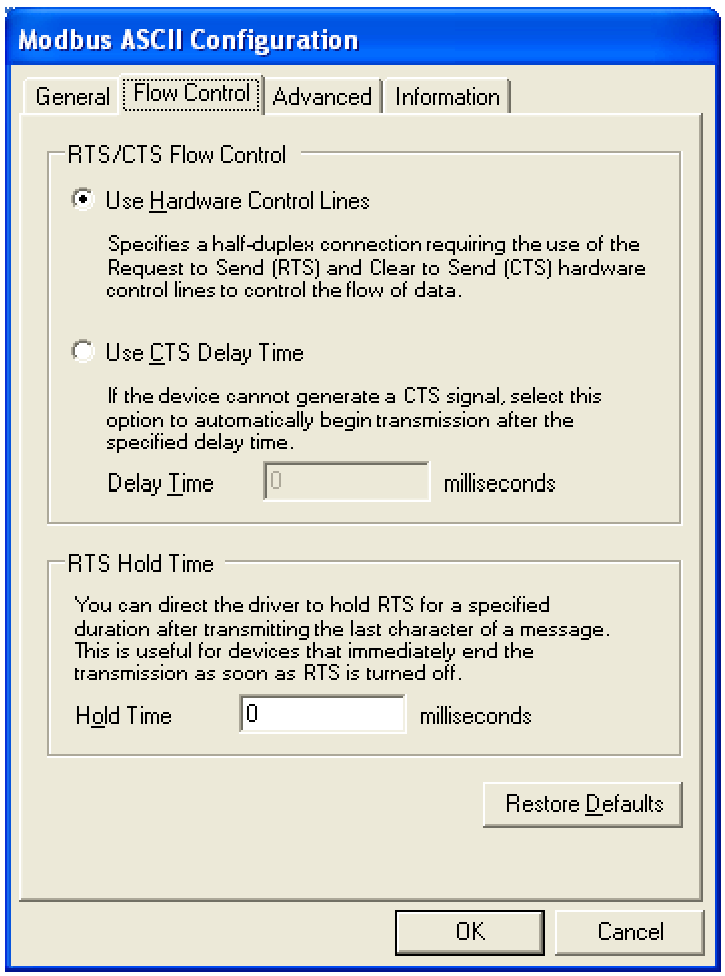
- Select **Direct Connection** for RS-232 for RS-485 connections not requiring the hardware control lines on the serial ports.
- Select **RTS/CTS Flow Control** to communicate over radio or leased-line networks using modems that require RTS/CTS handshaking. Selecting RTS/CTS Flow Control adds a new tab, Flow Control, to the

Modbus ASCII Configuration dialog. Refer to the Flow Control Parameters section below for configuration details.

- Select **Dial Up Connection** to communication over dial up modems. Selecting Dial Up Connection adds a new tab, Dial Up, to the Modbus ASCII Configuration dialog. Refer to the Dial Up Parameters section below for configuration details.
- Click **Restore Defaults** to restore default values to fields on this page.

Modbus ASCII Configuration (Flow Control)

Flow Control parameters are used to configure how RTS and CTS control is used. When RTS/CTS Flow Control is selected for Connection Type the Flow Control tab is added to the Modbus ASCII Configuration dialog. When the Flow Control tab heading is clicked the Flow Control dialog is opened as shown below.



The **RTS/CTS Flow Control** grouping contains two mutually exclusive options, Use Hardware Control Lines and Use CTS Delay Time. These options enable the driver to communicate over radio or leased-line networks using modems that require RTS/CTS handshaking.

The **Use Hardware Control Lines** option specifies a half-duplex connection requiring the use of the Request to Send (RTS) and Clear to Send (CTS) hardware control lines to control the flow of data. This selection is used with radios and dedicated telephone line modems. The driver turns on the RTS signal when it wants to transmit data. The modem or other device then turns on CTS when it is ready to transmit. The driver transmits the data, and then turns off the RTS signal. This selection is mutually exclusive of the Use CTS Delay Time selection described below. This is the default selection.

The **Use CTS Delay Time** option is selected if the device cannot generate a CTS signal. The driver will assert RTS then wait the specified Delay Time, in milliseconds, before proceeding. This option is mutually exclusive with the Use Hardware Control Lines selection described above.

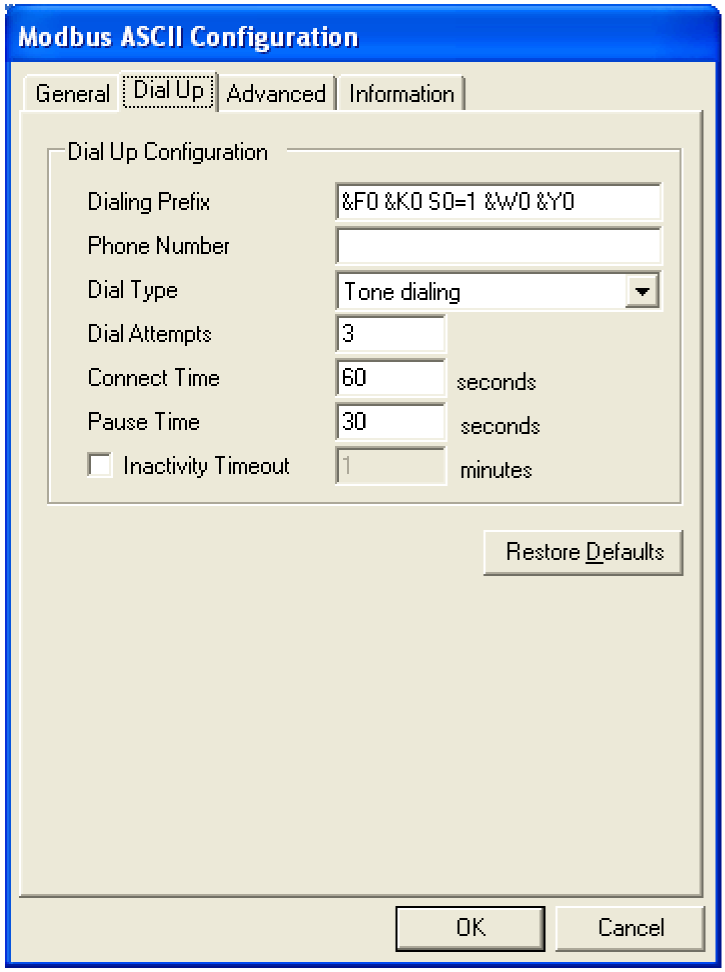
The **Delay Time** parameter sets the time in milliseconds that the driver will wait after asserting RTS before proceeding. The value of this field needs to be smaller than the Time Out value set in the General parameters dialog. For example, if the Timeout value is set to 3 seconds, the CTS Delay Time can be set to 2999 milliseconds or less. The minimum value for this field is 0 milliseconds. The value is initially set to 0 by default.

The **Hold Time** parameter specifies the time, in milliseconds, that the driver will hold RTS after the last character is transmitted. This is useful for devices that immediately end transmission when RTS is turned off. The value of this field needs to be smaller than the Time Out value set in the General parameters dialog. For example, if the Timeout value is set to 3 seconds, the CTS Delay Time can be set to 2999 milliseconds or less. The minimum value for this field is 0 milliseconds. The value is initially set to 0 by default.

- Click **Restore Defaults** to restore default values to all fields on this page.

Modbus ASCII Configuration (Dial Up)

Dial Up parameters are used to configure a dial up connection. When Dial Up is selected for Connection Type the Dial Up tab is added to the Modbus ASCII Configuration dialog. When the Dial Up tab heading is clicked the Dial Up dialog is opened as shown below.



The **Dialing Prefix** parameter specifies the commands sent to the modem before dialing. A maximum of 32 characters can be entered. Any character is valid. The default value is “&F0 &K0 S0=1 &W0 &Y0”.

The **Phone Number** parameter specifies the telephone number of the remote controller. A maximum of 32 characters can be entered. Any character is valid. This field’s default value is blank.

The **Dial Type** parameter specifies the dialing type. Valid values are Pulse and Tone. The default value is Tone.

The **Dial Attempts** parameter specifies how many dialing attempts will be made. Valid values are 1 to 10. The default value is 1.

The **Connect Time** parameter specifies the amount of time in seconds the modem will wait for a connection. Valid values are 6 to 300. The default value is 60.

The **Pause Time** parameter specifies the time in seconds between dialing attempts. Valid values are 6 to 600. The default value is 30.

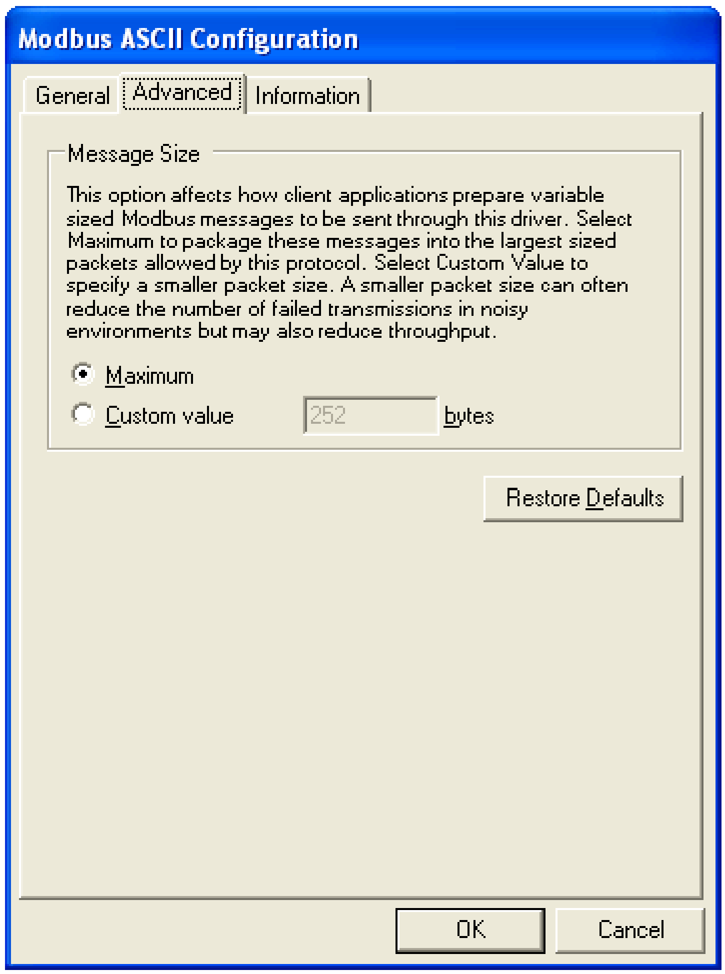
Check the **Inactivity Timeout** check box to automatically terminate the dialup connection after a period of inactivity. The Inactivity Time edit box is enabled only if this option is checked. The default state is checked.

Enter the inactivity period, in minutes, in the **Inactivity Timeout** box. The dialup connection will be terminated automatically after the specified number of minutes of inactivity has lapsed. This option is only active if the Inactivity Timeout box is checked. Valid values are from 1 to 30 minutes. The default value is 1.

- Click **Restore Defaults** to restore default values to all fields on this page, except for the Phone Number field. The content of this field will remain unchanged.

Advanced Parameters

Advanced parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.



The **Message Size** grouping parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput.

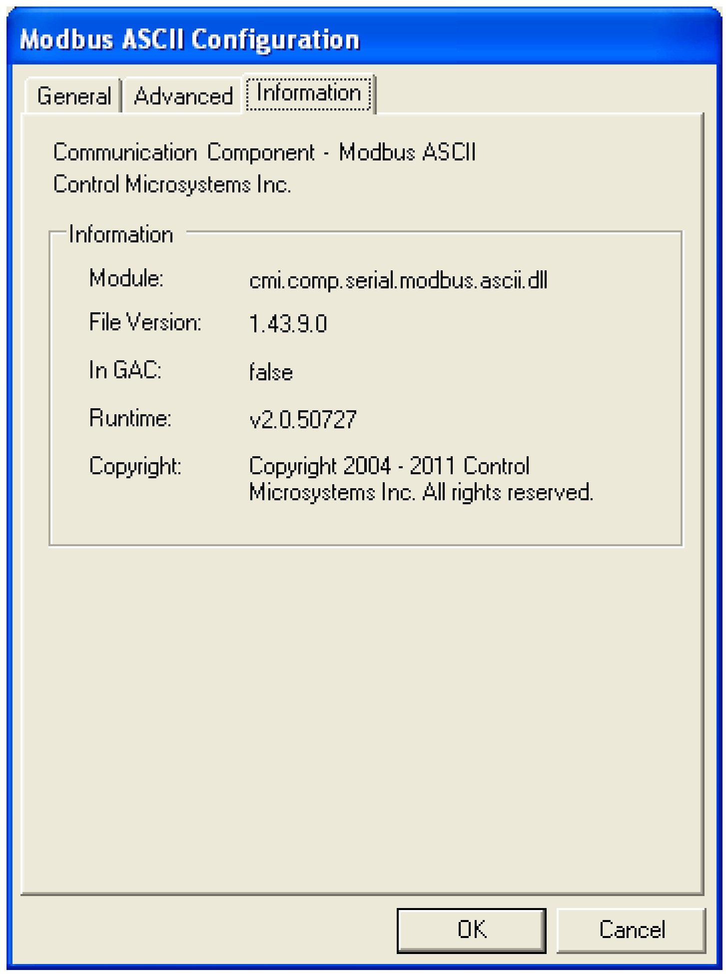
The **Maximum** selection indicates that the host application is to package messages using the maximum size allowable by the protocol.

The **Custom Value** selection specifies a custom value for the message size. This value indicates to the host application to package messages to be no larger than what is specified, if it is possible. Valid values are 2 to 250 when Addressing is set to Extended and Station is 255 or higher. When Addressing is set to Extended and Station is less than 255 valid values are 2 to 252. When Addressing is set to Standard valid values are 2 to 252.

- Click **Restore Defaults** to restore default values to fields on this page.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

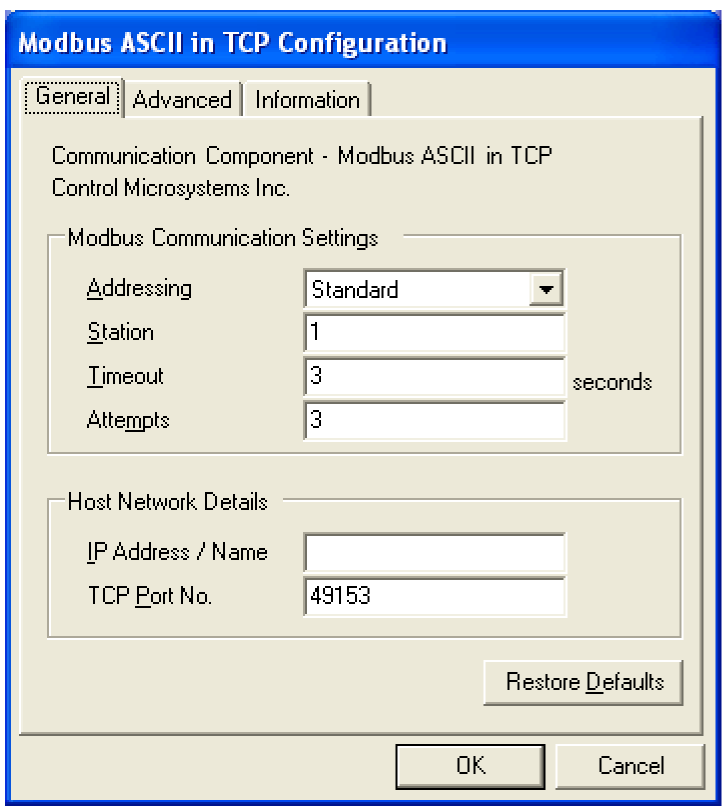
Modbus ASCII in TCP

Modbus ASCII in TCP message format is exactly same as that of the Modbus ASCII protocol. The main difference is that Modbus ASCII in TCP protocol communicates with a SCADAPack controller through the Internet and Modbus ASCII through the serial port. The Modbus ASCII in TCP protocol does not include a six-byte header prefix, as with the Modbus\TCP, but does include the Modbus 'CRC-16' or 'LRC' check fields.

- To configure a Modbus ASCII in TCP protocol connection, highlight **Modbus ASCII in TCP** in the Communication Protocols window and click the **Configure** button. The Modbus ASCII in TCP Configuration window is displayed.
- To select a configured Modbus ASCII in TCP protocol connection, highlight **Modbus ASCII in TCP** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

When Modbus ASCII in TCP is selected for configuration the Modbus ASCII in TCP Configuration dialog is opened with the General tab selected as shown below.



The **Modbus Communication Settings** grouping contains Modbus specific communication settings including the addressing mode, the station address, the timeout interval as well as the number of attempts.

The **Addressing** parameter selects standard or extended Modbus addressing. Standard addressing allows 255 stations and is compatible with standard Modbus devices. Extended addressing allows 65534 stations, with stations 1 to 254 compatible with standard Modbus devices. The default is Standard.

The **Station** parameter sets the target station number. The valid range is 1 to 255 if standard addressing is used, and 1 to 65534 if extended addressing is used. The default is 1.

The **Timeout** parameter sets the length of time, in seconds, to wait for a response from the controller before retrying (see Attempts). Valid entries are 1 to 255. The default is 3.

The **Attempts** parameter sets number of times to send a command to the controller before giving up and reporting this to the host application. Valid entries are 1 to 20. The default is 3.

The **Host Network Details** grouping contains entries for the host’s IP address or name and the TCP port on which it is listening.

The **IP Address / Name** entry specifies the Ethernet IP address in dotted quad notation, or a DNS host name that can be resolved to an IP address, of the PC where the ClearSCADA server is installed. The following IP addresses are not supported and will be rejected:

0.0.0.0 through 0.255.255.255

127.0.0.0 through 127.255.255.255 (except 127.0.0.1)

224.0.0.0 through 224.255.255.255

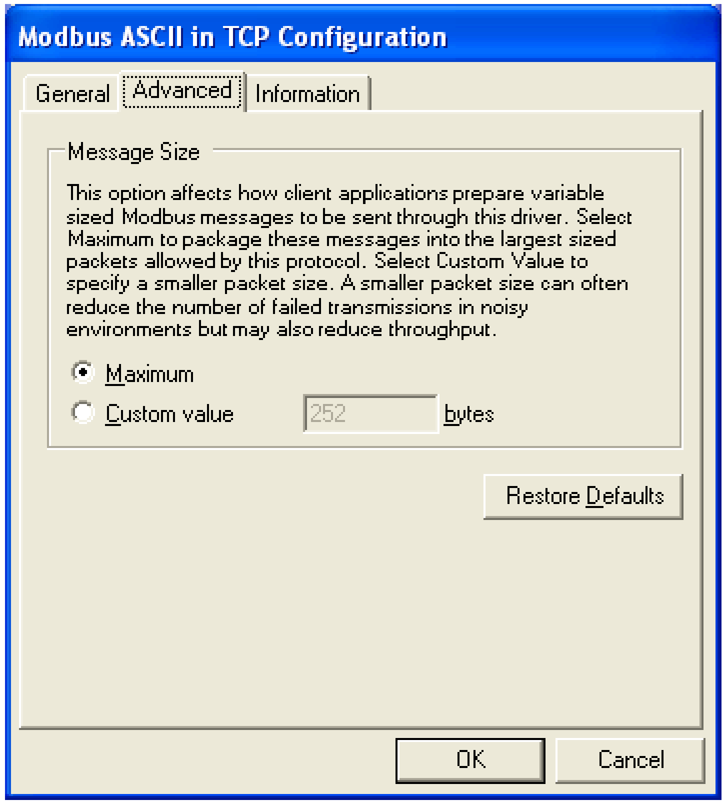
255.0.0.0 through 255.255.255.255.

The **TCP Port No.** field specifies the TCP port of the remote device. Valid values are 0 to 65535. The default value is 49153.

- Click **Restore Defaults** to restore default values to fields on this page, except for the IP Address / Name field. The content of this field will remain unchanged.

Advanced Parameters

Advanced parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.



The **Message Size** grouping parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput.

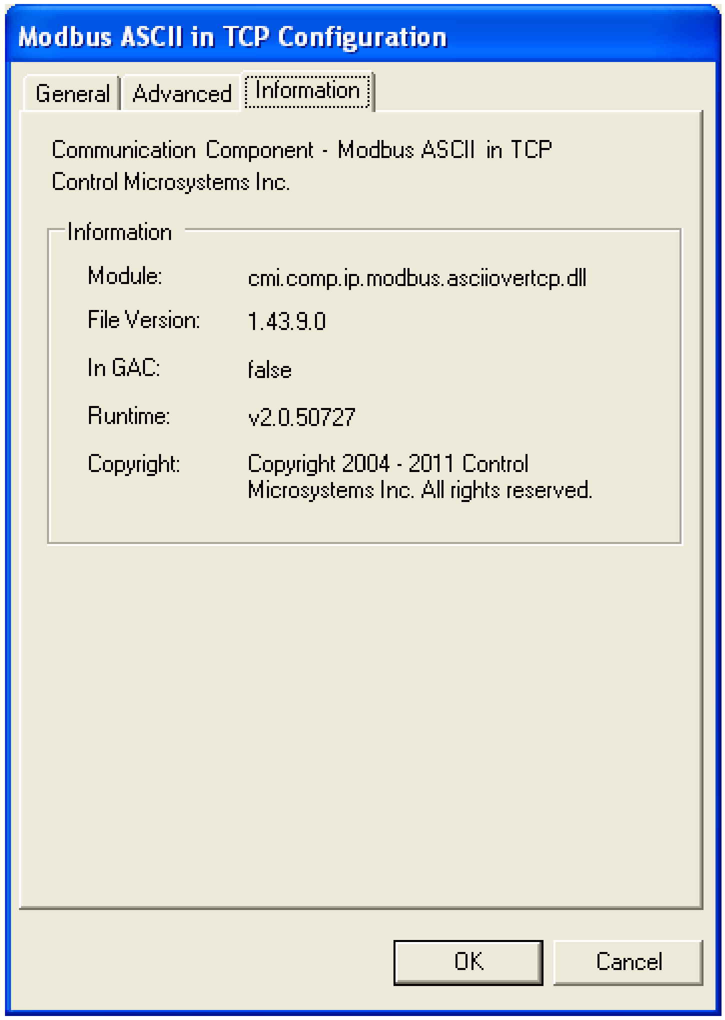
The **Maximum** selection indicates that the host application is to package messages using the maximum size allowable by the protocol.

The **Custom Value** selection specifies a custom value for the message size. This value indicates to the host application to package messages to be no larger than what is specified, if it is possible. Valid values are 2 to 250 when Addressing is set to Extended and Station is 255 or higher. When Addressing is set to Extended and Station is less than 255 valid values are 2 to 252. When Addressing is set to Standard valid values are 2 to 252.

- Click **Restore Defaults** to restore default values to all fields on this page.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

Modbus ASCII in UDP

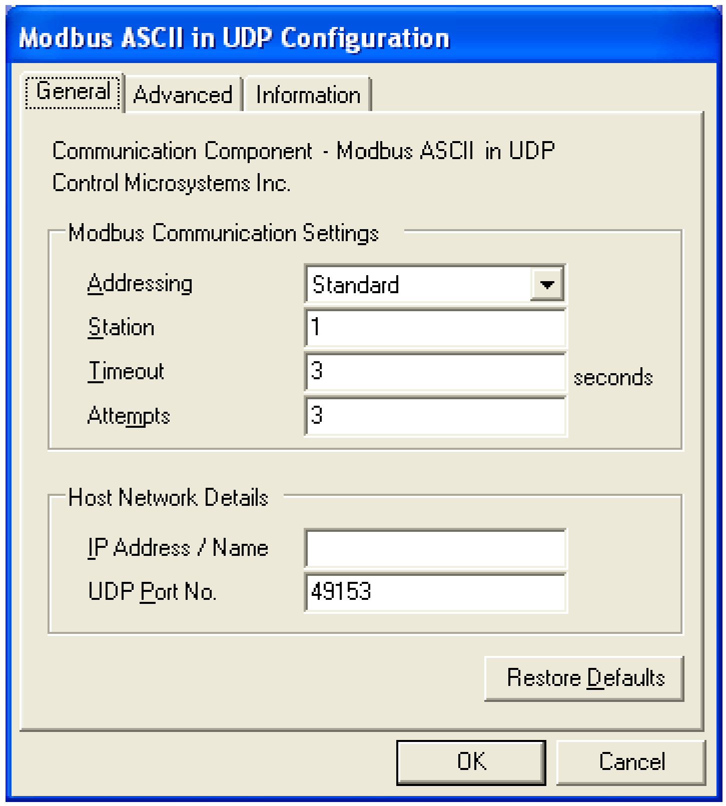
Modbus ASCII in UDP protocol is similar to Modbus ASCII in TCP protocol. It has the same message format as the Modbus ASCII in TCP. The only difference between them is one uses TCP protocol and another uses UDP protocol.

- To configure a Modbus ASCII in TCP protocol connection, highlight **Modbus ASCII in UDP** in the Communication Protocols window and click the **Configure** button. The Modbus ASCII in UDP Configuration window is displayed.

- To select a configured Modbus ASCII in TCP protocol connection, highlight **Modbus ASCII in UDP** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

When Modbus ASCII in UDP is selected for configuration the Modbus ASCII in UDP Configuration dialog is opened with the General tab selected as shown below.



The **Modbus Communication Settings** grouping contains Modbus specific communication settings including the addressing mode, the station address, the timeout interval as well as the number of attempts.

The **Addressing** parameter selects standard or extended Modbus addressing. Standard addressing allows 255 stations and is compatible with standard Modbus devices. Extended addressing allows 65534 stations, with stations 1 to 254 compatible with standard Modbus devices. The default is Standard.

The **Station** parameter sets the target station number. The valid range is 1 to 255 if standard addressing is used, and 1 to 65534 if extended addressing is used. The default is 1.

The **Timeout** parameter sets the length of time, in seconds, to wait for a response from the controller before retrying (see Attempts). Valid entries are 1 to 255. The default is 3.

The **Attempts** parameter sets number of times to send a command to the controller before giving up and reporting this to the host application. Valid entries are 1 to 20. The default is 3.

The **Host Network Details** grouping contains entries for the host's IP address or name and the TCP port on which it is listening.

The **IP Address / Name** entry specifies the Ethernet IP address in dotted quad notation, or a DNS host name that can be resolved to an IP address, of the PC where the ClearSCADA server is installed. The following IP addresses are not supported and will be rejected:

0.0.0.0 through 0.255.255.255

127.0.0.0 through 127.255.255.255 (except 127.0.0.1)

224.0.0.0 through 224.255.255.255

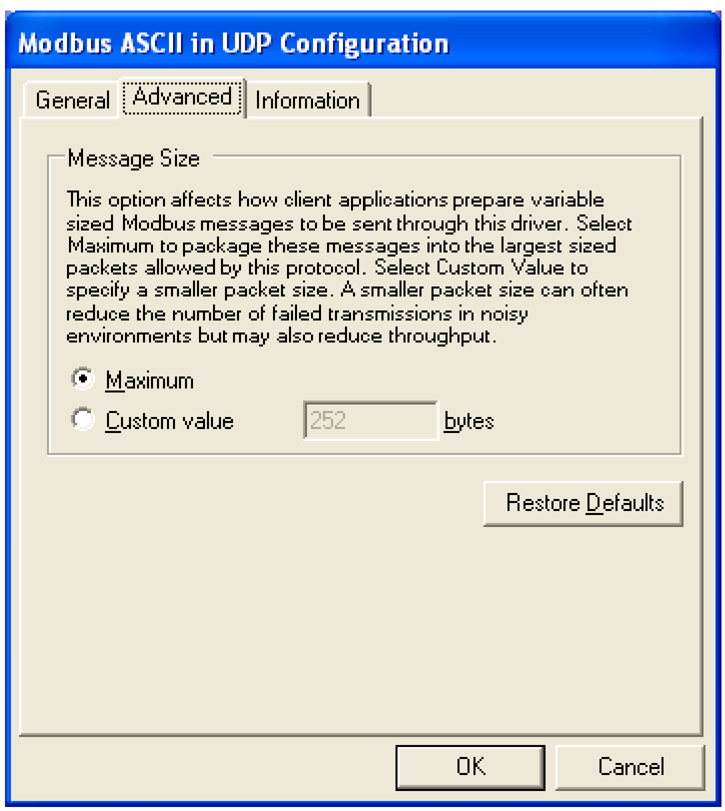
255.0.0.0 through 255.255.255.255.

The **UDP Port No.** field specifies the UDP port of the remote device. Valid values are 0 to 65535. The default value is 49153.

- Click **Restore Defaults** to restore default values to fields on this page, except for the IP Address / Name field. The content of this field will remain unchanged.

Advanced Parameters

Advanced parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked, the Advanced dialog is opened as shown below.



The **Message Size** grouping parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput.

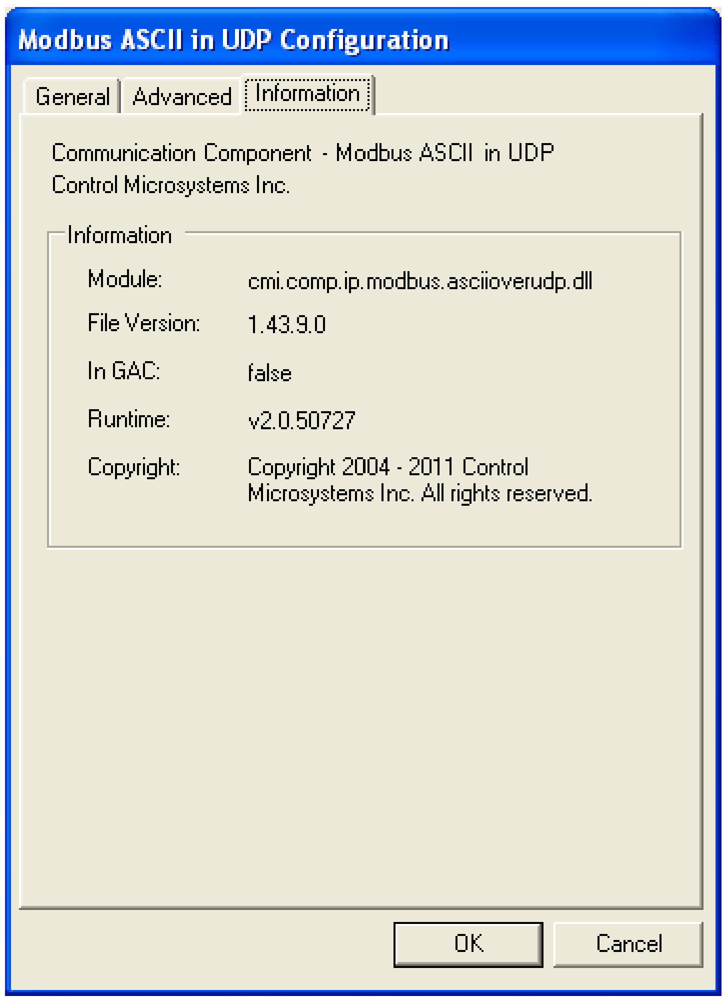
The **Maximum** selection indicates that the host application is to package messages using the maximum size allowable by the protocol.

The **Custom Value** selection specifies a custom value for the message size. This value indicates to the host application to package messages to be no larger than what is specified, if it is possible. Valid values are 2 to 250 when Addressing is set to Extended and Station is 255 or higher. When Addressing is set to Extended and Station is less than 255 valid values are 2 to 252. When Addressing is set to Standard valid values are 2 to 252.

- Click **Restore Defaults** to restore default values to fields on this page.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

Modbus RTU

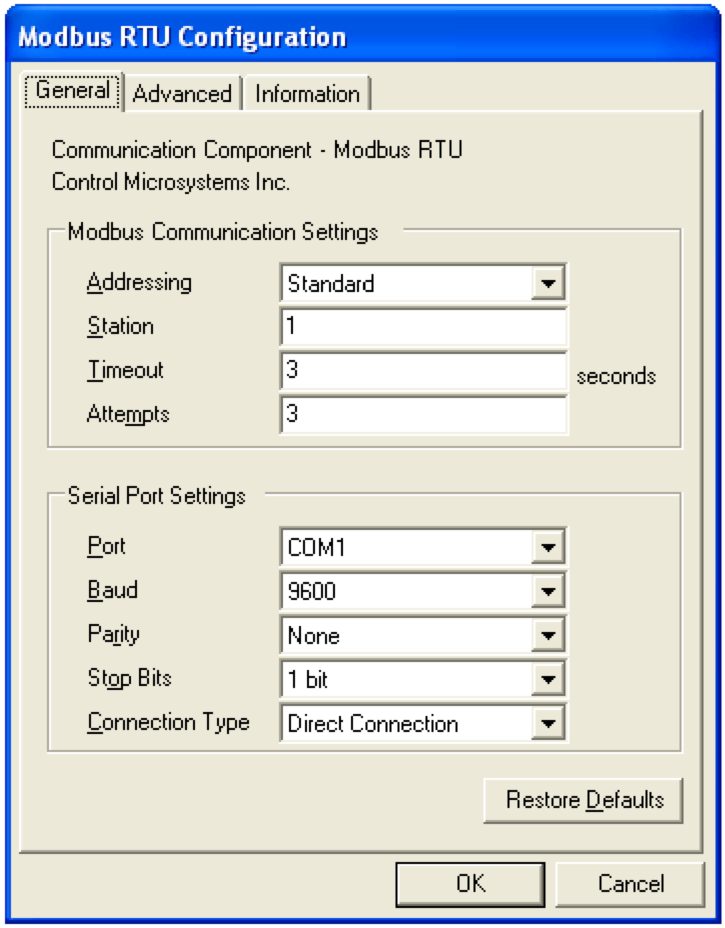
Introduction

The Modbus RTU protocol driver is used to communicate over a serial network, using Modbus RTU framing, to SCADAPack controllers configured for Modbus RTU protocol.

- To configure a Modbus RTU protocol connection, highlight **Modbus RTU** in the Communication Protocols window and click the **Configure** button. The Modbus RTU Configuration window is displayed.
- To select a configured Modbus RTU protocol connection, highlight **Modbus RTU** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

When Modbus RTU is selected for configuration the Modbus RTU Configuration dialog is opened with the General tab selected as shown below.



The **Modbus Communication Settings** grouping contains Modbus specific communication settings including the addressing mode, the station address, the timeout interval as well as the number of attempts.

The **Addressing** parameter selects standard or extended Modbus addressing. Standard addressing allows 255 stations and is compatible with standard Modbus devices. Extended addressing allows 65534 stations, with stations 1 to 254 compatible with standard Modbus devices. The default is Standard.

The **Station** parameter sets the target station number. The valid range is 1 to 255 if standard addressing is used and 1 to 65534 if extended addressing is used. The default is 1.

The **Timeout** parameter sets the length of time, in seconds, to wait for a response from the controller before retrying (see Attempts). Valid entries are 1 to 255. The default is 3.

The **Attempts** parameter sets number of times to send a command to the controller before giving up and reporting this to the host application. Valid entries are 1 to 20. The default is 3.

This **Serial Port Settings** grouping contains details directly related to the PC's communication port including the port number, the baud rate, parity, and stop bit settings.

The **Port** parameter specifies the PC serial port to use. The DNP driver determines what serial ports are available on the PC and presents these in the drop-down menu list. The available serial ports list will include any USB to serial converters used on the PC. The default value is the first existing port found by the driver.

The **Baud** parameter specifies the baud rate to use for communication. The menu list displays selections for 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, and 57600. The default value is 9600.

The **Parity** parameter specifies the type of parity to use for communication. The menu list displays selections for none, odd and even parity. The default value is None.

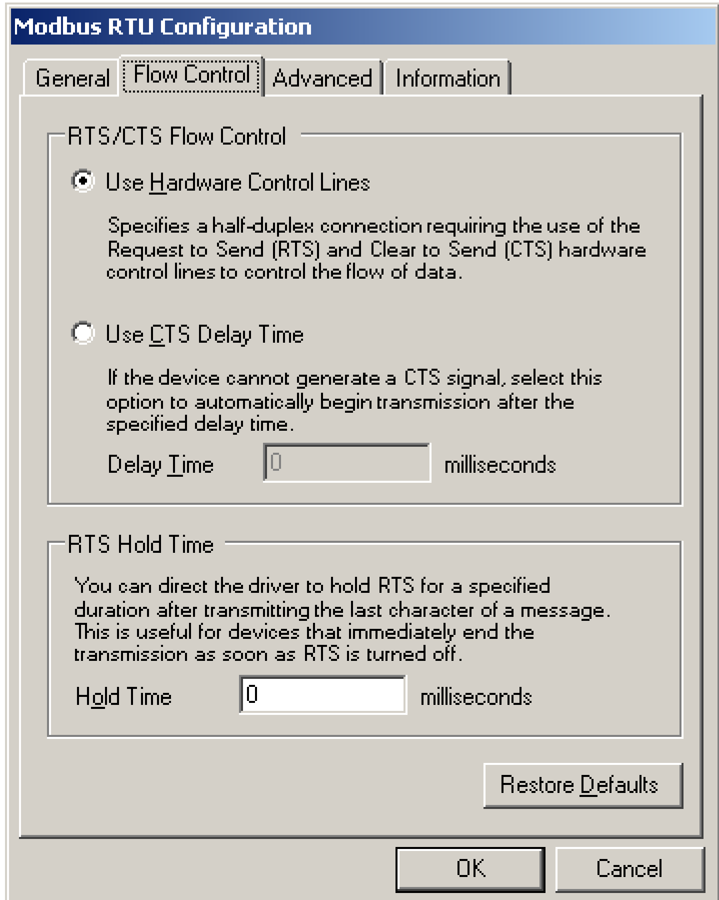
The **Stop Bits** parameter specifies the number of stop bits to use for communication. The menu list displays selections for 1 and 2 stop bits. The default value is 1 bit.

The **Connection Type** parameter specifies the serial connection type. The Modbus RTU driver supports direct serial connection with no flow control, Request-to-send (RTS) and clear-to-send (CTS) flow control and PSTN dial-up connections. The menu list displays selections for Direct Connection, RTS/CTS Flow Control and Dial Up Connection. The default selection is Direct Connection.

- Select **Direct Connection** for RS-232 for RS-485 connections not requiring the hardware control lines on the serial ports.
- Select **RTS/CTS Flow Control** to communicate over radio or leased-line networks using modems that require RTS/CTS handshaking. Selecting RTS/CTS Flow Control adds a new tab, Flow Control, to the Modbus RTU Configuration dialog. Refer to the Flow Control Parameters section below for configuration details.
- Select **Dial Up Connection** to communication over dial up modems. Selecting Dial Up Connection adds a new tab, Dial Up, to the Modbus RTU Configuration dialog. Refer to the Dial Up Parameters section below for configuration details.
- Click **Restore Defaults** to restore default values to fields on this page.

Modbus RTU Configuration (Flow Control)

Flow Control parameters are used to configure how RTS and CTS control is used. When RTS/CTS Flow Control is selected for Connection Type the Flow Control tab is added to the Modbus RTU Configuration dialog. When the Flow Control tab heading is clicked the Flow Control dialog is opened as shown below.



The **RTS/CTS Flow Control** grouping contains two mutually exclusive options, Use Hardware Control Lines and Use CTS Delay Time. These options enable the driver to communicate over radio or leased-line networks using modems that require RTS/CTS handshaking.

The **Use Hardware Control Lines** option specifies a half-duplex connection requiring the use of the Request to Send (RTS) and Clear to Send (CTS) hardware control lines to control the flow of data. This selection is used with radios and dedicated telephone line modems. The driver turns on the RTS signal when it wants to transmit data. The modem or other device then turns on CTS when it is ready to transmit. The driver transmits the data, and then turns off the RTS signal. This selection is mutually exclusive of the Use CTS Delay Time selection described below. This is the default selection.

The **Use CTS Delay Time** option is selected if the device cannot generate a CTS signal. The driver will assert RTS then wait the specified Delay Time, in milliseconds, before proceeding. This option is mutually exclusive with the Use Hardware Control Lines selection described above.

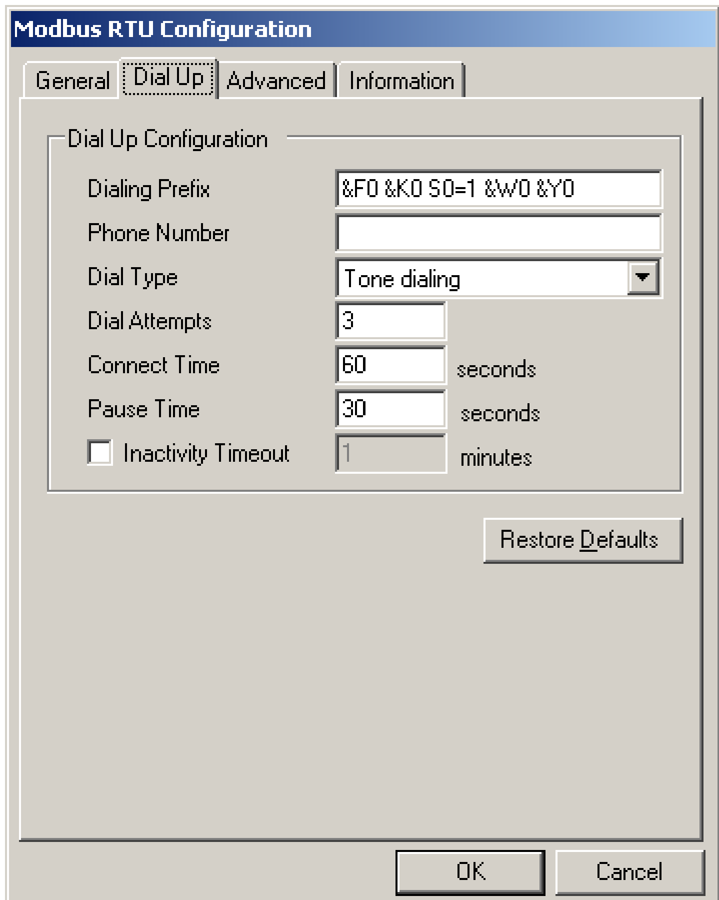
The **Delay Time** parameter sets the time in milliseconds that the driver will wait after asserting RTS before proceeding. The value of this field needs to be smaller than the Time Out value set in the General parameters dialog. For example, if the Timeout value is set to 3 seconds, the CTS Delay Time can be set to 2999 milliseconds or less. The minimum value for this field is 0 milliseconds. The value is initially set to 0 by default.

The **Hold Time** parameter specifies the time, in milliseconds, that the driver will hold RTS after the last character is transmitted. This is useful for devices that immediately end transmission when RTS is turned off. The value of this field needs to be smaller than the Time Out value set in the General parameters dialog. For example, if the Timeout value is set to 3 seconds, the CTS Delay Time can be set to 2999 milliseconds or less. The minimum value for this field is 0 milliseconds. The value is initially set to 0 by default.

- Click **Restore Defaults** to restore default values to fields on this page.

Modbus RTU Configuration (Dial Up)

Dial Up parameters are used to configure a dial up connection. When Dial Up is selected for Connection Type the Dial Up tab is added to the Modbus RTU Configuration dialog. When the Dial Up tab heading is clicked the Dial Up dialog is opened as shown below.



The **Dialing Prefix** parameter specifies the commands sent to the modem before dialing. A maximum of 32 characters can be entered. Any characters are valid. The default value is “&F0 &K0 S0=1 &W0 &Y0”.

The **Phone Number** parameter specifies the telephone number of the remote controller. A maximum of 32 characters can be entered. Any characters are valid. This field’s default value is blank.

The **Dial Type** parameter specifies the dialing type. Valid values are Pulse and Tone. The default value is Tone.

The **Dial Attempts** parameter specifies how many dialing attempts will be made. Valid values are 1 to 10. The default value is 1.

The **Connect Time** parameter specifies the amount of time in seconds the modem will wait for a connection. Valid values are 6 to 300. The default value is 60.

The **Pause Time** parameter specifies the time in seconds between dialing attempts. Valid values are 6 to 600. The default value is 30.

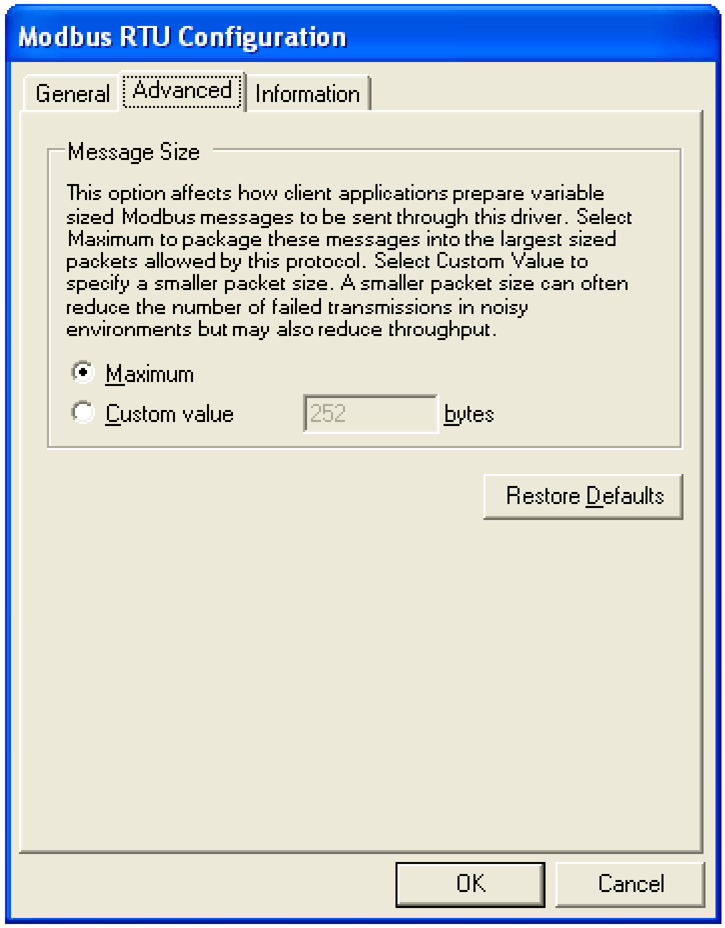
Check the **Inactivity Timeout** check box to automatically terminate the dialup connection after a period of inactivity. The Inactivity Time edit box is enabled only if this option is checked. The default state is checked.

Enter the inactivity period, in minutes, in the **Inactivity Timeout** box. The dialup connection will be terminated automatically after the specified number of minutes of inactivity has lapsed. This option is only active if the Inactivity Timeout box is checked. Valid values are from 1 to 30 minutes. The default value is 1.

- Click **Restore Defaults** to restore default values to fields on this page, except for the Phone Number field. The content of this field will remain unchanged.

Advanced Parameters

Advanced parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.



The **Message Size** grouping parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput.

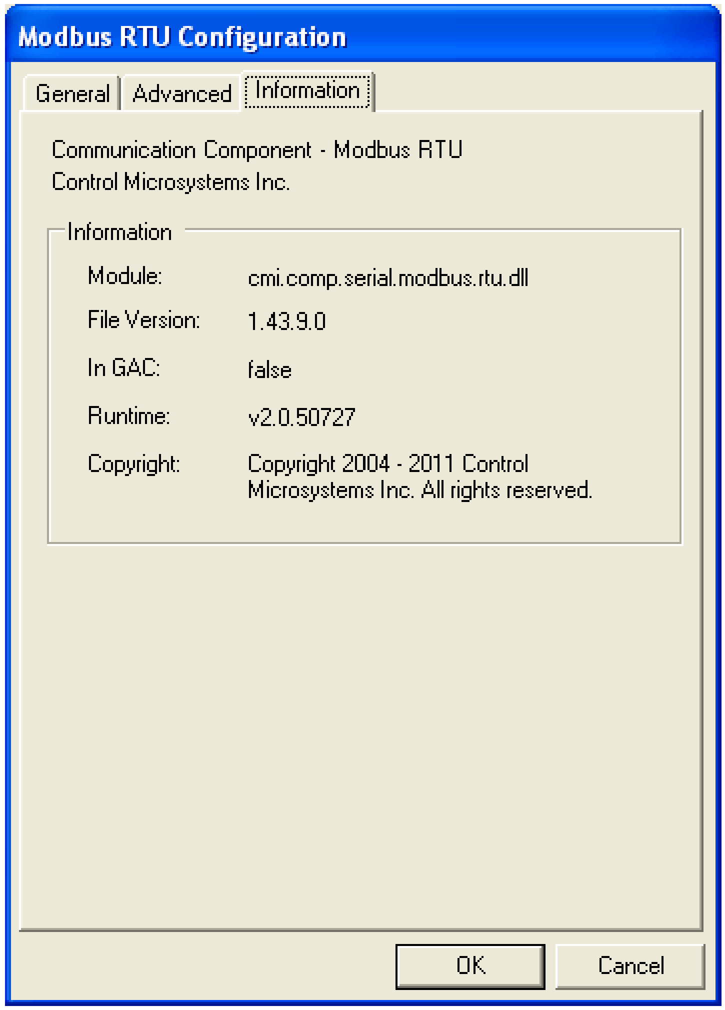
The **Maximum** selection indicates that the host application is to package messages using the maximum size allowable by the protocol.

The **Custom Value** selection specifies a custom value for the message size. This value indicates to the host application to package messages to be no larger than what is specified, if it is possible. Valid values are 2 to 250 when Addressing is set to Extended and Station is 255 or higher. When Addressing is set to Extended and Station is less than 255 valid values are 2 to 252. When Addressing is set to Standard valid values are 2 to 252.

- Click **Restore Defaults** to restore default values to fields on this page.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

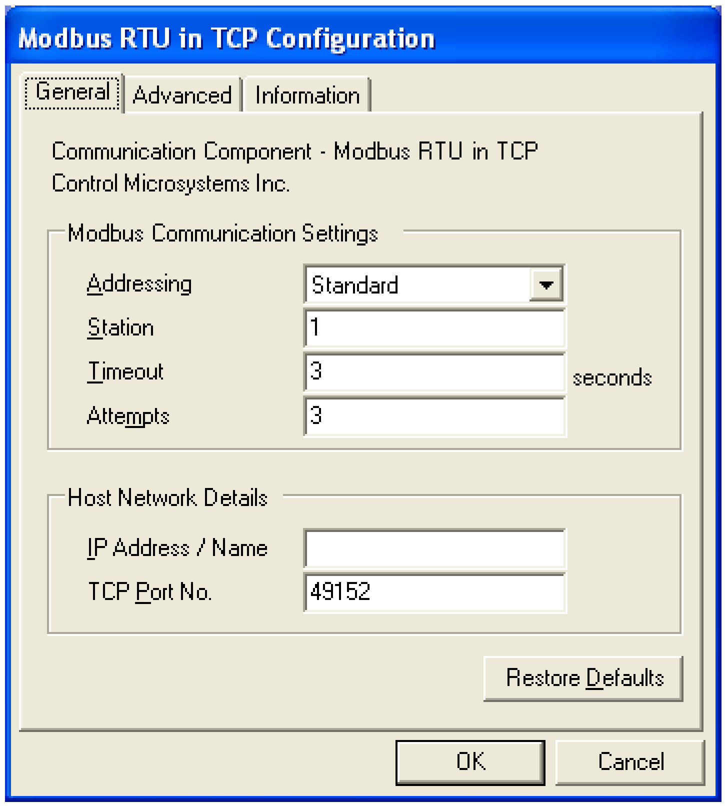
Modbus RTU in TCP

Modbus RTU in TCP message format is exactly same as that of the Modbus RTU protocol. The main difference is that Modbus RTU in TCP protocol communicates with a controller through the Internet and Modbus RTU protocol through the serial port. The Modbus RTU in TCP protocol does not include a six-byte header prefix, as with the Modbus\TCP, but does include the Modbus ‘CRC-16’ or ‘LRC’ check fields. The Modbus RTU in TCP message format supports Modbus RTU message format.

- To configure a Modbus RTU in TCP protocol connection, highlight **Modbus RTU in TCP** in the Communication Protocols window and click the **Configure** button. The Modbus RTU in TCP Configuration window is displayed.
- To select a configured Modbus RTU in TCP protocol connection, highlight **Modbus RTU in TCP** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

When Modbus RTU in TCP is selected for configuration the Modbus RTU in TCP Configuration dialog is opened with the General tab selected as shown below.



The **Modbus Communication Settings** grouping contains Modbus specific communication settings including the addressing mode, the station address, the timeout interval as well as the number of attempts.

The **Addressing** parameter selects standard or extended Modbus addressing. Standard addressing allows 255 stations and is compatible with standard Modbus devices. Extended addressing allows 65534 stations, with stations 1 to 254 compatible with standard Modbus devices. The default is Standard.

The **Station** parameter sets the target station number. The valid range is 1 to 255 if standard addressing is used and 1 to 65534 if extended addressing is used. The default is 1.

The **Timeout** parameter sets the length of time, in seconds, to wait for a response from the controller before retrying (see Attempts). Valid entries are 1 to 255. The default is 3.

The **Attempts** parameter sets number of times to send a command to the controller before giving up and reporting this to the host application. Valid entries are 1 to 20. The default is 3.

The **Host Network Details** grouping contains entries for the host's IP address or name and the TCP port on which it is listening.

The **IP Address / Name** entry specifies the Ethernet IP address in dotted quad notation, or a DNS host name that can be resolved to an IP address, of the PC where the ClearSCADA server is installed. The following IP addresses are not supported and will be rejected:

0.0.0.0 through 0.255.255.255

127.0.0.0 through 127.255.255.255 (except 127.0.0.1)

224.0.0.0 through 224.255.255.255

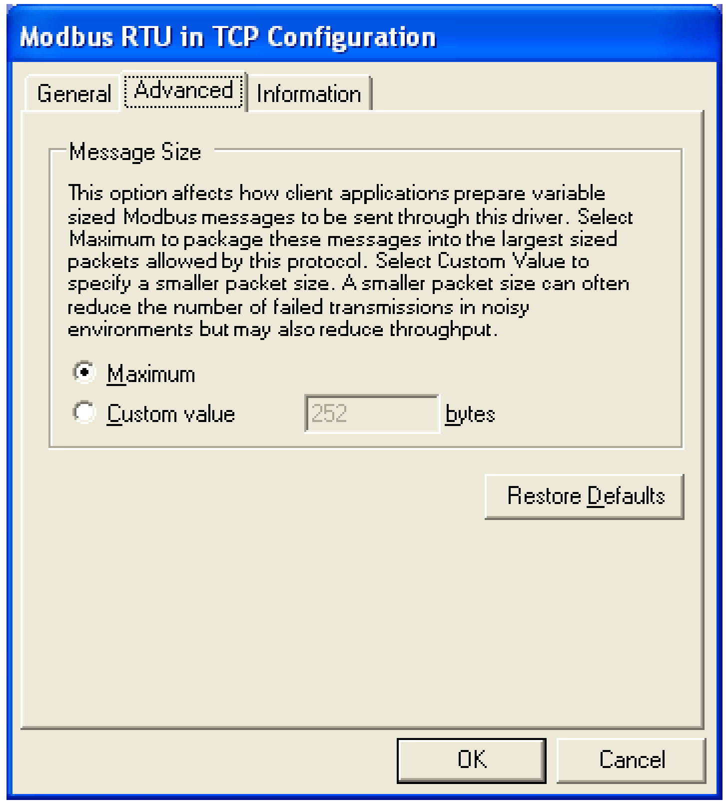
255.0.0.0 through 255.255.255.255.

The **TCP Port No.** field specifies the TCP port of the remote device. Valid values are 0 to 65535. The default value is 49152.

- Click **Restore Defaults** to restore default values to all fields on this page, except for the IP Address / Name field. The content of this field will remain unchanged.

Advanced Parameters

Advanced parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.



The **Message Size** grouping parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput.

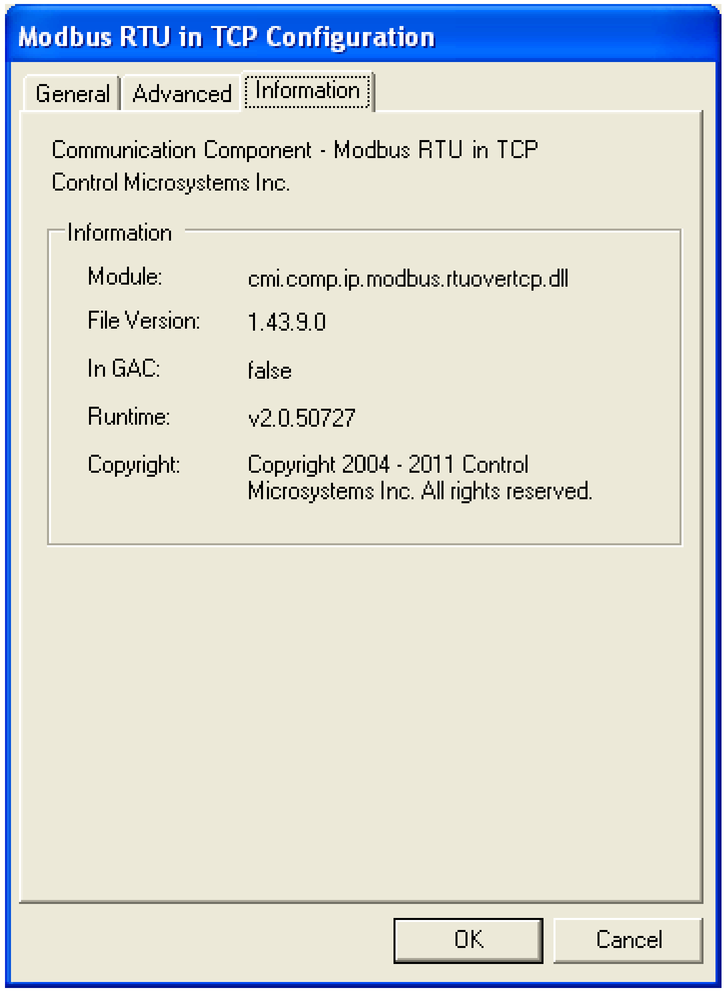
The **Maximum** selection indicates that the host application is to package messages using the maximum size allowable by the protocol.

The **Custom Value** selection specifies a custom value for the message size. This value indicates to the host application to package messages to be no larger than what is specified, if it is possible. Valid values are 2 to 250 when Addressing is set to Extended and Station is 255 or higher. When Addressing is set to Extended and Station is less than 255 valid values are 2 to 252. When Addressing is set to Standard valid values are 2 to 252.

- Click **Restore Defaults** to restore default values to fields on this page.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

Modbus RTU in UDP

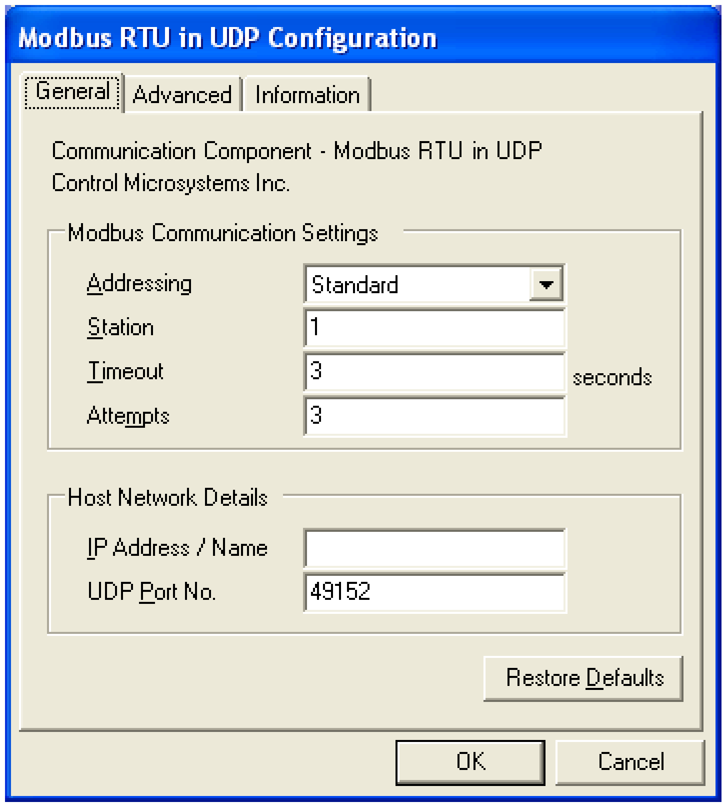
Modbus RTU in UDP protocol is similar to Modbus RTU in TCP protocol. It has the same message format as the RTU in TCP message. The only difference between them is one uses TCP protocol and another uses UDP protocol.

- To configure a Modbus RTU in UDP protocol connection, highlight **Modbus RTU in UDP** in the Communication Protocols window and click the **Configure** button. The Modbus RTU in UDP Configuration window is displayed.

- To select a configured Modbus RTU in UDP protocol connection, highlight **Modbus RTU in UDP** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

When Modbus RTU in UDP is selected for configuration the Modbus RTU in UDP Configuration dialog is opened with the General tab selected as shown below.



The **Modbus Communication Settings** grouping contains Modbus specific communication settings including the addressing mode, the station address, the timeout interval as well as the number of attempts.

The **Addressing** parameter selects standard or extended Modbus addressing. Standard addressing allows 255 stations and is compatible with standard Modbus devices. Extended addressing allows 65534 stations, with stations 1 to 254 compatible with standard Modbus devices. The default is Standard.

The **Station** parameter sets the target station number. The valid range is 1 to 255 if standard addressing is used and 1 to 65534 if extended addressing is used. The default is 1.

The **Timeout** parameter sets the length of time, in seconds, to wait for a response from the controller before retrying (see Attempts). Valid entries are 1 to 255. The default is 3.

The **Attempts** parameter sets number of times to send a command to the controller before giving up and reporting this to the host application. Valid entries are 1 to 20. The default is 3.

The **Host Network Details** grouping contains entries for the host's IP address or name and the TCP port on which it is listening.

The **IP Address / Name** entry specifies the Ethernet IP address in dotted quad notation, or a DNS host name that can be resolved to an IP address, of the PC where the ClearSCADA server is installed. The following IP addresses are not supported and will be rejected:

0.0.0.0 through 0.255.255.255

127.0.0.0 through 127.255.255.255 (except 127.0.0.1)

224.0.0.0 through 224.255.255.255

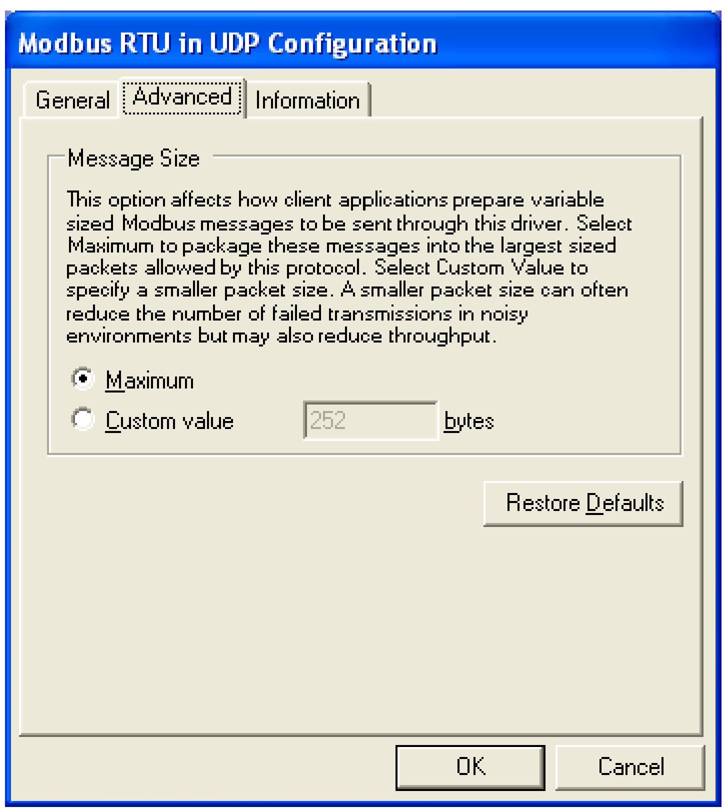
255.0.0.0 through 255.255.255.255.

The **UDP Port No.** field specifies the UDP port of the remote device. Valid values are 0 to 65535. The default value is 49152.

- Click **Restore Defaults** to restore default values to fields on this page, except for the IP Address / Name field. The content of this field will remain unchanged.

Advanced Parameters

Advanced parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.



The **Message Size** grouping parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput.

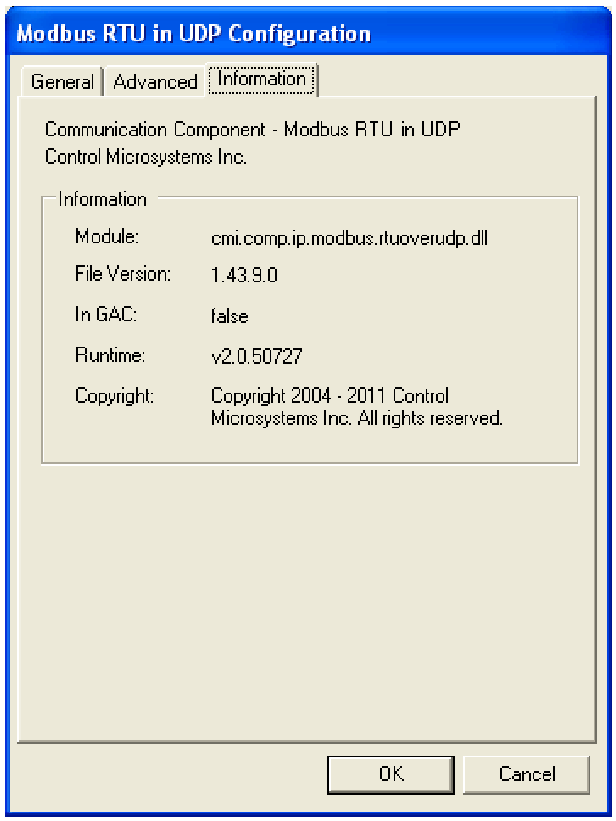
The **Maximum** selection indicates that the host application is to package messages using the maximum size allowable by the protocol.

The **Custom Value** selection specifies a custom value for the message size. This value indicates to the host application to package messages to be no larger than what is specified, if it is possible. Valid values are 2 to 250 when Addressing is set to Extended and Station is 255 or higher. When Addressing is set to Extended and Station is less than 255 valid values are 2 to 252. When Addressing is set to Standard valid values are 2 to 252.

- Click **Restore Defaults** to restore default values to fields on this page.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

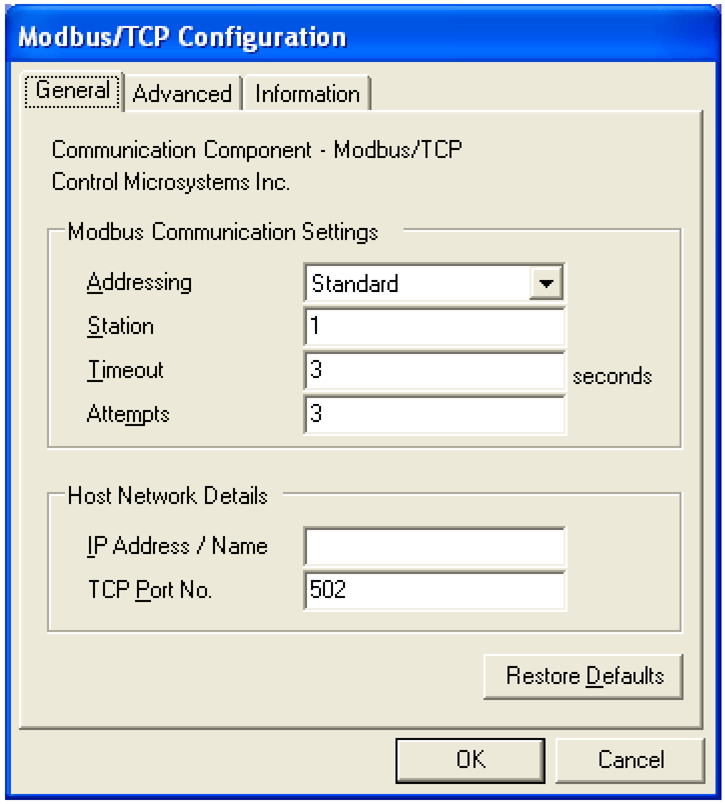
Modbus/TCP

Modbus/TCP is an extension of serial Modbus, which defines how Modbus messages are encoded within and transported over TCP/IP-based networks. The Modbus/TCP protocol uses a custom Modbus protocol layer on top of the TCP protocol. Its request and response messages are prefixed by six bytes. These six bytes consist of three fields: transaction ID field, protocol ID field and length field. The encapsulated Modbus message has exactly the same layout and meaning, from the function code to the end of the data portion, as other Modbus messages. The Modbus ‘CRC-16’ or ‘LRC’ check fields are not used in Modbus/TCP. The TCP/IP and link layer (e.g. Ethernet) checksum mechanisms instead are used to verify accurate delivery of the packet.

- To configure a Modbus/TCP protocol connection, highlight **Modbus/TCP** in the Communication Protocols window and click the **Configure** button. The Modbus/TCP Configuration window is displayed.
- To select a configured Modbus/TCP protocol connection, highlight **Modbus/TCP** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

When Modbus/TCP is selected for configuration the Modbus/TCP Configuration dialog is opened with the General tab selected as shown below.



The **Modbus Communication Settings** grouping contains Modbus specific communication settings including the addressing mode, the station address, the timeout interval as well as the number of attempts.

The **Addressing** parameter selects standard or extended Modbus addressing. Standard addressing allows 255 stations and is compatible with standard Modbus devices. Extended addressing allows 65534 stations, with stations 1 to 254 compatible with standard Modbus devices. The default is Standard.

The **Station** parameter sets the target station number. The valid range is 1 to 255 if standard addressing is used and 1 to 65534 if extended addressing is used. The default is 1.

The **Timeout** parameter sets the length of time, in seconds, to wait for a response from the controller before retrying (see Attempts). Valid entries are 1 to 255. The default is 3.

The **Attempts** parameter sets number of times to send a command to the controller before giving up and reporting this to the host application. Valid entries are 1 to 20. The default is 3.

The **Host Network Details** grouping contains entries for the host's IP address or name and the TCP port on which it is listening.

The **IP Address / Name** entry specifies the Ethernet IP address in dotted quad notation, or a DNS host name that can be resolved to an IP address, of the PC where the ClearSCADA server is installed. The following IP addresses are not supported and will be rejected:

0.0.0.0 through 0.255.255.255

127.0.0.0 through 127.255.255.255 (except 127.0.0.1)

224.0.0.0 through 224.255.255.255

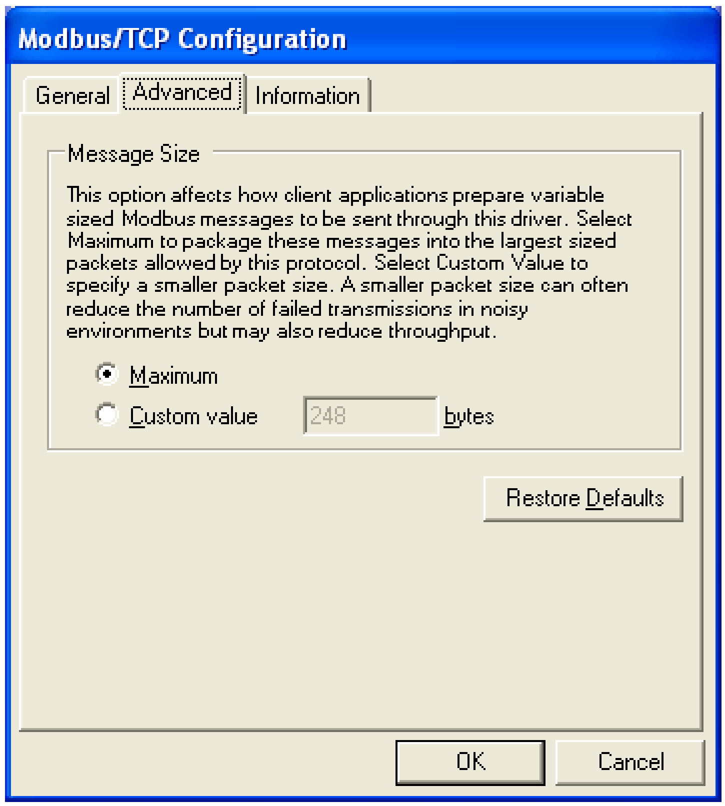
255.0.0.0 through 255.255.255.255.

The **TCP Port No.** field specifies the UDP port of the remote device. Valid values are 0 to 65535. The default value is 502.

- Click **Restore Defaults** to restore default values to fields on this page, except for the IP Address / Name field. The content of this field will remain unchanged.

Advanced Parameters

Advanced parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.



The **Message Size** grouping parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput.

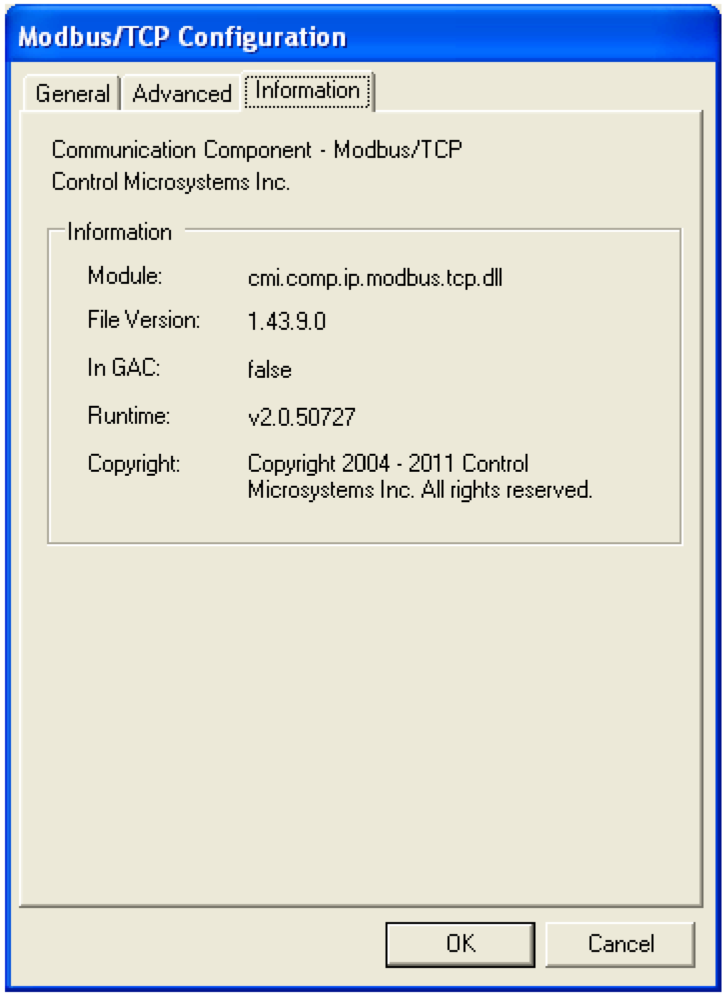
The **Maximum** selection indicates that the host application is to package messages using the maximum size allowable by the protocol.

The **Custom Value** selection specifies a custom value for the message size. This value indicates to the host application to package messages to be no larger than what is specified, if it is possible. Valid values are 2 to 246 when Addressing is set to Extended and Station is 255 or higher. When Addressing is set to Extended and Station is less than 255 valid values are 2 to 248. When Addressing is set to Standard valid values are 2 to 248.

- Click **Restore Defaults** to restore default values to fields on this page.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

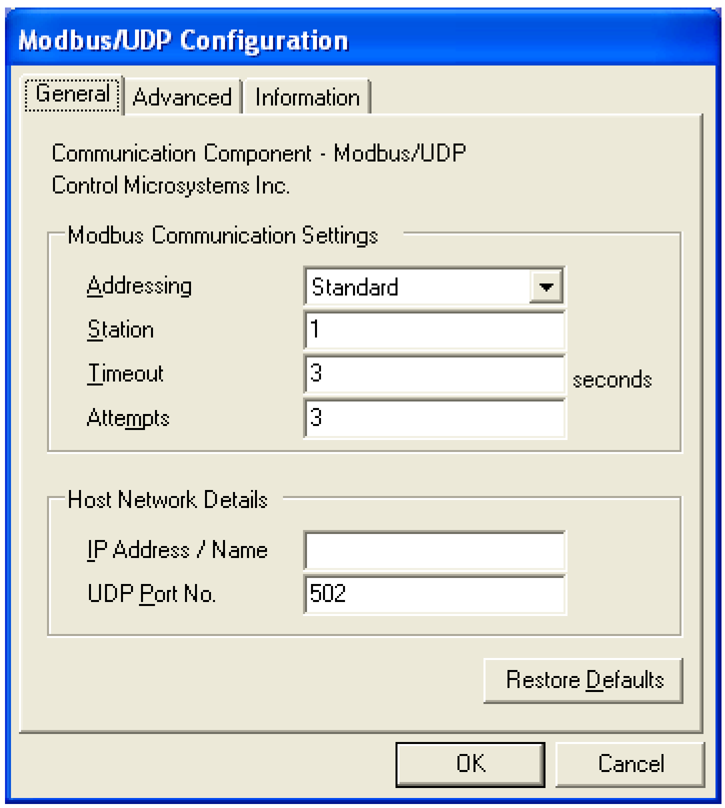
Modbus/UDP

Modbus/UDP communication mode is similar to Modbus/TCP communication mode. It has the same message format with the Modbus/TCP. The only difference between them is one uses TCP protocol and another uses UDP protocol.

- To configure a Modbus/UDP protocol connection, highlight **Modbus/UDP** in the Communication Protocols window and click the **Configure** button. The Modbus/ UDP Configuration window is displayed.
- To select a configured Modbus/UDP protocol connection, highlight **Modbus/ UDP** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

When Modbus/UDP is selected for configuration the Modbus/ UDP Configuration dialog is opened with the General tab selected as shown below.



The **Modbus Communication Settings** grouping contains Modbus specific communication settings including the addressing mode, the station address, the timeout interval as well as the number of attempts.

The **Addressing** parameter selects standard or extended Modbus addressing. Standard addressing allows 255 stations and is compatible with standard Modbus devices. Extended addressing allows 65534 stations, with stations 1 to 254 compatible with standard Modbus devices. The default is Standard.

The **Station** parameter sets the target station number. The valid range is 1 to 255 if standard addressing is used and 1 to 65534 if extended addressing is used. The default is 1.

The **Timeout** parameter sets the length of time, in seconds, to wait for a response from the controller before retrying (see Attempts). Valid entries are 1 to 255. The default is 3.

The **Attempts** parameter sets number of times to send a command to the controller before giving up and reporting this to the host application. Valid entries are 1 to 20. The default is 3.

The **Host Network Details** grouping contains entries for the host's IP address or name and the TCP port on which it is listening.

The **IP Address / Name** entry specifies the Ethernet IP address in dotted quad notation, or a DNS host name that can be resolved to an IP address, of the PC where the ClearSCADA server is installed. The following IP addresses are not supported and will be rejected:

0.0.0.0 through 0.255.255.255

127.0.0.0 through 127.255.255.255 (except 127.0.0.1)

224.0.0.0 through 224.255.255.255

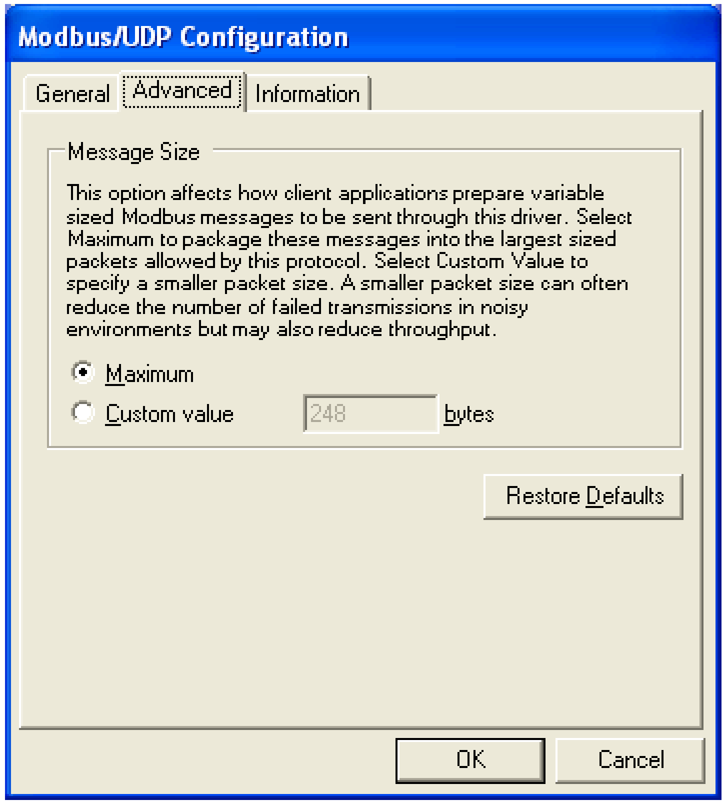
255.0.0.0 through 255.255.255.255.

The **UDP Port No.** field specifies the UDP port of the remote device. Valid values are 0 to 65535. The default value is 502.

- Click **Restore Defaults** to restore default values to fields on this page, except for the IP Address / Name field. The content of this field will remain unchanged.

Advanced Parameters

Advanced parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.



The **Message Size** grouping parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput.

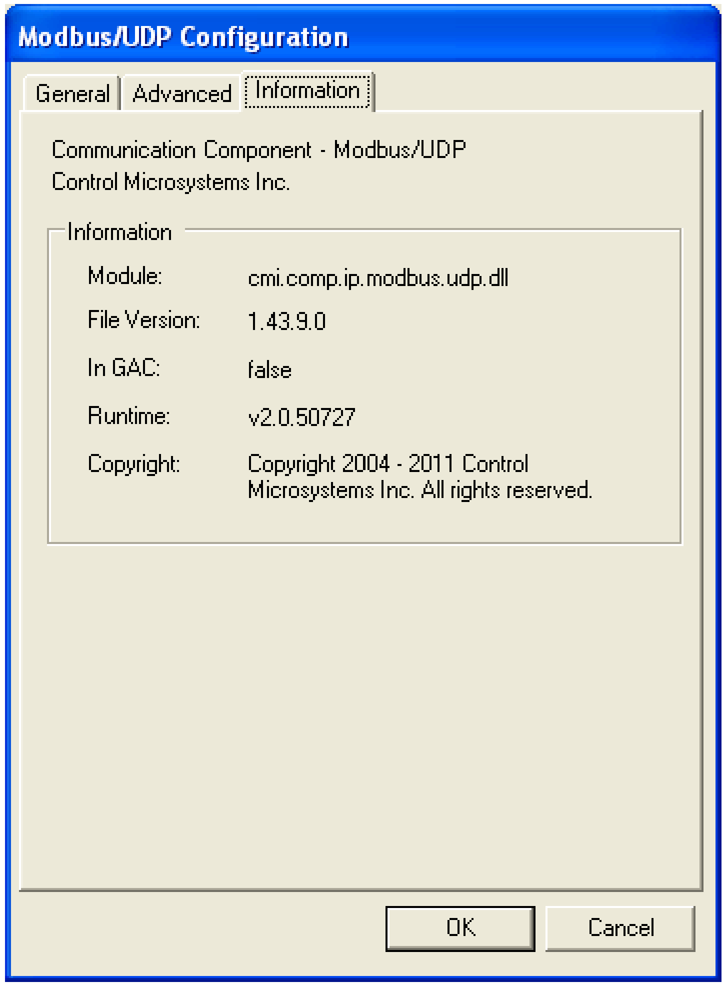
The **Maximum** selection indicates that the host application is to package messages using the maximum size allowable by the protocol.

The **Custom Value** selection specifies a custom value for the message size. This value indicates to the host application to package messages to be no larger than what is specified, if it is possible. Valid values are 2 to 246 when Addressing is set to Extended and Station is 255 or higher. When Addressing is set to Extended and Station is less than 255 valid values are 2 to 248. When Addressing is set to Standard valid values are 2 to 248.

- Click **Restore Defaults** to restore default values to fields on this page.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

Modbus/USB

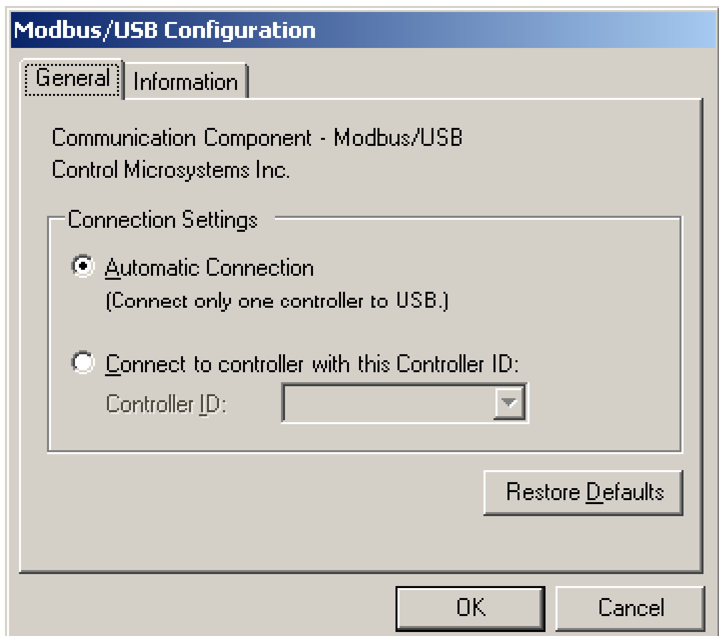
The Modbus/USB protocol specifies a Universal Serial Bus (USB) connection between SCADAPack controllers equipped with a USB peripheral port and the PC.

Windows NT does not support USB. The Modbus/USB selection will be displayed but it will not work with Windows NT. This is a limitation of the Windows NT operating system.

- To configure a Modbus/USB protocol connection, highlight **Modbus/USB** in the Communication Protocols window and click the **Configure** button. The Modbus/USB Configuration window is displayed.
- To select a configured Modbus/USB protocol connection, highlight **Modbus/USB** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

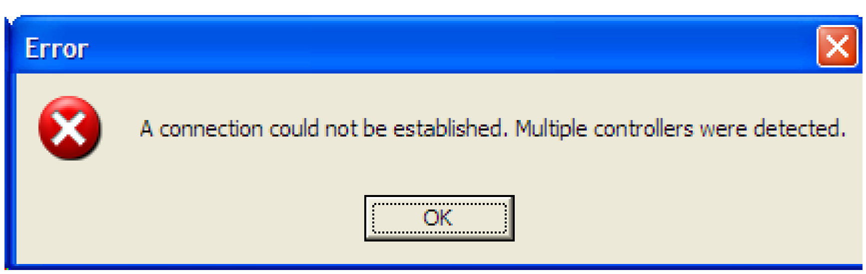
When Modbus/USB is selected for configuration the Modbus/USB Configuration dialog is opened with the General tab selected as shown below.



The **Connection Settings** grouping presents two options for Modbus/USB connections. These options are *Automatic Connection* and *Connect to controller with this Controller ID*.

Automatic Connection

The **Automatic Connection** selection enables communication with any single SCADAPack controller equipped with a USB peripheral port. A message, as shown below, is displayed when more than one SCADAPack controller is detected on the Bus.



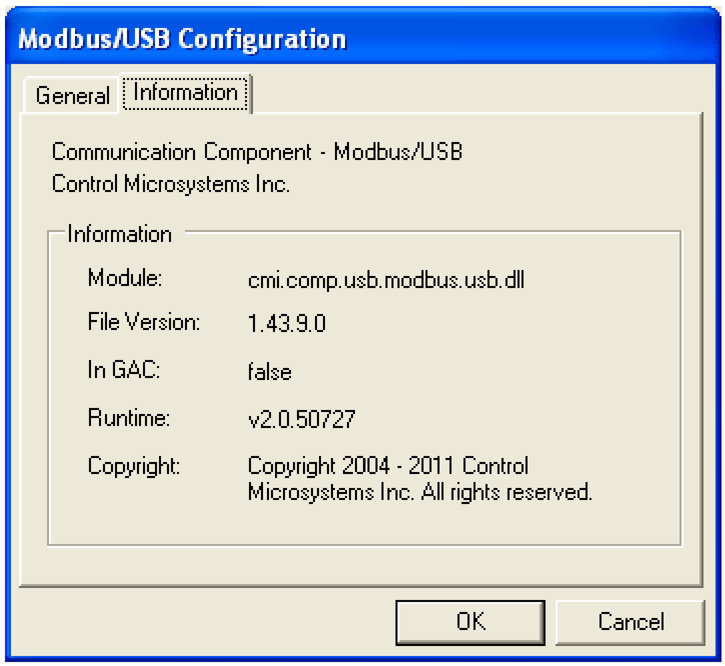
The **Connect to controller with this Controller ID** selection enables Modbus/USB communication to a specific controller regardless of the existence of multiple controllers on the bus. Each SCADAPack controller is uniquely identified through its Controller ID.

The **Controller ID** list box will display the Controller ID for each controller on the Bus. The Controller ID may be entered in the entry window or selected from the list.

The **Restore Defaults** button will restore the configuration dialog to the default state. The *Automatic Connection* option is selected, and the *Connect to controller with this Controller ID* selection will be disabled. If text was present in the *Controller ID* window when the button is pressed it will be displayed in grey.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

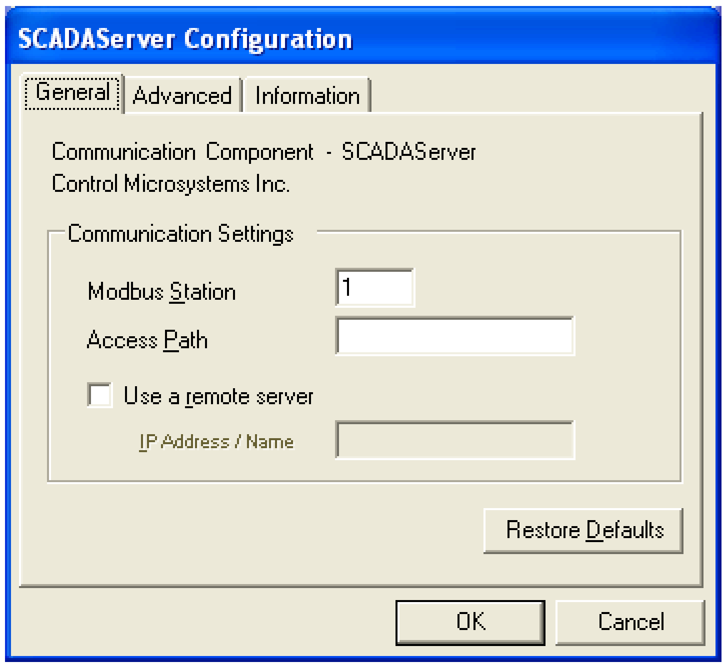
SCADAServer

The SCADAServer protocol specifies a SCADAServer Host connection. Applications will act as an OPC client and route programming commands through the SCADAServer Host to the SCADAPack controller. The type of connection to the field device: no flow control, hardware flow control or dial-up modem is configured in the SCADAServer Host itself.

- To configure a SCADAServer protocol connection, highlight **SCADAServer** in the Communication Protocols window and click the **Configure** button. The SCADAServer Configuration window is displayed.
- To select a configured SCADAServer protocol connection, highlight **SCADAServer** in the Communication Protocols window and click the **OK** button.
- To close the dialog, without making a selection click the **Cancel** button.

General Parameters

When SCADAServer is selected for configuration the SCADAServer Configuration dialog is opened with the General tab selected as shown below.



The **Communication Settings** grouping contains details necessary to establish communication to a device through a local or remote SCADAServer installation.

The **Modbus Station** parameter specifies the station address of the target device. The valid range is 1 to 65534. The default is station 1.

The **Access Path** parameter specifies the access path to a SCADAServer connection. This parameter is entered as a string with a maximum size of 16 characters. This access path was named when a connection was defined within the SCADAServer installation. If the access path is left blank, the default SCADAServer connection will be used, as defined within the SCADAServer installation. The default for this entry is blank.

The **Use a remote server** check box defines whether the SCADAServer connection uses a SCADAServer installation installed on the same physical PC as the client application or on a remote PC. If the SCADAServer installation is located on a separate machine, check this option and enter the host name or IP address of the remote PC into the “IP Address / Name” edit box. If the SCADAServer installation is located on the same PC as the client application leave this box unchecked. The default state for this check box is unchecked.

The **IP Address / Name** entry specifies the Ethernet IP address in dotted quad notation, or a DNS host name that can be resolved to an IP address, of the PC where the ClearSCADA server is installed. The following IP addresses are not supported and will be rejected:

0.0.0.0 through 0.255.255.255

127.0.0.0 through 127.255.255.255 (except 127.0.0.1)

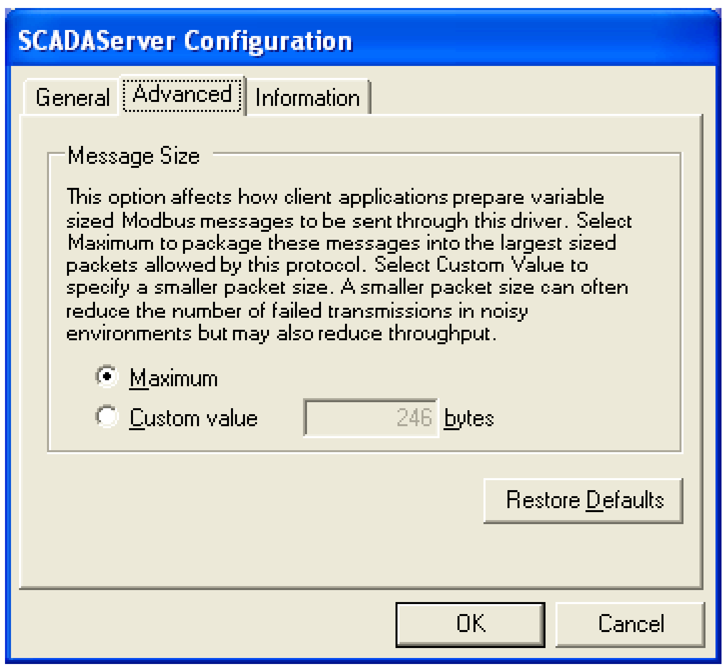
224.0.0.0 through 224.255.255.255

255.0.0.0 through 255.255.255.255.

- Click **Restore Defaults** to restore default values to fields on this page.

Advanced Parameters

Advanced parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput. When the Advanced tab heading is clicked the Advanced dialog is opened as shown below.



The **Message Size** grouping parameters are used to control the message size for the protocol. Control over message length is needed when writing large amounts of data over certain communication networks. A larger value can improve communication speed but can increase the number of missing transmissions. A smaller value can reduce the number of missing transmissions but may reduce throughput.

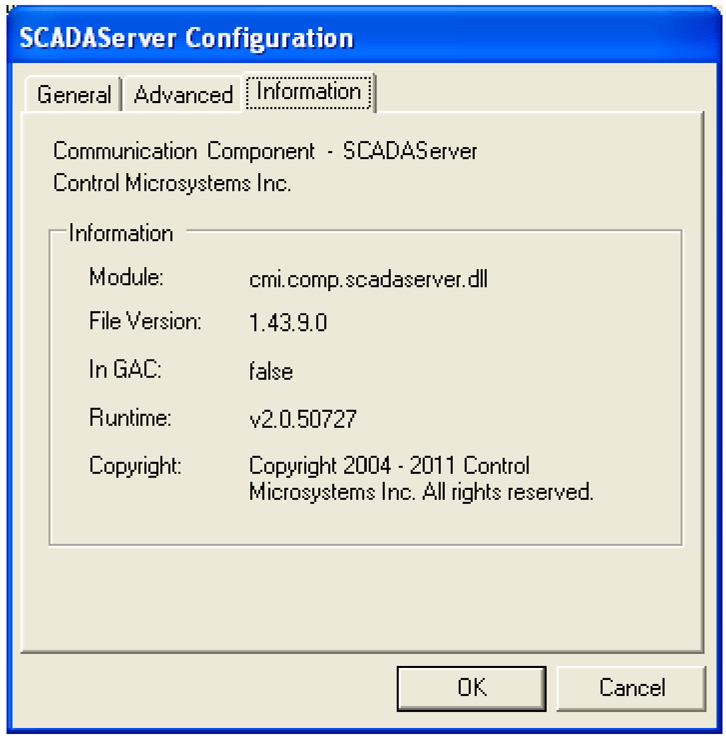
The **Maximum** selection indicates that the host application is to package messages using the maximum size allowable by the protocol.

The **Custom Value** selection specifies a custom value for the message size. This value indicates to the host application to package messages to be no larger than what is specified, if it is possible. Valid values are 2 to 246.

- Click **Restore Defaults** to restore default values to fields on this page.

Information

Information displays detailed driver information. When the Information tab heading is clicked the Information dialog is opened as shown below.



The Information grouping presents informative details concerning the executing protocol driver.

Module is the physical name of the driver.

File Version is the version number of the driver.

In GAC indicates whether the module (assembly) was loaded from the Global Assembly Cache (GAC).

Runtime is the version of the Common Language Runtime (CLR) the driver was built against.

Copyright indicates the copyright information of the protocol driver.

Connect to Controller Command

The Connect to Controller command starts a dial-up connection to a remote flow computer. To connect to a dial-up flow computer, select **Connect to Controller** from the **Communication** menu. Wait for Realflo to connect to the remote flow computer.

Disconnect from Controller Command

The Disconnect from Controller command terminates a dial-up connection. To disconnect from a dial-up flow computer select **Disconnect From**

Controller from the **Communication** menu. Wait for Realflo to disconnect with the remote flow computer.

Communication Progress Dialog

The Communication Progress dialog is displayed whenever Realflo is communicating with the flow computer. The dialog indicates the operation being performed and the status of the communication. If a long operation is being performed, a progress bar is displayed as well.

Click on the **Cancel** button to abort the operation. This is useful if communication is not progressing or if you have initiated the operation in error.

Communication Failures

Communication with the flow computer may fail for one of the following reasons.

- The message to the flow computer was garbled or lost by the communication network.
- The response from the flow computer was garbled or lost by the communication network.
- The flow computer is not connected.
- The PC Serial Port Settings are not set correctly.
- The flow computer did not respond or responded too late. Setting the time-out value too small in the PC Communications Settings can cause this.

If communication fails a message box appears. You have two options:

- Select **Retry** to attempt the communication again. This is useful when an occasional message is garbled by the communication system.
- Select **Cancel** to abort the command.

Inactive Phone Connection Dialog

The Inactive Phone Connection dialog is displayed when a dial-up phone connection has been inactive for longer than the period set in PC Communications Settings. The dialog notifies the user that the connection will be terminated.

Click on **OK** to terminate the connection immediately.

Click on **Cancel** to stay connected.

Window Menu

The Window menu contains the commands for opening and arranging windows used in Realflo.

New Window Command

Use this command to create a copy of the currently selected window. You can change the view in the copy of the window so you can look at more than one view at a time.

Cascade Command

Use this command to arrange open, non-minimized windows, so they stack upon each other with an offset so the title bar of each window is visible. All minimized windows are collected at the bottom of the main window.

Tile Command

Use this command to arrange open, non-minimized windows, so that they are visible. Minimized windows are collected at the bottom of the main window.

Arrange All Command

Use this command to arrange icons (minimized windows) at the bottom of the main window.

Open Window List

Use the numbers and file names listed at the bottom of the Window menu to switch to any open window. Choose the number that corresponds with the window you want to activate.

If there are more than nine open windows, the last item in the open window list will be the command *More Windows*. This will open a dialog with a list box showing open windows.

Help Menu

The Help menu contains the commands for opening and using Realflo on line help and for viewing information about Realflo.

Contents Command

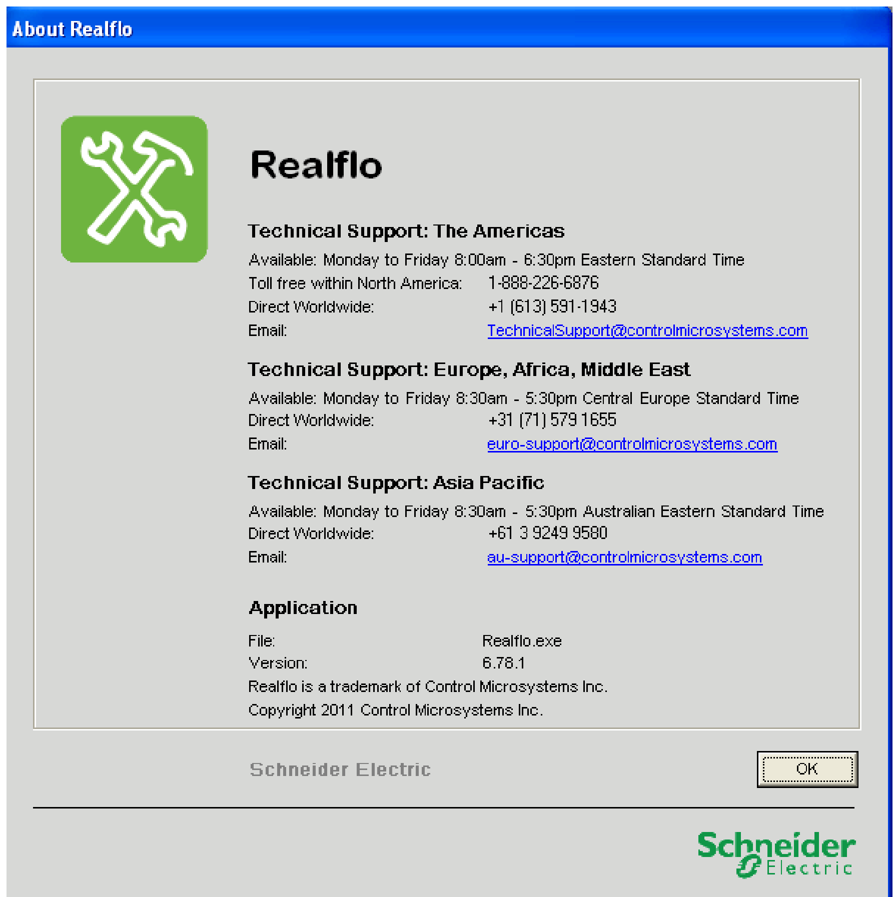
Use this command to open the Realflo help file using the Windows Help program. The Contents page of the help file is displayed.

The **F1** key on your keyboard will open the Realflo Help file.

The help file has a general description of how the Realflo program operates and how to use the Realflo program. It also has specific descriptions for each view, dialog and command.

About Command

Use this command to display information about Realflo.



Realflo Wizards

The following sections describe the Realflo Wizards to make the tasks you need to perform easier.

- Create New File Wizard
- Replace Flow Computer Wizard
- Read Logs and Flow History Wizard
- Calibrate Inputs Wizard
- Change Orifice Plate Wizard
- Force Inputs Wizard

Navigating Wizards

The wizards display four navigation buttons until the final step of the wizard when the **Finish** button becomes visible. These buttons are:

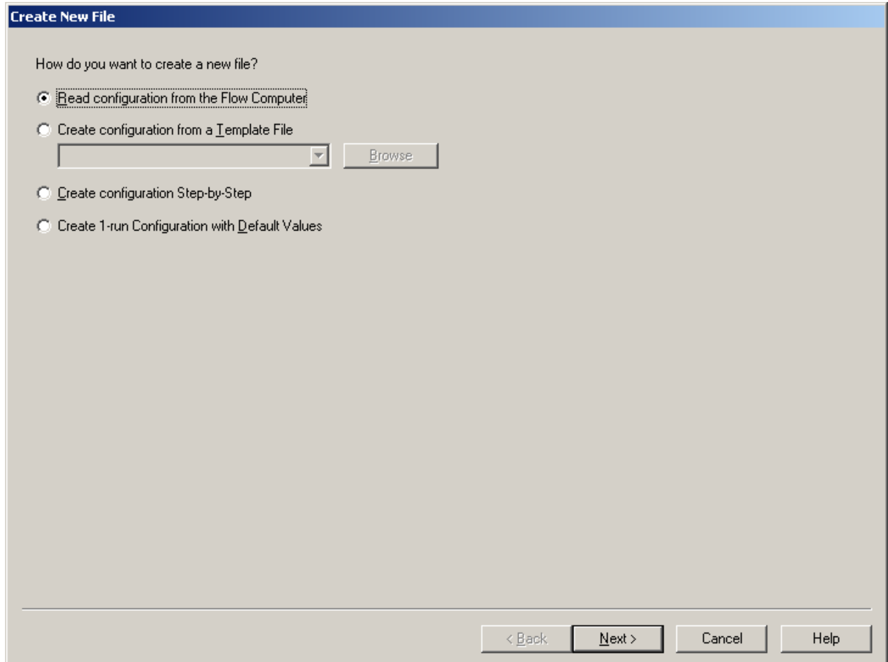
- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Cancel** cancels the operation and closes the wizard. Steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.
- **Help** opens the on-line Realflo User and Reference Manual.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.

Create New File Wizard

When the File New command is selected from the **Expert Mode >> File menu >> New** or when the Select Flow Computer command is selected from Maintenance Mode main screen, the New File wizard starts.

In Expert Mode, the New File wizard is used to create a new Realflo configuration file. It offers four ways to create a new file.

- Read the configuration from the target flow computer.
- Create a new configuration from a template file.
- Create a new configuration step-by-step.
- Create 1-run Configuration with Default Values. (This option is available in Expert Mode only).
- When the New File Wizard starts, the Create New File dialog opens.



The **How do you want to create a new file?** selections determine how the new file is created.

Select **Read Configuration from the Flow Computer** to read the configuration of an existing flow computer. Realflo will connect to the flow computer, read configuration, and save the file.

- Follow the wizard steps described in the **Read Configuration from the Flow Computer** section below when this option is selected.

Select **Create Configuration from a Template File** to create a new configuration file based on a template. A template contains pre-defined settings requiring you to fill in configuration data specific this flow computer.

- Select the template file from the dropdown list. The last ten recently used templates are shown. The recently used template is selected by default.

The selection edit box is blank if no recently used templates are available.

- Click **Browse** to choose another template file. A File Open dialog appears which allows you to select any template file.

Select **Create Configuration from Template file** to use a congiguration template to create the configuration. To create a template file, see **Template Steps**. When templates are created, some flow computer configuration parameters are preset and are not displayed in the Create Configuration from Template wizard steps.

- Follow the wizard steps described in the **Create Configuration From a Template File** section below when this option is selected.

Select **Create Configuration Step-by-Step** to create a new configuration file. Realflo will lead you through the steps required using a wizard. You will need to modify the default data at each step.

- Follow the wizard steps described in the **Create Configuration Step-by-Step** section below when this option is selected.

Select **Create 1-run Configuration with Default Values** option to create a new configuration file with a default configuration. A file with configuration for a 1-run flow computer, using a 4202 DR is created. You will need to edit the configuration manually.

Once you select the radio button to create 1-run configuration with default values, do the following:

- Click **Next.**
- Click **Finish**.

Read Configuration From the Flow Computer

The Read Configuration from Flow Computer option enables you to connect to the flow computer and read the existing configuration from the flow computer. A communication link needs to exist between Realflo and the flow computer to use this option. The wizard prompts you for default communication settings or allows you to select new communication settings.

When Realflo reads configuration from a 32-bit flow computer, Realflo reads the flowing fields for each flow run:

- Use Value on Sensor Fail (see **Value on Sensor Fail** section)
- Differential Pressure default value (see **Differential Pressure Limits** section)
- Static Pressure default value (see **Static Pressure** section)
- Temperature default value (see **Temperature Limits** section)

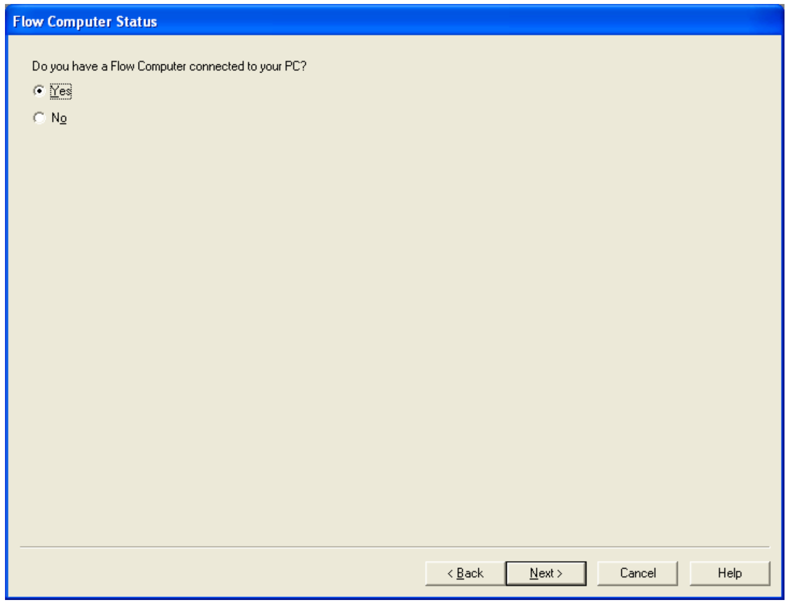
For flow computers not supporting this feature, Realflo reads the following fields for each flow run:

- Use Value on Sensor Fail = Last Known Good Value (see **Value on Sensor Fail** section)
- Differential Pressure default value = 0 (see **Differential Pressure Limits** section)
- Static Pressure default value = 0 (see **Static Pressure** section)
- Temperature default value = 0 (see **Temperature Limits** section)

When the Read Configuration from Flow Computer option is selected, the Connect to Flow Computer wizard leads you through the necessary steps. The sequence of steps to read the configuration from a flow computer is as follows.

Flow Computer Status

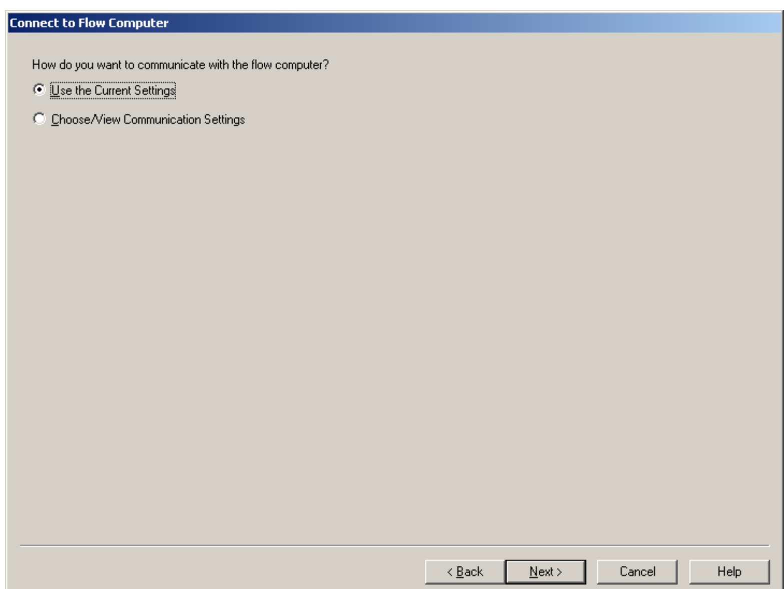
The flow computer status step selects whether a flow computer is connected to the PC running Realflo.



Select **Yes** is a flow computer is connected to the PC or select **No** if no flow computer is connected. The Connect to Flow Computer step following is only displayed if the selection is **Yes**.

Connect to Flow Computer

The Connect to Flow Computer step defines the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two option.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo. (The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are:

- COM 1 (serial port on the PC)
- 9600 baud, no parity
- 8 Data bits
- 1 Stop bit

The default Modbus address to which Realflo connects is station 1.

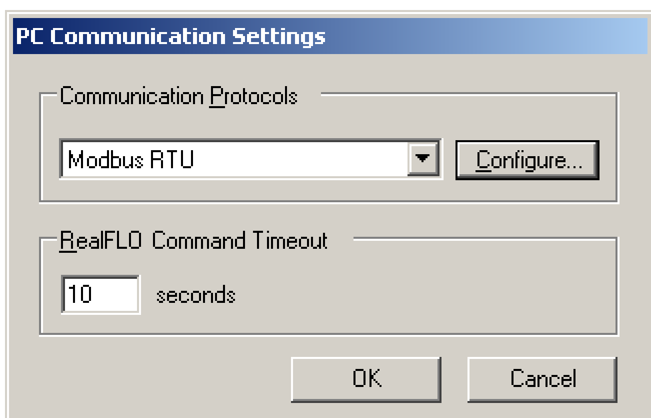
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click **Next>** to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

See the section **Communication** >> **PC Communications Settings Command** in the **Realflo Expert Mode Reference** for complete details on the parameter settings in this dialog.

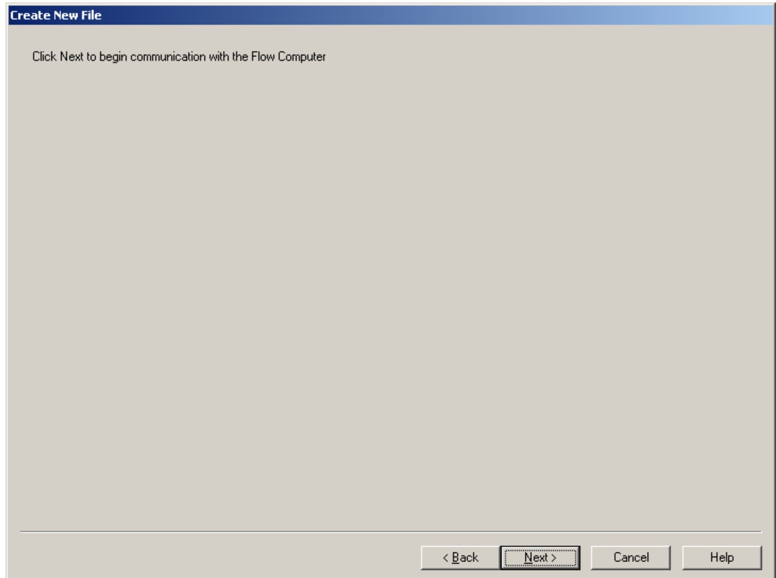
You need to know the communication settings for the connection to the flow computer to use this step.



- Once the communication settings have been selected, click **OK>** to close the dialog and begin communication with the flow computer.

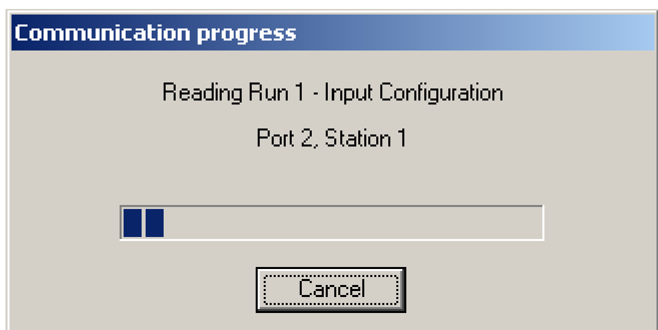
Read Configuration from the Flow Computer

The Read Configuration from Flow Computer step starts with the Create New File window as shown below.



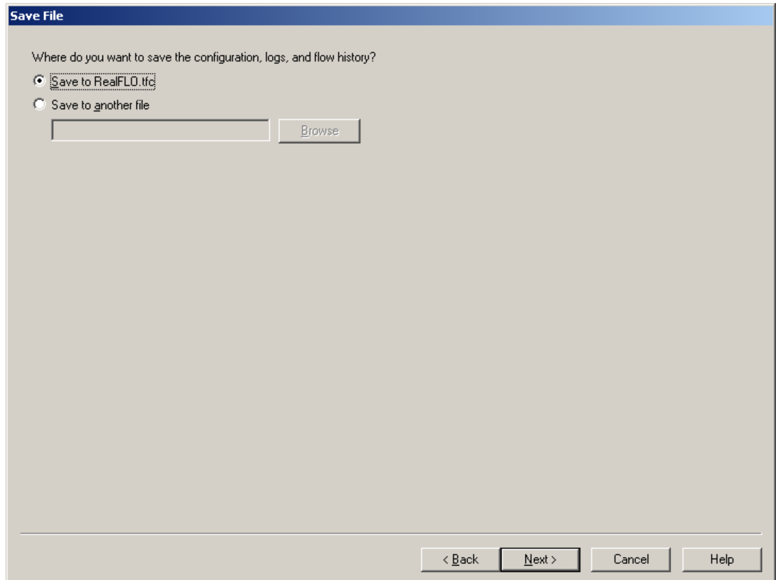
- Click **Next>** to begin reading the flow computer configuration form the flow computer.

The **Communication progress** displays the status of the reading of the configuration.



Save Configuration File

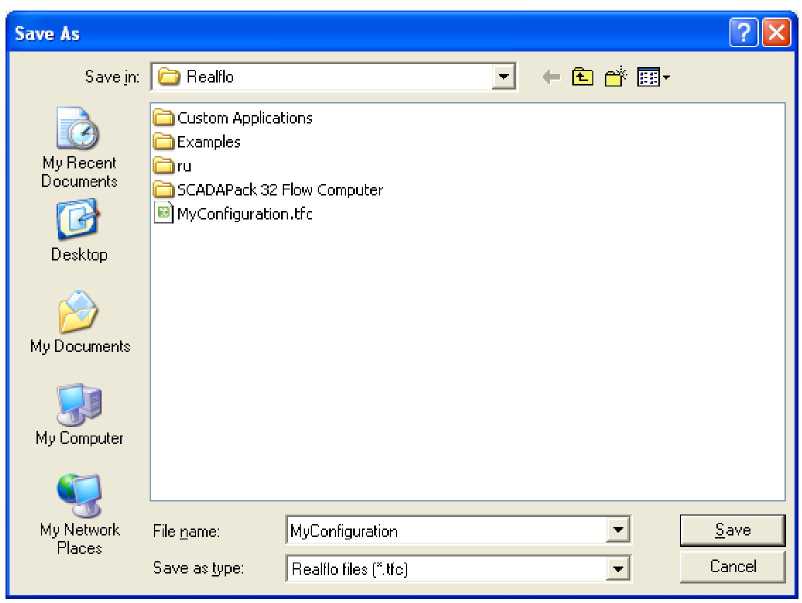
Once the configuration has been read from the flow computer, the **Save File** dialog is opened to prompt for a file name to which save the configuration.



Select the **Save to Realflo.tfc** to save the configuration to the default Realflo.tfc file. This file will be located in the folder Realflo was installed in.

- Click **Next>** to save the configuration and move to the next step.

Select the **Save to another file** to save the file to a specified name and location. When this option is selected the Save As dialog is opened as shown below.



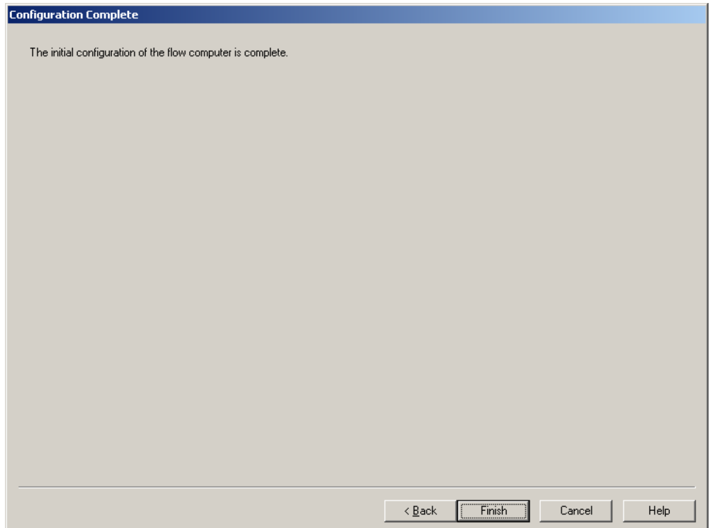
Select the folder to save the file in the **Save in:** window. Use the dropdown selector to browse the available folders on your PC. Enter the file name in the **File name:** window. The file will automatically be saved with the Realflo **.tfc** extension.

- Click **Save** to save the configuration file and close the Save As dialog.
- Click **Next>** to move to the next step.

Configuration Complete

The Configuration Complete dialog is the last step in the Read Configuration from Flow Computer wizard.

- Click **Finish** to complete the wizard.



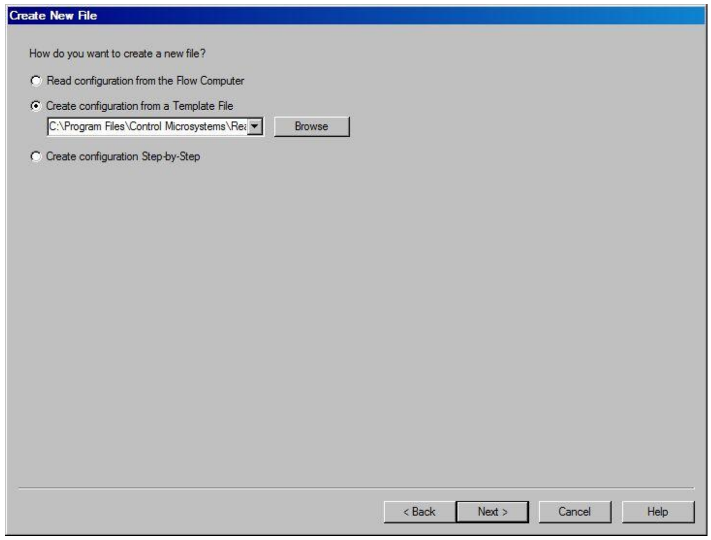
Create Configuration From a Template File

When you choose to configure the flow computer using a template file, the Create New File wizard prompts you through the steps needed.

- Select **File >> New** from the Realflo command menu.

The Create New File dialog is displayed and the wizard will lead you through the steps to create a congiuration file from a temple.

Create New File Dialog



- Select the Create Configuration from a Template File radio button.
- Do one of the following:

- Select the template file from the dropdown list. The last ten recently used templates are shown. The recently used template is selected by default.
- Click Browse to choose another template file. A File Open dialog appears which allows you to select any template file.

- Click Next > to continue.

Template files are created in the Expert Mode. When templates are created some flow computer configuration parameters are preset and are not displayed in the Create Configuration from Template wizard steps.

Follow the wizard steps described in the following sections to configure the flow computer using the selected template.

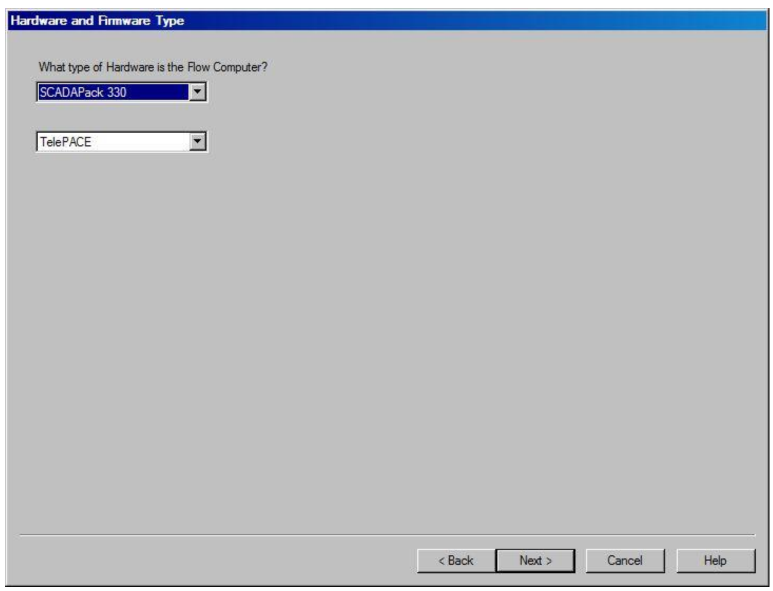
Flow Computer Information

Flow Computer Status Dialog

When configuring the flow computer using a template file, select **No** when the Flow Computer Status dialog opens. This lets you choose the hardware type and firmware type manually.

Hardware and Firmware Type Step

The Hardware and Firmware Type Dialog opens when you select **No** in the Flow Computer Status dialog.



First, select the **Hardware Type** from the dropdown list. The template selected determines the default value when creating the configuration using a template. The options from which you can select are:

- Micro16
- SCADAPack
- SCADAPack Plus
- SCADAPack Light
- SCADAPack LP
- SCADAPack 32

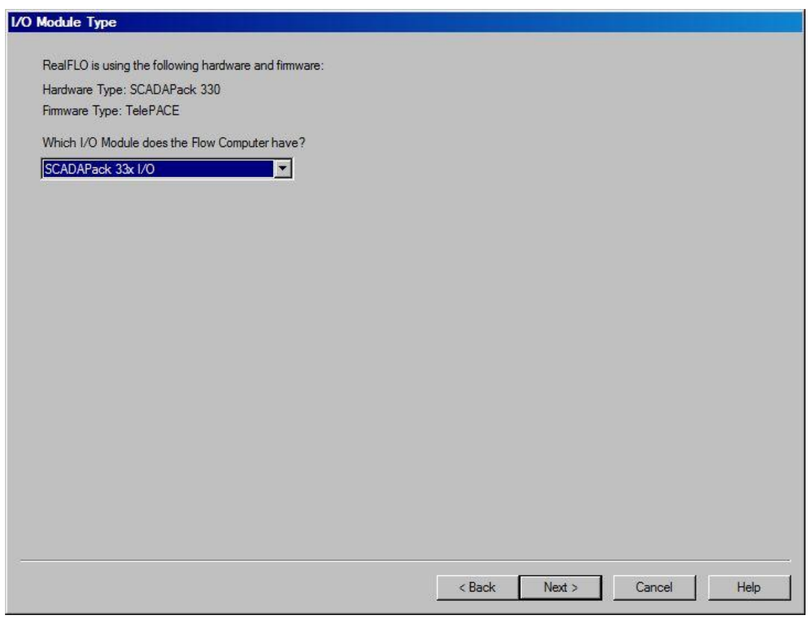
- SCADAPack 32P
- 4202 DR
- SCADAPack 100: 1024K
- 4202 DS
- SCADAPack 314
- SCADAPack 330
- SCADAPack 334
- SCADAPack 350
- 4203 DR
- 4203 DS
- SolarPack 410

Second, select the **Firmware Type** from the dropdown list. The template selected determines the default value (either Telepace or ISaGRAF).

If the firmware selected is Telepace, the I/O Module Type dialog opens, followed by the Flow Computer ID dialog. If the firmware type selected is ISaGRAF, the Flow Computer ID dialog opens.

I/O Module Type Step

This step selects the I/O module to use for the selected Hardware type. The register assignment in the new file is set to the default register assignment for the selected hardware type.



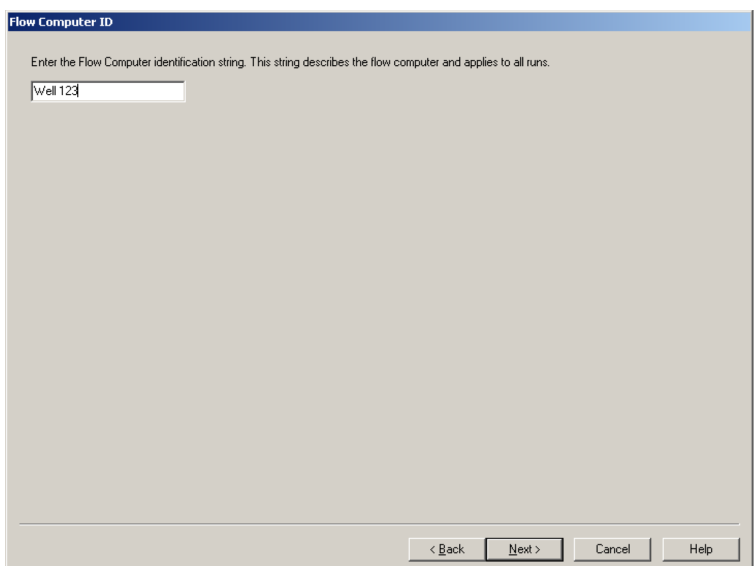
Select the I/O module for the flow computer from the dropdown list. Selections displayed in the list depend on the flow computer hardware type.

Hardware Type	I/O Modules Available
Micro16	Controller I/O only or Backwards compatible

Hardware Type	I/O Modules Available
	modules.
SCADAPack	5601 I/O Module, 5604 I/O Module, or 5606 I/O Module
SCADAPack Plus	5601 I/O Module, 5604 I/O Module, or 5606 I/O Module
SCADAPack Light	5602 I/O Module
SCADAPack LP	SCADAPack LP I./O
SCADAPack 32	5601 I/O Module 5604 10V/40mA I/O module 5604 5V/20mA I/O module , 5604 I/O Module, or 5606 I/O Module
SCADAPack 32P	SCADAPack 32P I/O
4202 DR	4202 DR or 4202 DR Extended/4203 DR I/O
SCADAPack 100: 1024K	SCADAPack 100: 1024K I/O
4202 DS	4202/4203 DS I/O
SCADAPack 314	SCADAPack 314/33x I/O
SCADAPack 330	SCADAPack 330 Controller.
SCADAPack 334	SCADAPack 33x I/O
SCADAPack 350	SCADAPack 350 10V/40mA I/O SCADAPack 350 5V/20mA I/O
4203 DR	4202 DR Extended/4203 DR I/O
4203 DS	4202/4203 DS I/O
SolarPack 410	

Flow Computer ID Step

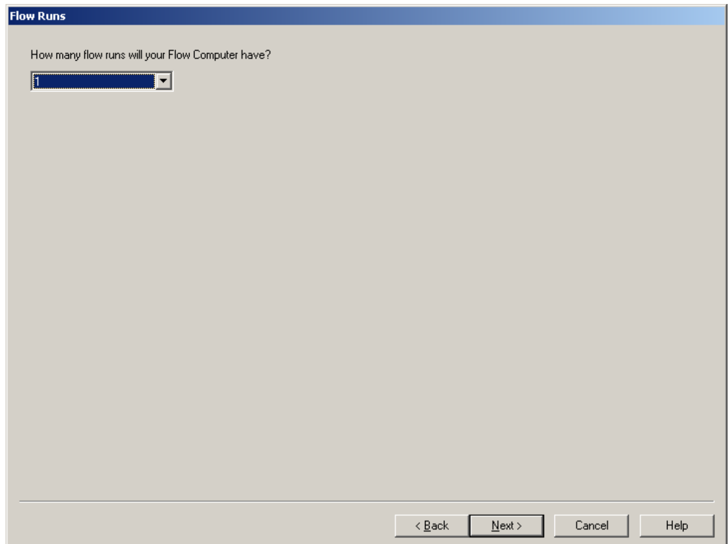
This step sets the Flow Computer ID.



Type the Flow Computer ID string in the edit box. This unique ID stops accidental mixing of data from different flow computers. The maximum length of the Flow Computer ID is eight characters. Any characters are valid. You can leave the Flow Computer ID edit box blank.

Number of Flow Runs Step

This step selects the number of flow runs in the flow computer. The wizard will step through the configuration of the first run and then each subsequent run if more than one run is selected.



Select the number of flow runs with the dropdown list. Valid values depend on the hardware type and the number of flow runs enabled for the flow computer. The template determines the default value when using a template.

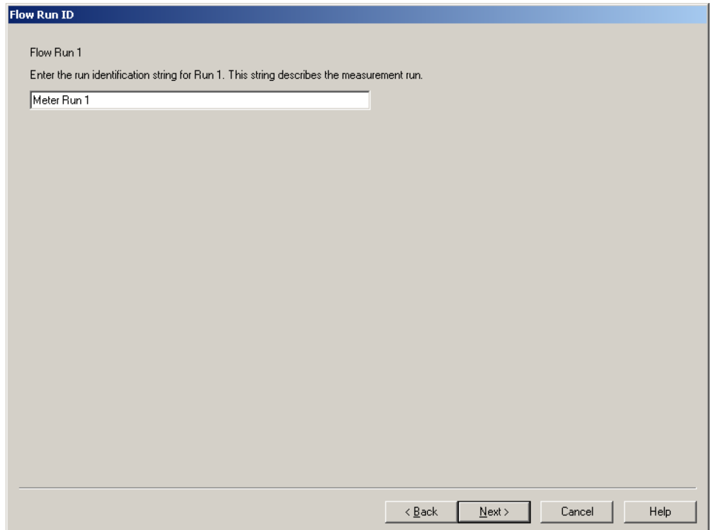
- For Micro16, SCADAPack, SCADAPack Light and SCADAPack Plus Flow Computers, the maximum number of meter runs is three.

The selection of three meter runs is available for older flow computers that could be enabled for three meter runs.

- For SCADAPack LP and SCADAPack (4202 and 4203) Flow Computers, the maximum number of meter runs is two.
- For SCADAPack 100: 1024K and SolarPack 410 Flow Computers, the maximum number of meter runs is one.
- For SCADAPack 314/330/334 and SCADAPack 350 Flow Computers the maximum number of meter runs is four.
- For SCADAPack 32 and SCADAPack 32P Flow computers the maximum number of runs you can select is ten.

Flow Run ID Step

This step sets the Flow Run ID for the meter run. This is the first step of a flow run configuration. The wizard will step you through the flow run configuration steps for the first run and then each subsequent run if you select more than one run.



The **Flow Run ID** helps to identify the flow run. Type a string up to 32 characters long. Any characters are valid. You can leave the Flow Run ID edit box blank.

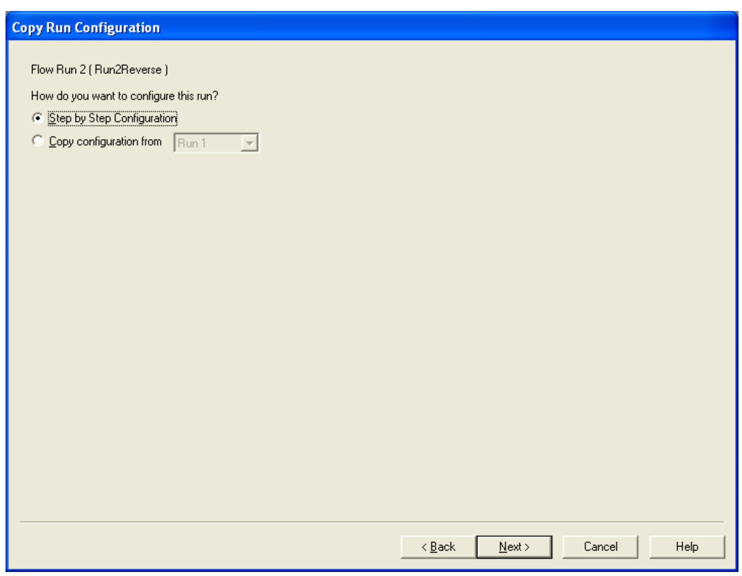
Older flow computers allow a string up to 16 characters. See the TeleBUS Protocol Interface section.

For run 1 the next step is **Flow and Compressibility *Calculations*** **.**

For subsequent runs, the next step is ***Copy Run Step***.

Copy Run Step

This step controls how multiple runs are configured once the first run has been configured.



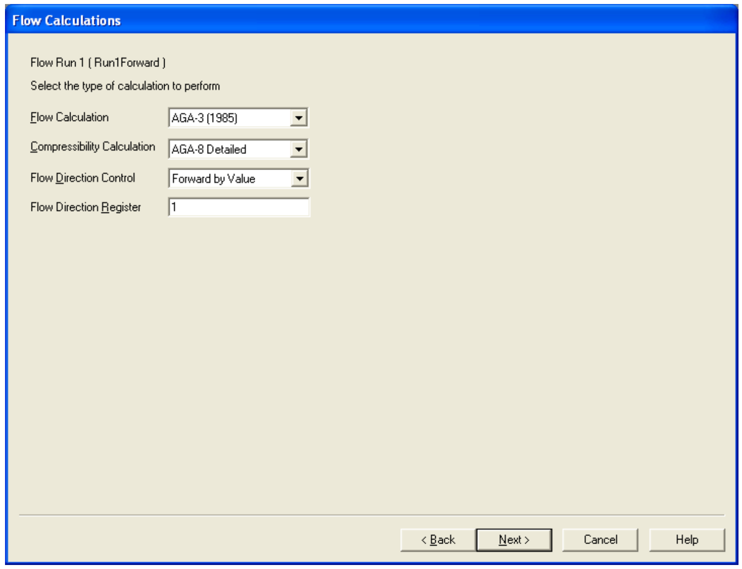
The **Step by Step Configuration** radio button selects that the run will be configured step by step as was the previous run. Parameters for each step are configured one at a time.

The **Copy configuration from** radio button selects that the run will be configured the same as the run selected in the drop down window.

Flow Calculation Configuration

Flow and Compressibility Calculations Step

This step selects the flow and compressibility calculations for the first run.



Flow Calculation selects the type of flow calculation for the meter run. Valid values are:

- AGA-3 (1985 version)
- AGA-3 (1992 version)
- AGA-7
- AGA-11 (not available for 16-bit controllers)
- V-cone calculations

The template selected determines the default value.

Compressibility Calculation selects the type of compressibility calculation for the meter run. Valid compressibility calculation values are:

- AGA-8 Detailed
- NX-19 (Not supported for PEMEX flow computers)

AGA-8 Detailed is the recommended calculation for new systems as it has superior performance compared to NX-19. NX-19 is provided for legacy systems. The template selected determines the default value.

Flow Direction Control selects the direction of flow indication, forward or reverse, for a meter run.

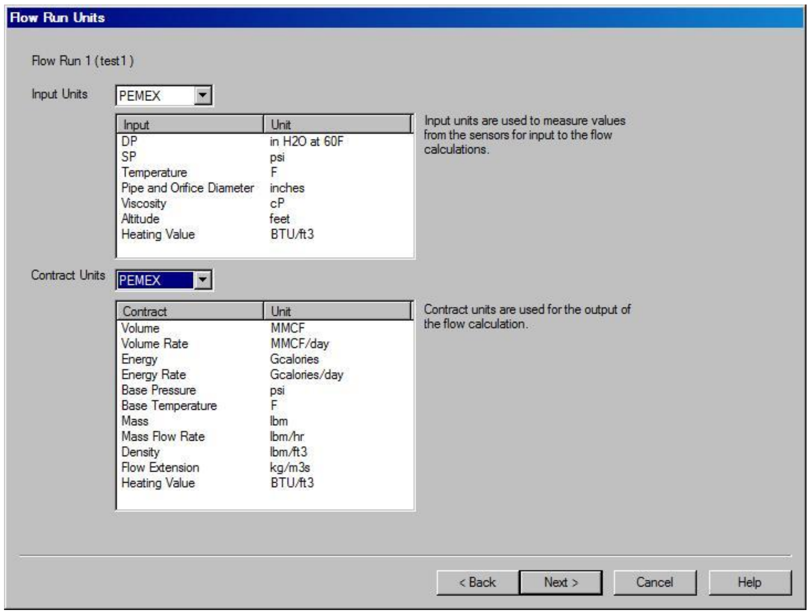
- **Forward by Value** selection indicates the flow direction is forward when the value from a differential pressure (DP) sensor is positive or the mass flow rate value from a Coriolis meter is positive.
- **Reverse by Value** selection indicates the flow direction is reverse when the value from a differential pressure (DP) sensor is negative or the mass flow rate value from a Coriolis meter is negative.

- **Forward by Status** selection indicates the flow direction is forward when the Flow Direction Register has a value of 0 (OFF).
- **Reverse by Status** selection indicates the flow direction is reverse when the Flow Direction Register has a value of 1 (ON).

Flow Direction Register specifies which register indicates the forward or reverse flow direction status. Any valid register for the flow computer controller can be used for this setting. The default register is 1. This edit control is disabled if **Flow Direction Control** selection is Value. This control is hidden in GOST mode flow computers.

Flow Run Units Step

This step lets you select the units that are used for input measurements and contracts.



Input Units selects the units of measurement of input values for the meter run. Inputs may be measured in different units than the calculated results. This allows you to use units that are convenient to you for measuring inputs. A dropdown list allows the selection of the following unit types. The template selected determines the default value.

- US1
- US2
- US3
- IP
- Metric1
- Metric2
- Metric3
- SI
- US4
- US5

- US6
- US7
- US8
- PEMEX

The reference list for the Input Units displays the parameters and units for these parameters:

- DP (Differential pressure)
- SP (Static pressure)
- Temperature
- Pipe and Orifice Diameter
- Viscosity
- Altitude
- Heating Value

Contract Units selects the units of measurement of contract values. These units are used for the calculated results. A dropdown list allows the selection of the following unit types. The template selected determines the default value.

- US1
- US2
- US3
- IP
- Metric1
- Metric2
- Metric3
- SI
- US4
- US5
- US6
- US7
- US8
- PEMEX

The reference list for the Contract Units displays the parameters and units for these parameters when used for the contract. The parameters displayed depend on the contract units selected. The parameters are:

- Volume
- Volume Rate
- Energy
- Energy Rate

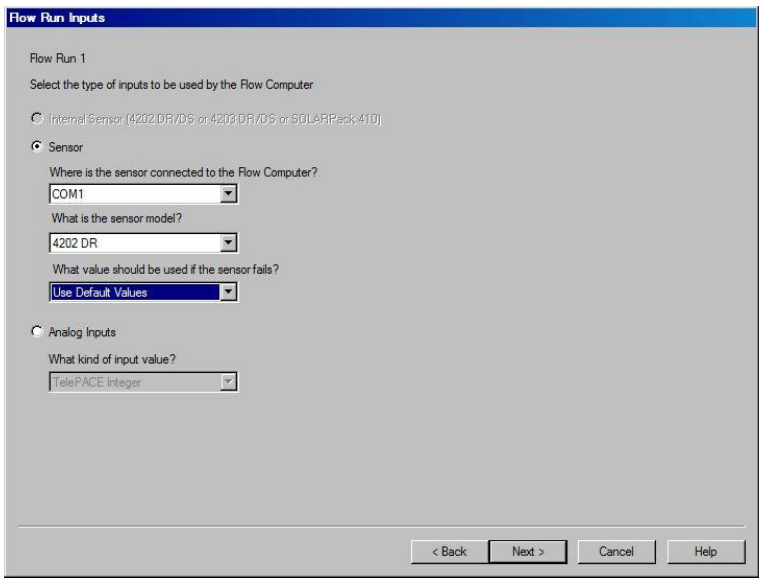
- Base Pressure
- Base Temperature
- Mass
- Mass Flow Rate
- Density
- Flow Extension
- Heating Value

Flow Run Inputs Step

This step lets you configure the flow run inputs. One of two configuration dialogs is presented based on the input type you configure.

- Sensor Inputs
- Analog Inputs

Sensor Inputs



Select Internal Sensor (4202 DR/DS or 4203DR/DS or SolarPack 410) to use a SCADAPack internal transmitter as the input device. The transmitter is the input for pressure, differential pressure, and temperature. This is the only valid selection for run 1 of a SCADAPack flow computer. Other options are disabled.

Select **Sensor** to use a multivariable transmitter as the input device. The transmitter is the input for pressure, differential pressure, and temperature. This is the default selection, except for run 1 of a SCADAPack controller.

The **Where is sensor connected to the Flow Computer** parameter enables the ability to select the serial or LAN port where the sensor is connected to the flow computer. Selections vary according to the flow-computer type. Valid selections can include:

- com1
- com2

- com3
- com4
- LAN

The **What is the sensor model** parameter selects the multivariable transmitter (MVT) type. The selections available are:

- 3095FB
- 4101
- 4102
- 4202 DR
- 4202 DS
- 4203 DR
- 4203 DS

The **What value should be used if the sensor fails** parameter selects the specified value in this field as the live input value when communicating with a sensor. The dropdown list lets you select:

- Use Last Known Good Value
- Use Default Value

When you open a file using an older file format, Realflo sets the default value of the **Values on Sensor Fail** field to **Use Last Known Good.**

When the status to a sensor changes and you select the **Use Default Value** option, this is added to the Event Log.

- For flow computers 6.70 and later, when communication to a sensor fails and the configuration option “Use Last Known Good Value” is set to “Use Default Value,” the flow computer needs to use the specified default value in the configuration in place of a live input value.
- When communication to a sensor is restored and the configuration option for the **Value on Sensor Fail** field is set to use the default value, the flow computer uses the input value from the sensor as the live input value.
- For flow computers prior to 6.70, the value on sensor fail is ``Use Last Known Good Value.”

Analog Inputs

Select **Analog Inputs** to use analog inputs to measure pressure, differential pressure, and temperature.

Valid values are:

- Telepace Integer
- ISaGRAF Integer
- Float
- Raw Float

The template selected determines the default value displayed.

For AGA-7 calculations, the value is fixed and set automatically. The value is Telepace Long if Telepace firmware is running, otherwise it is an ISaGRAF integer if ISaGRAF firmware is running.

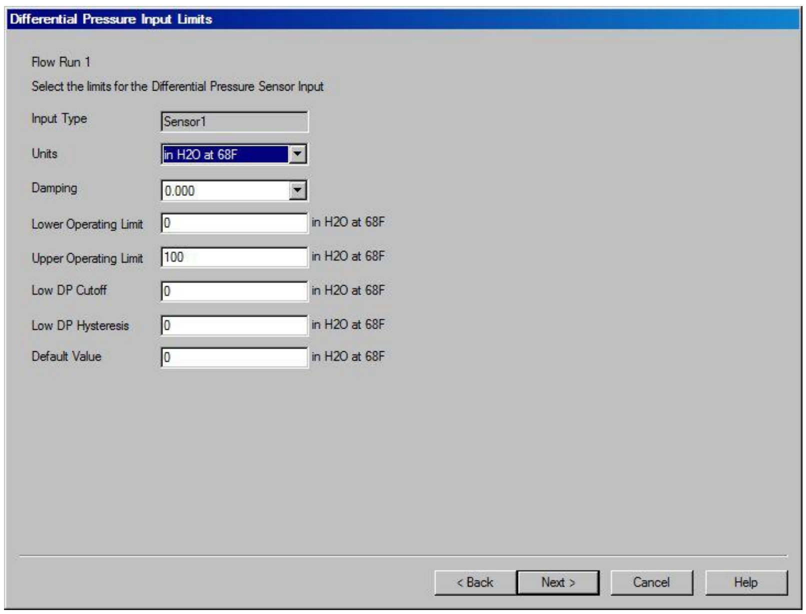
- The next step is **Differential Pressure Settings** if AGA-3 or V-Cone is configured.
- The next step is **Turbine Settings** if AGA-7 is configured.

Differential Pressure Limits Step

This step lets you configure the differential pressure input limits. One of two configuration dialogs is presented based on the input type you configure.

- Sensor Inputs
- Analog Inputs

Sensor Inputs



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

Units are the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display, the transmitter uses these units. Valid values depend on the MVT type:

- For SCADAPack transmtters, valid units are: inches H2O at 68°F, Pascal (Pa) and kiloPascal (kPa). The default is inches H2O at 68°F.
- For the 3095 MVT valid units are: inches H2O at 60°F, Pascal (Pa), kiloPascal (kPa) and inches H2O at 68°F. The default is inches H2O at 60°F.

Damping is the response time of the transmitter. It is used to smooth the process variable reading when there are rapid input variations.

For SCADAPack transmitters the valid values are 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 seconds. The template selected determines the default value displayed.
For the 3095 MVT the valid values are 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824 and 27.648. The default is 0.864.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Low DP Cutoff is the differential pressure where flow accumulation will stop and needs to be less than the UOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

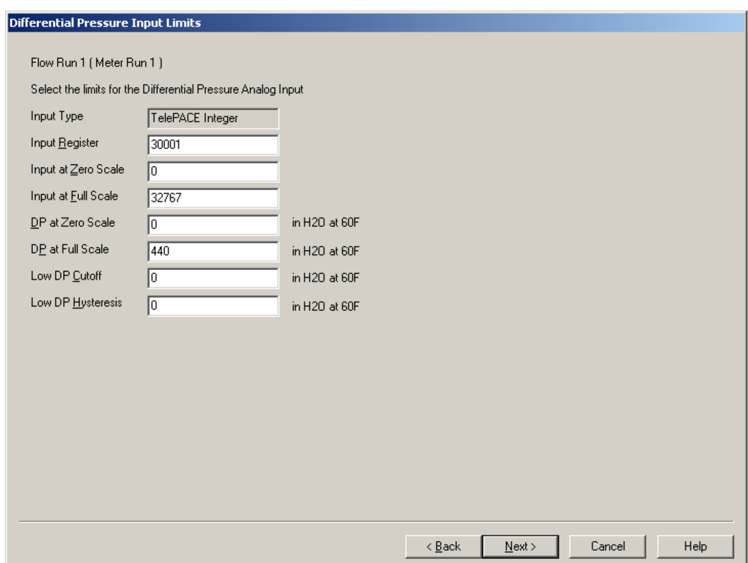
Low DP Hysteresis is the amount by which the differential pressure needs to rise above the Low DP Cutoff for flow accumulation to start. It may be a value using the DP units or may be a percentage of the operating span. The operating span is the difference between the Upper Operating Limit and the Lower Operating limit. Values depend on the transmitter. The flow accumulation level needs to be less than the Upper Operating Limit. The template selected determines the default value displayed.

Default Value is enabled if you configured the field using the Flow Run Inputs dialog. Type the live input value to use when communicating with a sensor. The template selected determines the default value displayed.

If you configured sensor inputs, go to the **Static Pressure** section.

Analog Inputs

The dialog below opens when analog inputs are selected.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

DP at Zero Scale is the pressure that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

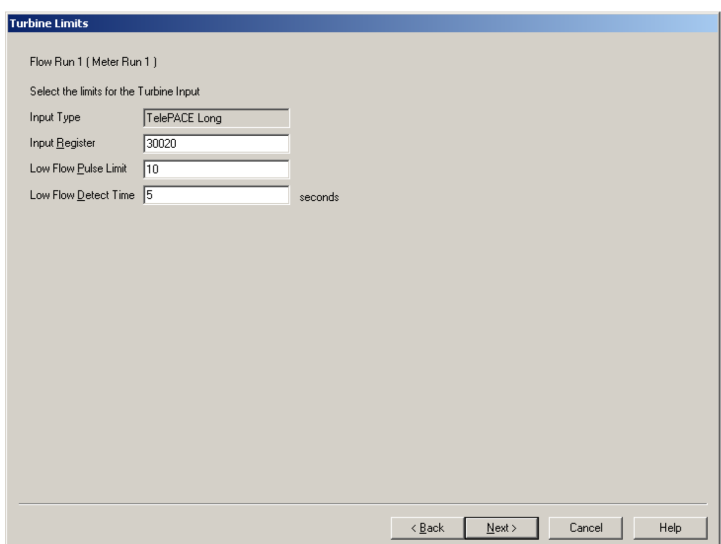
DP at Full Scale is the pressure that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

Low DP Cutoff is the differential pressure where flow accumulation will stop and needs to be less than the UOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Low DP Hysteresis is the amount by which the differential pressure needs to rise above the Low DP Cutoff for flow accumulation to start. It may be a value using the DP units or may be a percentage of the operating span. The operating span is the difference between the Upper Operating Limit and the Lower Operating limit. Values depend on the transmitter. The flow accumulation level needs to be less than the Upper Operating Limit. The template selected determines the default value displayed.

Turbine Limits Step

This step configures the turbine input for AGA-7 calculations.



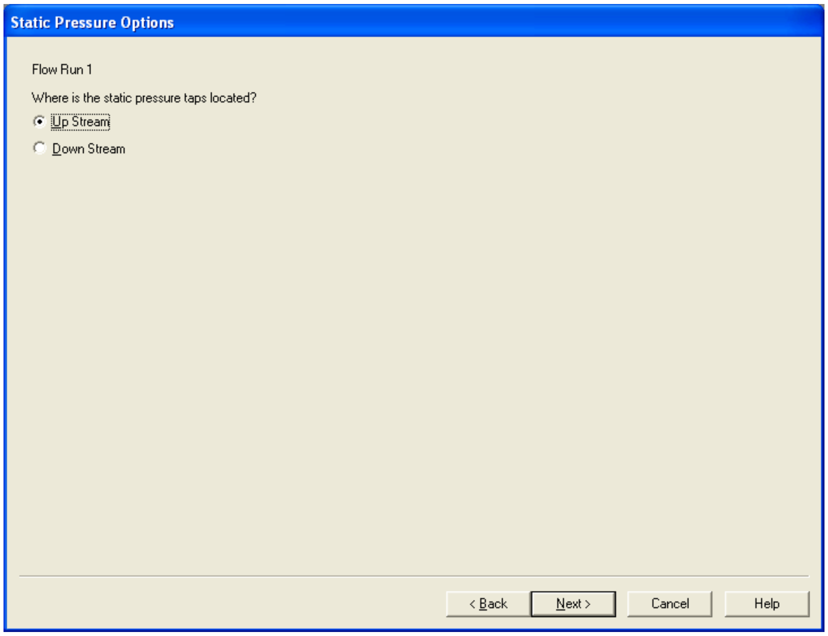
Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Low Flow Pulse Limit is the number of pulses below which a low flow alarm will occur. The template selected determines the default value displayed.

Low Flow Detect Time is the length of time the number of pulses needs to remain below the Low Flow Pulse Limit for a low flow alarm to occur. Valid values are 1 to 5 seconds. The template selected determines the default value displayed.

Static Pressure Measurement Step

This step lets you select how the static pressure is measured.



The pressure tap may be upstream or downstream of the orifice plate for AGA-3.

- Select **Up Stream** for an upstream static pressure tap. This is the default value. The control is disabled for AGA-7 and V-Cone calculations.
- Select **Down Stream** for a downstream static pressure tap. The control is disabled for AGA-7 and V-Cone calculations.

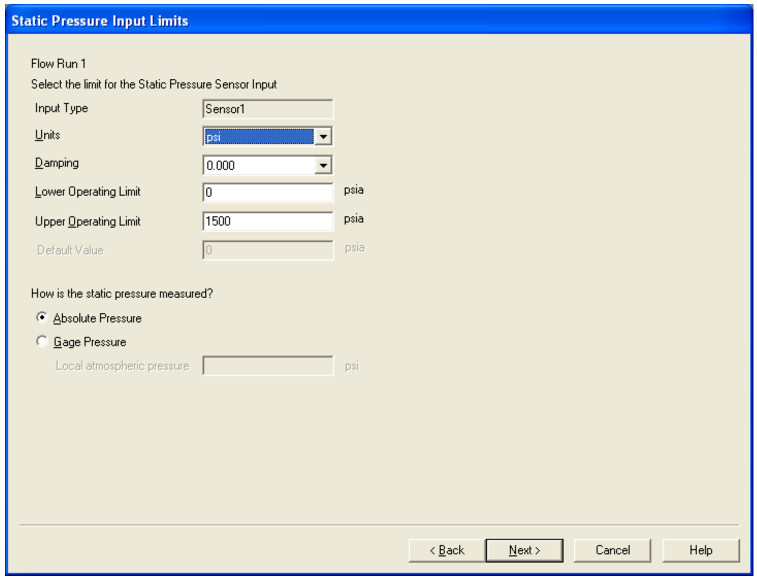
Static Pressure Input Limits Step

This step lets you define the limits for the static pressure input. One of two configuration dialogs is presented based on the Input Type configured for static pressure limits:

- Sensor Inputs
- Analog Inputs

Sensor Inputs

The dialog below is presented when sensor inputs are used.



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

Units is the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display it uses these units. Valid values are kiloPascal, MegaPascal, and psi (pounds per square inch). The default is psi.

Damping is the response time of the transmitter. It is used to smooth the process variable reading when there are rapid input variations.

- For SCADAPack transmitters the valid values are 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 seconds. The template selected determines the default value displayed.
- For the 3095 MVT the valid values are 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824 and 27.648. The default is 0.864.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Default Value is enabled if you gage pressure using the Static Pressure Options. Type the live input value to use when communicating with a sensor. The template selected determines the default value displayed.

The pressure sensor may measure absolute or gage pressure.

- Select **Absolute Pressure** to measure absolute static pressure.
- Select **Gage Pressure** to measure gage static pressure.
- Type the **Atmospheric Pressure** measured at the site. This control is disabled and set to zero if absolute pressure is selected.

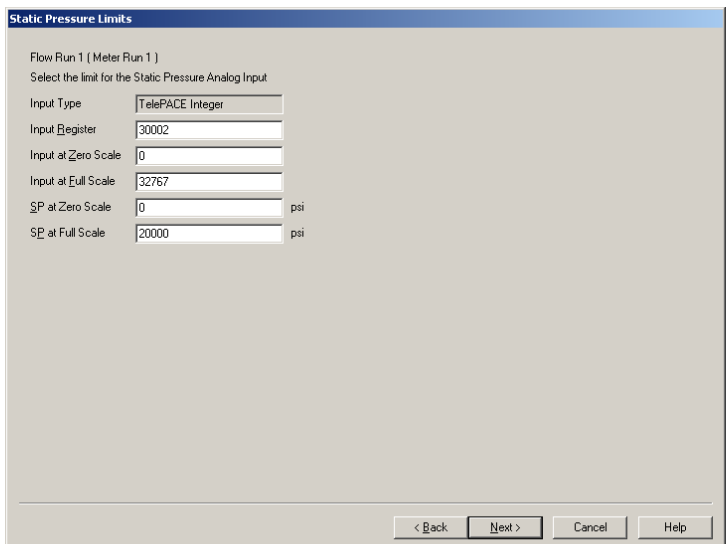
The atmospheric pressure entered needs to be greater than zero. The maximum upper limits for atmospheric pressure are:

30	psi	for US1, US2, US3, US4, US5, US6, US7, US8, and PEMEX units
4320	lbf/ft2	for IP units
207	kPa	for Metric1 units
2.07	bar	for Metric2 units
0.207	MPa	for Metric3 units
207000	Pa	for SI units

If you configured sensor inputs, see the **Static Pressure Compensation** section.

Analog Inputs

The dialog below is presented when analog inputs are used.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float, and ISaGRAF integer types and disabled otherwise.

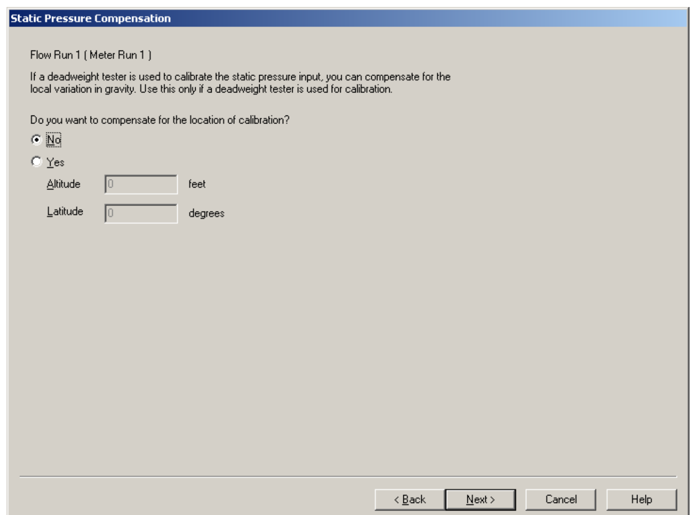
Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

SP at Zero Scale is the pressure that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

SP at Full Scale is the pressure that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

Static Pressure Compensation Step

This step selects if compensation is applied for the location where calibration was performed. If you configured sensors or analog inputs from the Static Pressure Limits dialog, this is the next step in the configuration sequence.



Select **No** if compensation is not required. This is the default value.

Select **Yes** to compensate for the altitude and latitude.

- Type the **Altitude** of the location. Valid values are –30000 to 30000. The template selected determines the default value displayed. This control is disabled if No is selected.
- Type the **Latitude** of the location. Valid values are –90 to 90. The template selected determines the default value displayed. This control is disabled if No is selected.

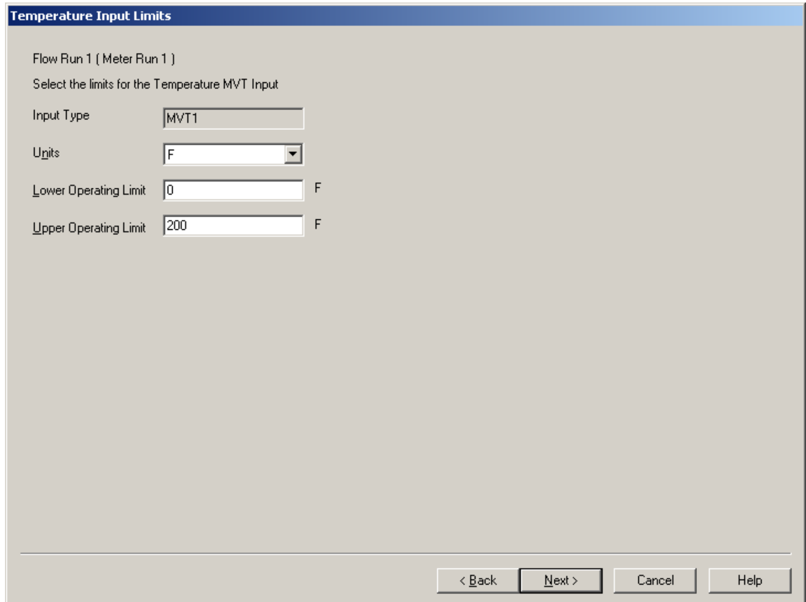
Temperature Limits Step

This step defines the limits for the temperature input. One of two configuration dialogs is presented based on the Input Type configured for static pressure limits:

- Sensor Inputs
- Analog Inputs

Sensor Inputs

The following dialog is presented when sensor (MVT) inputs are used.



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

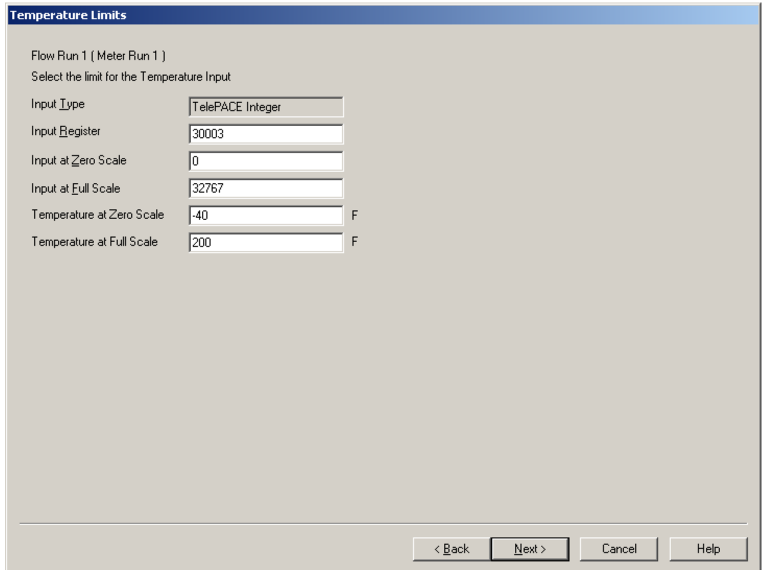
Units is the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display it uses these units. Valid values are kiloPascal, MegaPascal, and psi (pounds per square inch). The default is psi.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The template selected determines the default value displayed. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Analog Inputs

The following dialog is presented when analog inputs are used.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

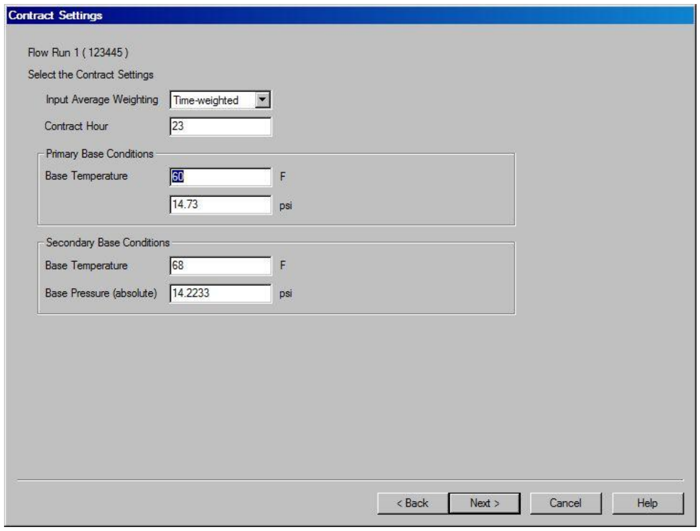
Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The template selected determines the default value displayed. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

Temperature at Zero Scale is the temperature that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

Temperature at Full Scale is the temperature that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The template selected determines the default value displayed.

Contract Settings Step

This step lets you set the contract settings for the run.



Input Average Weighting is the weighting method of the linear inputs. This applies to the differential pressure, static pressure, and temperature. Valid values are time-weighted or flow-weighted (see Input Averaging on page 948 for more information). The template selected determines the default value.

Contract Hour is the hour of the day that starts a new contract day using a 24-hour clock. The contract day begins at 00 minutes and 00 seconds of the specified hour. Valid values are 0 to 23. The template selected determines the default value displayed.

Standard Base Conditions are the default **Base Temperature** and **Base Pressure (absolute)** values.

- **Base Temperature** is the reference temperature to which contract flow values are corrected. Valid values are –40 to 200. The default value is given in the table below.
- **Base Pressure** is the reference pressure to which contract flow values are corrected. The base pressure is measured as absolute pressure (not a gauge pressure). Valid values are 0 to 32000. The default value is given in the table below.

Contract Units	Standard Base Temperature	Standard Base Pressure
US1	60 F	14.73 psi
US2	60 F	14.73 psi
US3	60 F	14.73 psi
IP	60 F	2116.2281 lbf/ft^2
Metric1	15 C	101.325 kPa
Metric2	15 C	1.01325 bar
Metric3	15 C	0.101325 MPa
SI	288.15 K	101325 Pa
US4	60 F	14.73 psi
US5	60 F	14.73 psi
US6	60 F	14.73 psi
US7	60 F	14.73 psi

Contract Units	Standard Base Temperature	Standard Base Pressure
US8	60 F	14.73 psi
PEMEX	60 F	14.73 psi

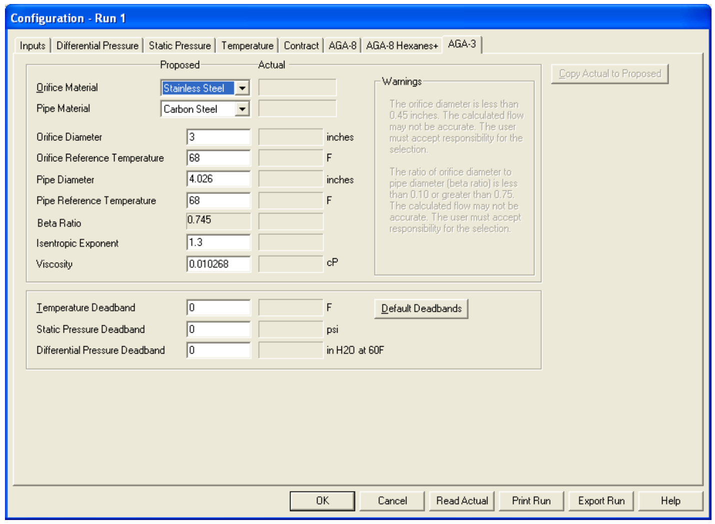
Realflo for PEMEX flow computers provide a second set of base conditions. **PEMEX Base Conditions** are the default **Base Temperature** and **Base Pressure (absolute)** values when Realflo is operating in PEMEX mode.

- **Base Temperature** is the reference temperature to which contract flow values are corrected. The default is listed in the table below for each type of contract unit.
- **Base Pressure** is the reference pressure to which contract flow values are corrected. The base pressure is measured as absolute pressure (not a gauge pressure). Valid values are 0 to 32000. The default values are listed in the table below for each contract unit.

Contract Units	Standard Base Temperature	Standard Base Pressure
US1	60 F	14.73 psi
US2	60 F	14.73 psi
US3	60 F	14.73 psi
IP	60 F	2116.2281 lbf/ft^2
Metric1	15 C	101.325 kPa
Metric2	15 C	1.01325 bar
Metric3	15 C	0.101325 MPa
SI	288.15 K	101325 Pa
US4	60 F	14.73 psi
US5	60 F	14.73 psi
US6	60 F	14.73 psi
US7	60 F	14.73 psi
US8	60 F	14.73 psi
PEMEX	68 F	14.73 psi

AGA-3 Settings Step

This step sets the AGA-3 calculation parameters.



Orifice Material is the material from which the orifice plate for the meter run is made. Valid values are Stainless Steel, Monel, and Carbon Steel. The template selected determines the default value displayed.

Pipe Material is the material from which the meter run pipe is made. Valid values are Stainless Steel, Monel, and Carbon Steel. The template selected determines the default value displayed.

Orifice Diameter is the diameter of the meter run orifice. The template selected determines the default value displayed.

Orifice reference temperature is the temperature at which the diameter of the meter run orifice was measured. The template selected determines the default value displayed.

Pipe Diameter is the measurement of the meter run pipe inside diameter. The template selected determines the default value displayed.

Pipe reference temperature is temperature at which the meter run pipe diameter was measured. The template selected determines the default value displayed.

Beta Ratio is the ratio of orifice diameter to pipe diameter. It is displayed for information purposes only and cannot be edited.

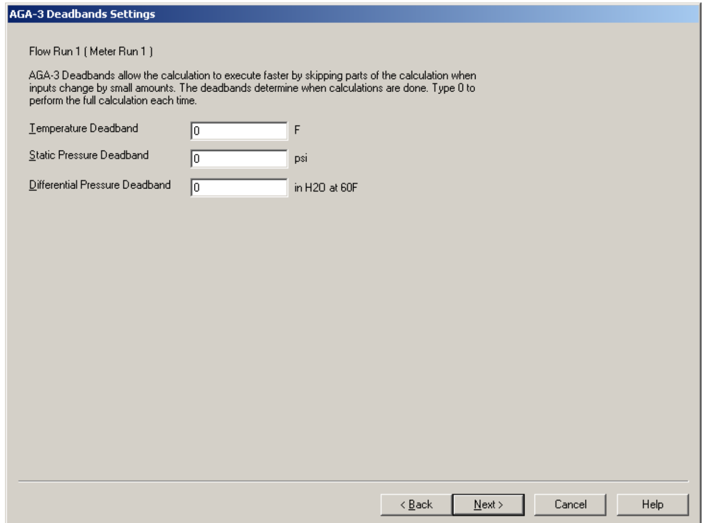
Realflo displays messages if the beta ratio is outside recommended limits.

Isentropic Exponent is a thermodynamic property of gas used to predict the relationships between pressure, temperature, volume and energy. If you are unsure of this value, a typical value of 1.3 is commonly used. The template selected determines the default value displayed.

Viscosity is a measure of the resistance of a measured gas to flow. Valid values are 0 to 1. The template selected determines the default value displayed.

AGA-3 Deadband Settings Step

This step sets AGA-3 calculation deadbands.



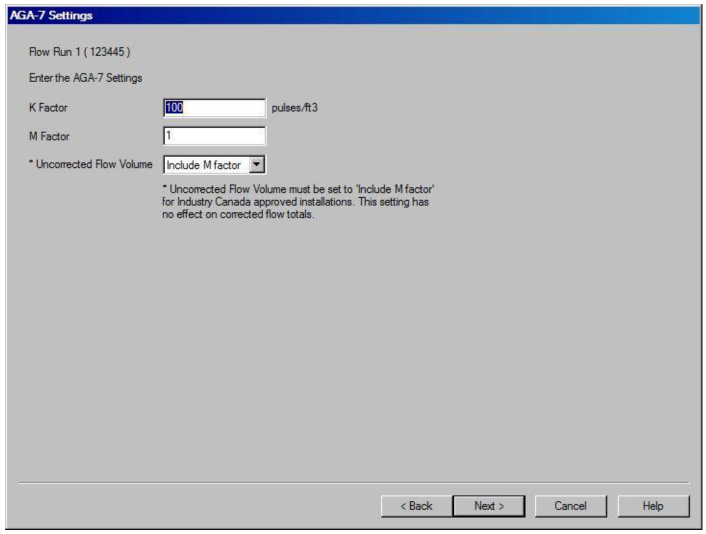
Temperature Deadband is the tolerated change in the flowing temperature before temperature dependent factors in the flow calculation are recalculated. Changes in the temperature smaller than the deadband will be ignored in determining the result. The template selected determines the default value displayed. The upper limit is 7°F or 4°C.

Static Pressure Deadband is the tolerated change in the static pressure before static pressure dependent factors in the flow calculation are recalculated. Changes in the static pressure smaller than the deadband will be ignored in determining the result. A static pressure deadband setting of up to four percent of the typical static pressure level should have a small effect on the accuracy of the AGA-3 calculation. The template selected determines the default value displayed. The upper limit is 800 psi or 5500 kPa or the equivalent in other units.

Differential Pressure Deadband is the tolerated change in the differential pressure before differential pressure dependent factors in the flow calculation are recalculated. Changes in the differential pressure smaller than the deadband will be ignored in determining the result. A change of N in the differential pressure input will cause a change of 0.5 N in the calculation volume at base conditions. It is recommended that the differential pressure deadband be set to zero. The template selected determines the default value displayed. The upper limit is 4.5 inWC or 1.1 kPa or the equivalent in other units.

AGA-7 Settings Step

This step lets you define the AGA-7 settings.



K Factor is the number of pulses per unit volume of the turbine meter. Valid values are 0.001 to 1000000. The template selected determines the default value displayed.

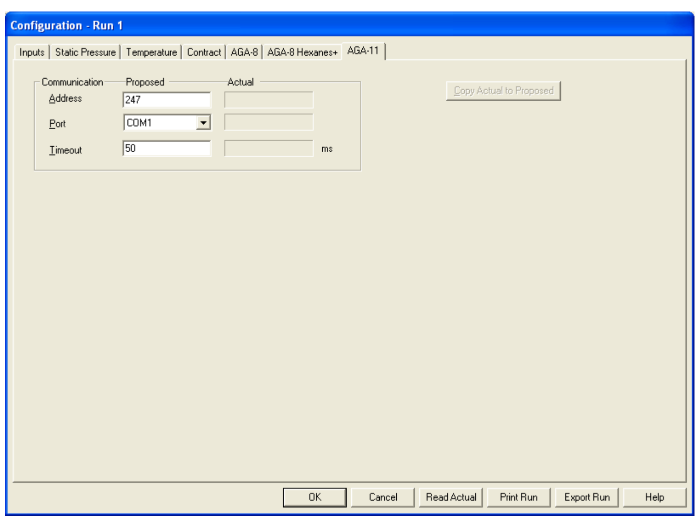
M Factor is the adjustment to the number of pulses per unit volume for the turbine meter compared to an ideal meter. Valid values are 0.001 to 1000. The template selected determines the default value displayed.

***Uncorrected Flow Volume** is the measurement of the volume of gas during the contract period.

The Uncorrected Flow Volume control is available in Realflo versions 6.20 and higher.

AGA -11 Configuration Step

AGA-11 configuration defines parameters unique to the AGA-11 calculation. The AGA-11 calculation communicates with a Coriolis meter for the calculation. The AGA-11 configuration sets the communication parameters for communication between the Coriolis meter and the flow computer.



Address

This is the Modbus address of the Coriolis Meter for serial communications. Multiple Coriolis meters using the same serial port on the flow computer needs to each have a unique Modbus address. Valid Modbus addresses are between 1 and 247. The default address is 247.

Port

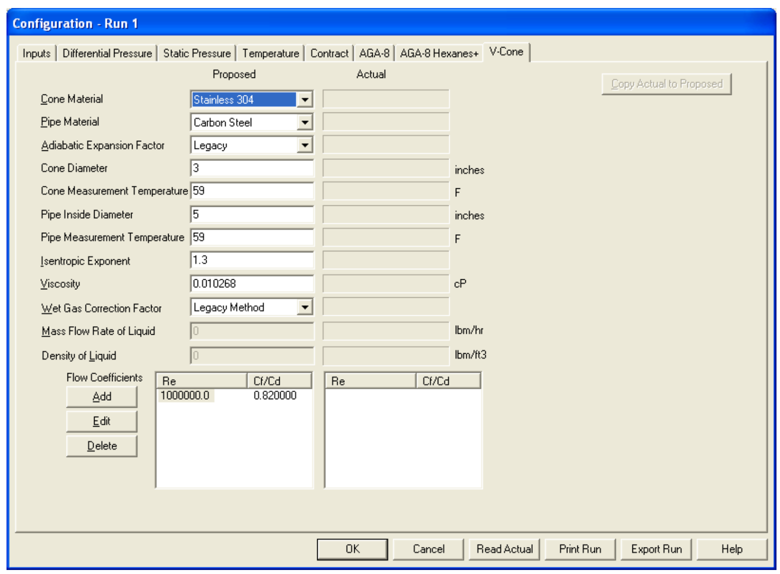
This is the communication port on the flow computer that will be used to communicate with the Coriolis meter. Valid port selections depend on the type of controller the flow computer running on. The default port is the first valid port available on the controller.

Timeout

This is the time the flow computer will wait for a response for Modbus read commands send to the Coriolis meter. When the timeout time is exceeded the command is unsuccessful and an alarm is added to the flow computer alarm list. Valid timeout values are from 0 to 1000 ms. The default value is 50 ms.

V-Cone Settings Step

V-Cone Configuration defines parameters unique to the V-Cone calculation.



Cone Material

This is the material of the V-cone. Valid values are Carbon Steel, Stainless 304, and Stainless 316. The default value is determined by the template selected.

Pipe Material

This is the material from which the meter run pipe is made. Valid values are Carbon Steel, Stainless 304, and Stainless 316. The default value is determined by the template selected.

Adiabatic Expansion Factor

The **Adiabatic Expansion Factor** drop down list selects which calculation is used for the adiabatic expansion factor of the calculation.

- Select **Legacy Calculation** to use the older calculation method. This is the default selection. Flow computers prior to version 6.71 support only this selection.

- Select **V-Cone** to use the V-Cone specific calculation. This selection should be used with V-Cone devices.
- Select **Wafer-Cone** to use the Wafer-Cone specific calculation. This selection should be used with Wafer-Cone devices.

This control is disabled and forced to **Legacy Calculation** if the controller type is not one of SCADAPack 32, SCADAPack 32P, SCADAPack 314/330/334, SCADAPack 350 SCADAPack 4203 or SolarPack 410.

When **reading** from a flow computer that does not support the adiabatic expansion factor configuration, the method will be set to Legacy Calculation.

When **writing** to a flow computer that does not support the adiabatic expansion factor method, the configuration registers will be ignored and the expansion factor will not be written.

Cone Diameter

The diameter of the meter run cone used for the flow calculation. The measurement units are displayed depending on the input units selected. The default value is 3 inches.

Cone Measurement Temperature

This is the reference temperature at which the cone diameter for the meter run was measured. The measurement units are displayed depending on the input units selected. The default value is 59 degrees F.

Pipe Inside Diameter

This is the measurement of the meter run pipe inside diameter. The measurement units are displayed depending on the input units selected. The default value is 5 inches.

Pipe reference temperature

The temperature at which the meter run pipe diameter was measured. The measurement units are displayed depending on the input units selected. The default value is 59 degrees.

Isentropic Exponent

In general, this is a thermodynamic property of gas used to predict the relationships between pressure, temperature, volume and energy. If you are unsure of this value a typical value of 1.3 is commonly used. The default value is 1.3.

Viscosity

This is the viscosity of the measured gas. In general, this is the resistance of a gas or semi-fluid resistance to flow. The measurement units are displayed depending on the input units selected. Valid values are 0 to 1. The default value is 0.010268 centiPoise.

Wet Gas Correction Factor

The Wet Gas Correction Factor Method drop down list selects which calculation is used for the wet gas correction factor of the calculation.

- Select **Legacy Method** to use the older correction method. This is the default selection. Flow computers prior to version 6.73 support only this selection.

- Select **V-Cone or Wafer Cone** to use the V-Cone and Wafer Cone specific calculation. This selection should be used with V-Cone or Wafer Cone devices.

This control is disabled and forced to **Legacy Calculation** if the controller type is not one of SCADAPack 32, SCADAPack 32P, SCADAPack 314/330/334, SCADAPack 350 SCADAPack 4203 or SolarPack 410.

The V-Cone or Wafer Cone supported **Beta Ratios** are:

For Fr (Froude Number) < 5 supported Beta Ratio is 0.55.

For Fr (Froude Number) < 5 supported Beta Ratio is 0.75.

For Fr (Froude Number) > 5 supported Beta Ratio is 0.75.

When **V-Cone or Wafer Cone** is selected and if the current Beta ratio is not supported when executing verification, a message is displayed.

When **V-Cone or Wafer Cone** is selected, configuration of the fixed wet gas factor parameter, as set in the Contract tab, is disabled.

When **Legacy Method** is selected, configuration of the parameters used by the V-Cone or Wafer Cone method is disabled.

Mass Flow Rate of Liquid

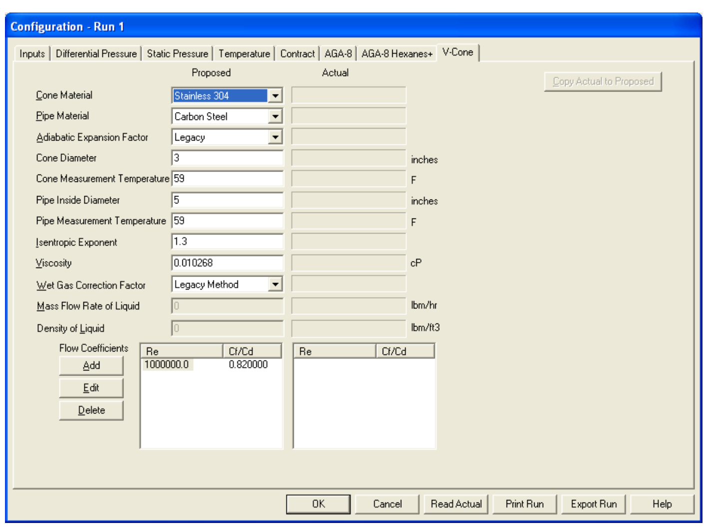
The Mass flow rate of liquid at flow conditions parameter is used by the V-Cone or Wafer Cone method and can be configured when **V-Cone or Wafer Cone** is selected. This information needs to be gathered using a sampling method or a tracer method. The default is 0.

Density of Liquid

The Density of liquid at flow conditions parameter is used by the V-Cone or Wafer Cone method and can be configured when **V-Cone or Wafer Cone** is selected. The default is 0.

V-Cone Coefficients

This step defines the V-Cone coefficients.

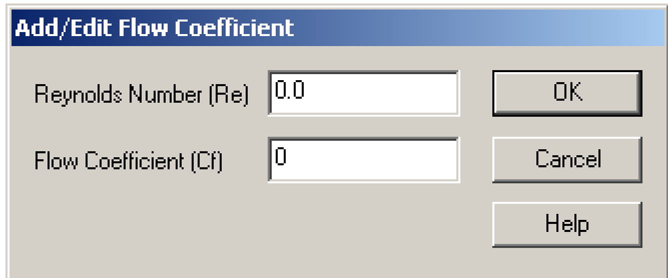


Enter the V-Cone coefficient pairs from the meter-sizing report. The default list contains one pair: Re = 1000000; Cf = 0.82.

Click **Add** to add a coefficient pair.

In the original McCrometer V-Cone Application Sizing sheet that is included with V-Cone meters uses the terminology **Cd** (discharge coefficient) rather than **Cf** (flow coefficient). You will need to use the **Re** and **Cd** values from the V-Cone Application Sizing sheet for the **Re** and **Cf** entries. If the **Re** value is the same for all entries in the table only the first pair is used.

McCrometer now supplies one value of **Cd** in the sizing document. You need to enter one **Re/Cd** pair only. See the McCrometer Application Sizing sheet for the **Re/Cd** pair for your meter.



To edit a coefficient pair in the table:

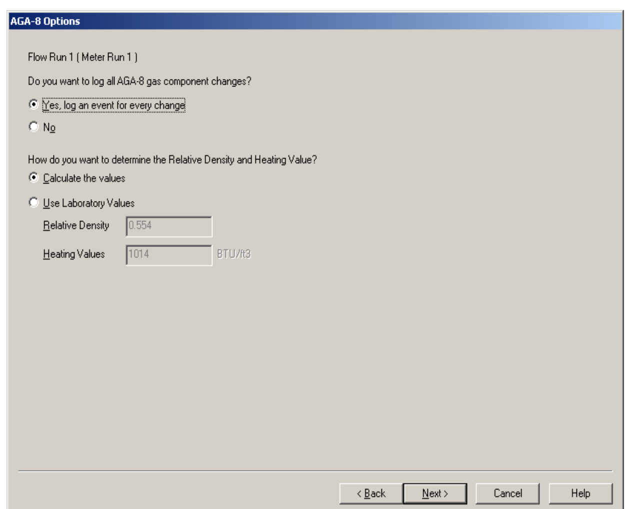
- Select a row in the list.
- Click **Edit** to open the Add/Edit Flow Coefficient dialog.

To delete a coefficient pair in the table:

- Select a row in the list.
- Click **Delete** to delete the pair form the list.

AGA-8 Options Step

This step sets AGA-8 calculation options.



Events can be logged each time an AGA-8 gas component changes.

- Select **Yes** to log each change to the gas composition. Use this option if the gas composition changes infrequently. This is the default selection.
- Select **No** to skip logging changes. Use this option if you are making frequent changes to the gas composition.

The Relative Density and Heating values can be calculated from the AGA-8 calculation or determined in a laboratory.

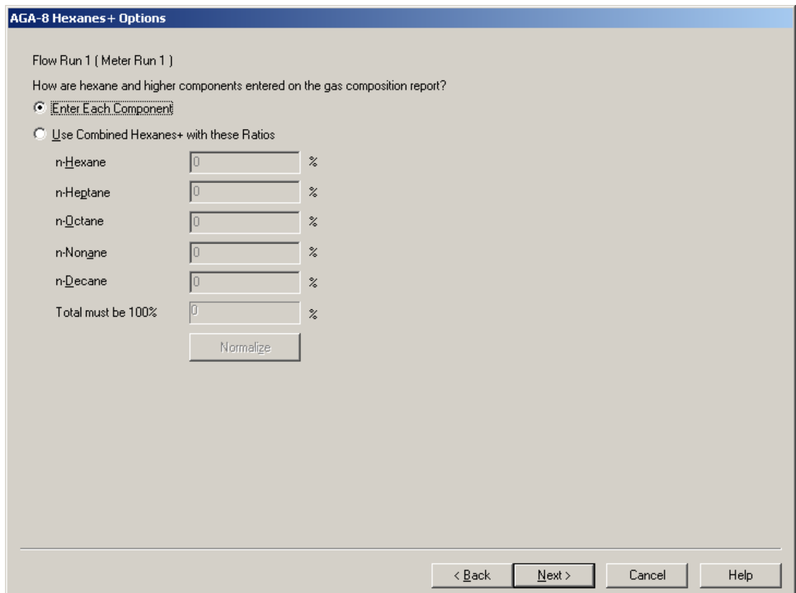
- Select **Calculate the Values** to have AGA-8 calculate the values.
- Select **Use Laboratory Values** to used fixed values.

Relative Density sets the real relative density of the gas. Valid values are 0.07 to 1.52. The template selected determines the default value displayed. This control is disabled if **Calculate the Values** is selected.

Heating Value sets the heating value of the gas. Valid values are 0 to 1800 BTU(60)/ ft^3 or the equivalent in the selected units. The template selected determines the default value displayed. This control is disabled if **Calculate the Values** is selected.

AGA-8 Hexanes+ Options

This step lets you choose to enter Hexane and higher components individually or as a single combined value.



Gas composition can be measured with individual values for hexane and higher components or use a combined value.

Select **Enter Each Component** to use individual values for the higher components. This is the default selection.

Select **Use Combined Hexanes+ with these Ratios** to use a combined value. Type the ratios of the higher components.

- **n-Hexane** defines the percentage of the Hexanes+ contributed by n-Hexane.
- **n-Heptane** defines the percentage of the Hexanes+ contributed by n-Heptane.
- **n-Octane** defines the percentage of the Hexanes+ contributed by n-Octane.
- **n-Nonane** defines the percentage of the Hexanes+ contributed by n-Nonane.
- **n-Decane** defines the percentage of the Hexanes+ contributed by n-Decane.

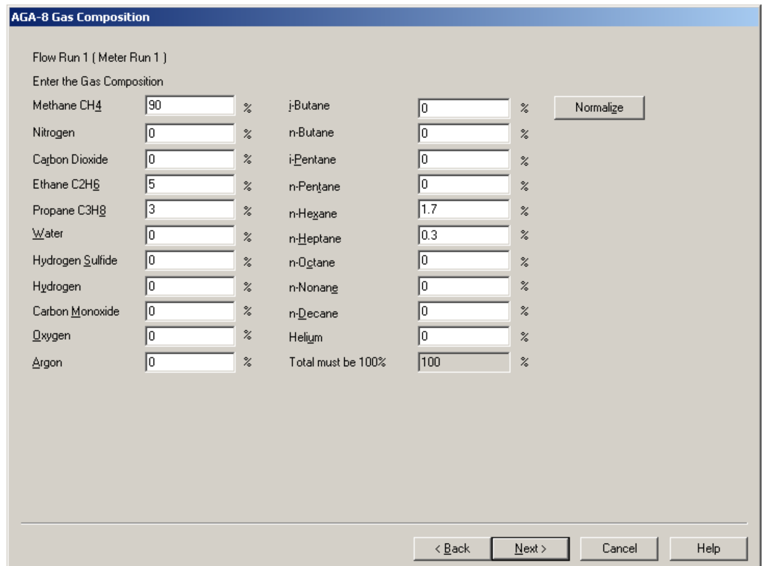
- The **Total** field displays the sum of portions. This value cannot be edited. The total of portions needs to be 100 percent.

AGA-8 Gas Composition Step

This step lets you define the AGA-8 gas composition. One of two configuration dialogs opens based on how you elected to enter Hexane and higher components.

Individual Components

The dialog below lets you enter combined Hexanes+ composition.

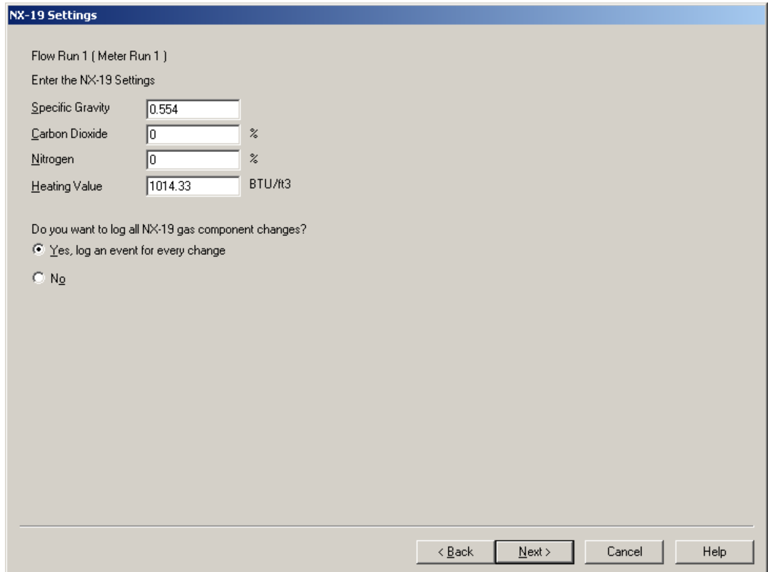


Type the gas composition according to the laboratory analysis. The total of components needs to be 100 percent.

Normalize adjusts non-zero components so that the total of components is 1.0000 (or 100.00 percent). The ratio to each other for the components remains the same.

NX-19 Settings

This step defines the NX-19 calculation. This is not supported for PEMEX flow computers.



Specific Gravity is the specific gravity of the gas being measured. Valid values are 0.554 to 1.000. The template selected determines the default value displayed.

Carbon Dioxide is the percent of carbon dioxide in the gas being measured. This value needs to be in the range 0 to 15. The template selected determines the default value displayed.

Nitrogen is the percent of nitrogen in the gas being measured. This value needs to be in the range 0 to 15.

Heating Value is the heating value of the gas being measured. Valid values are 0 to 1800 BTU(60)/ft^3 or the equivalent in the selected units. The template selected determines the default value displayed.

Events can be logged each time the NX-19 configuration changes.

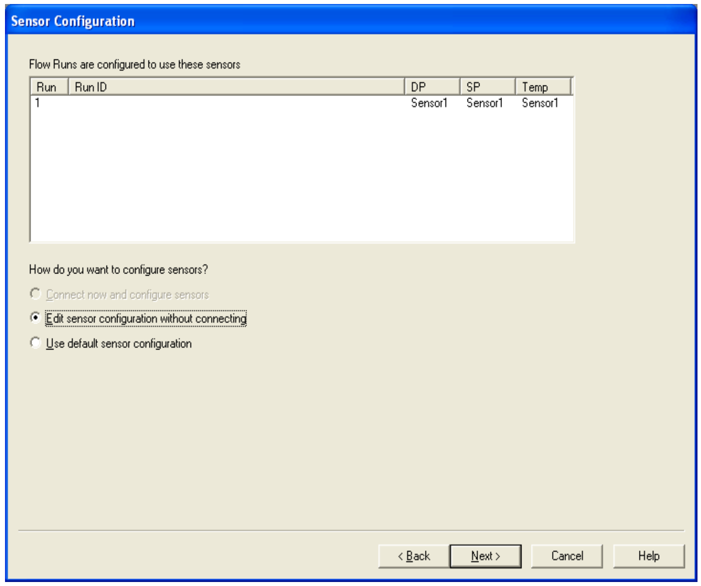
- Select **Yes** to log each change to the configuration. Use this option if the configuration changes infrequently. This is the default selection.
- Select **No** to skip logging changes. Use this option if you are making frequent changes to the configuration.

Sensor Configuration

The next step is Sensor Configuration if any transmitters were used in the input configuration. Otherwise the next step is **Flow Computer Configuration Summary**.

Sensor Configuration

This step lets you select how the transmitters are to be configured.



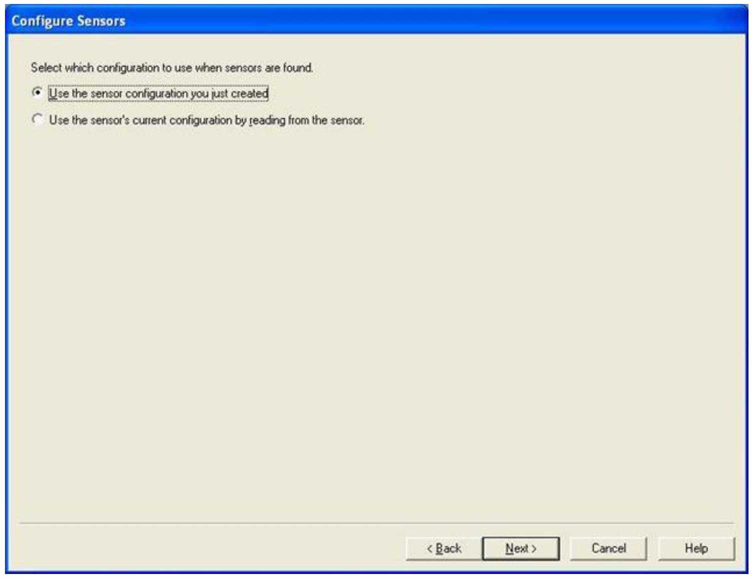
The **Flow Runs are configured to use these transmitters** dialog is a table that shows each of the configured flow run numbers, the Flow Run ID for each, and the transmitter that the run uses for the differential pressure (DP), static pressure (SP), and temperature sensors. If an analog input is used for the flow run, AIN will be displayed in the coresponding DP, SP, or Temp column.

The **How do you want to configure sensors?** option lets you select how to continue configuring the sensors. The three options are:

- **Connect now and configure transmitters** to connect to the flow computer and configure the attached transmitters. This selection is disabled if the flow computer configuration was selected to be completed offline in the Flow Computer Status step. If you choose this option, go to the **Configure Sensors** section to continue.
- **Edit sensor configuration without connecting** to proceed directly to the editing pages, without connecting to the flow computer. If you choose this option, go to the **Review Transmitters** section to continue.
- **Use default sensor configuration** to complete the configuration without changing the sensor configuration. Sensor configuration will be set to default values. If you choose this option, the next step is **Finish**.

Configure Sensors

This step lets you select to use the Realflo configuration or the sensor’s configuration file.

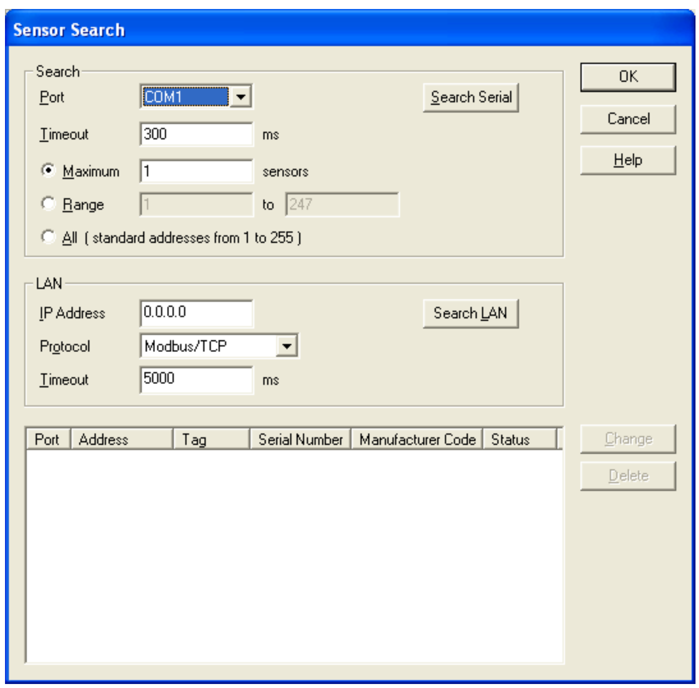


Select **Use the configuration from Realflo** to use the configuration data from the Realflo file. This is the default setting.

Select **Use the transmitter's current configuration by reading from the transmitter** to read configuration from a pre-configured transmitter.

Sensor Search

This step searches for sensors connected to the flow computer serial ports or LAN port.



Search Serial Option

Select **Search Serial** to search for transmitters connected to a serial port of the flow computer.

The **Port** parameter selects the flow computer serial port where the sensor is attached. Valid values are com1, com2, com3, and com4. The template selected determines the default value displayed.

The **Timeout** parameter specifies the length of time the flow computer will wait for a response from a sensor. Valid values are 100 ms to 10000 ms. The default is 300 ms.

Select **Maximum** to search for a number of MVT transmitters. The search operation will stop after finding the specified number of transmitters. The valid value is from 1 to 255. The default is 1.

Select **Range** to search the addresses in a specified range. The range to search for is typed in the edit boxes to the right of the radio button. The value in *To* edit control needs to be equal or great than the value in the first edit control. The maximum search range that can be typed is for 255 transmitters. The default range is 1 to 247.

- Range Search supports addresses 1 to 255 in standard Modbus mode, and 1 to 65534 in extended address mode. The address mode of the flow computer serial port needs to be set to extended in order to search for transmitters with extended addresses.

Select **All** to search the addresses of all transmitters connected with the serial port selected in *Port*. Up to 255 addresses are searched.

Click **Next** to start the search for sensors or 4000 transmitters. A search process dialog is displayed so that the search operation can be cancelled at any time.

Search LAN Option

Select **Search LAN** to search for transmitters connected to a LAN port of the flow computer.

The **IP Address** parameter specifies the IP address of a 4000 transmitter. Valid entries are IP addresses in the format nnn.nnn.nnn.nnn where nnn are values between 0 and 255.

The **Protocol** parameter selects the type of IP protocol that will be used to query the transmitter. Valid IP protocol selections are Modbus/TCP and Modbus RTU in UDP.

The IP port (for example port 502) for the selected protocol needs to be the same in the flow computer and the 4000 transmitter.

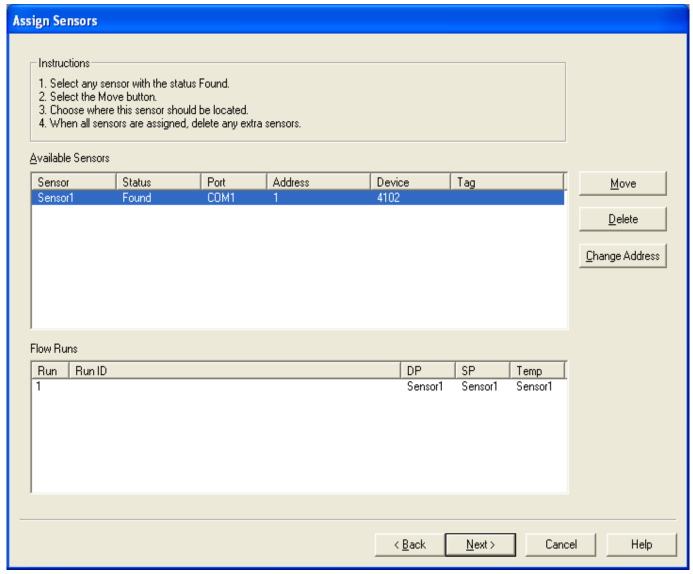
The **Timeout** parameter specifies the length of time the flow computer will wait for a response from a 4000 transmitter. Valid values are 100 to 10000 milliseconds. The default is 5000 ms.

Click **Next** to start the search for MVT transmitters or 4000 transmitters. A search process dialog is displayed so that the search operation can be cancelled at any time.

If no transmitters were found, then a message is displayed and the search step is displayed again.

Assign Sensors

This step assigns found transmitters to flow runs.



The **Available Sensors** window shows the transmitters that have been configured and the transmitters that were found by the search. There may be more transmitters in the list than there are runs.

The **Sensor** column shows the transmitter slots that have been configured. Transmitters that were found but not assigned are listed as *Not assigned*.

The **Status** column indicates if configuration data for the transmitter exists.

- ***Found*** indicates a transmitter has been configured and the search found one with the same port, address and device type.
- ***Missing*** means a transmitter has been configured but the search did not find one with the same port, address and device type.

The **Port** column displays the serial or LAN port the flow computer is using to communicate with the transmitter.

The **Address** column displays the Modbus station address or IP address of the transmitter.

The **Tag** column displays the Tag Name assigned to the transmitter. This column may be blank if a Tag Name has not been assigned to the transmitter.

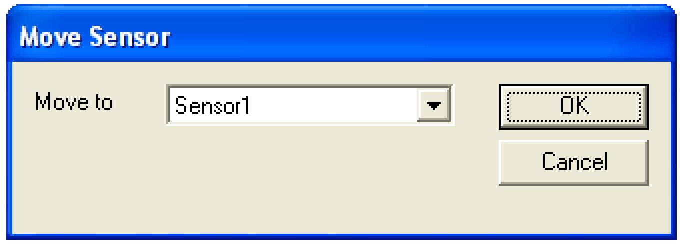
The **Device** type column displays type of transmitter. Valid values are 3095FB, 4101, 4102, 4202 DR, 4202 DS, 4203 DR, or 4203 DS.

The **Flow Runs** window shows which MVTs are assigned to the runs.

To Change the order of the sensors:

- Select a sensor in **Available Sensors** window.
- Click **Move**.

The Move Sensor dialog opens:



- In the Move Sensor dialog, use **Move To** selection to select the new location
- Click **OK**.

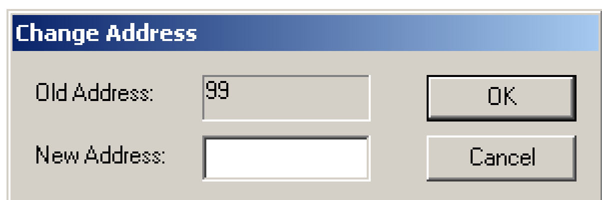
To delete a sensor:

- Select a transmitter in **Available Sensors**
- Click **Delete**.

To change the address of a Sensor:

- Select a transmitter in **Available Sensors**
- Click **Change Address**.

The Change Address dialog opens:



- Enter a new address for the transmitter in the **New Address:** window.
- Click **OK**.

Click **Next** when the transmitters are moved to the correct location. **Next** is disabled if there are *Not Assigned* transmitters still in the list.

The next step is Search for More Transmitters.

Notes

The following actions may occur when moving a Sensor.

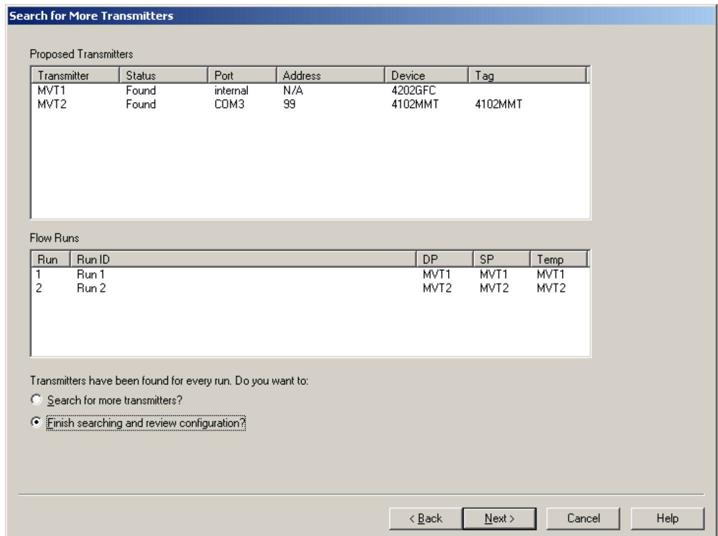
- Moving one sensor to another results in the both swapping positions.
- When *Use the configuration from Realflo* was selected, assigning a *Not assigned* transmitter to a Sensor with status ***Missing*** and device type matching will result in the sensor adopting the transmitter's port and address and retaining the rest of the sensor configuration. The sensor, being assigned, will disappear from the list.
- When *Read the configuration from the transmitter* was selected, assigning a *Not assigned* transmitter to a sensor with status ***Missing*** and device type matching will result in the sensor adopting the transmitter's configuration. The transmitter, being assigned, will disappear from the list.
- Assigning a *Not assigned* transmitter to a sensor with status ***Missing*** and device type not matching will result in the sensor adopting the

transmitter's configuration. The transmitter, being assigned, will disappear from the list.

- Other assignments are not permitted.

Search for More Sensors

This step displays the current sensor assignments and asks if more searches are needed.



Proposed Sensors shows the transmitters that have been configured and the transmitters that were found by the search.

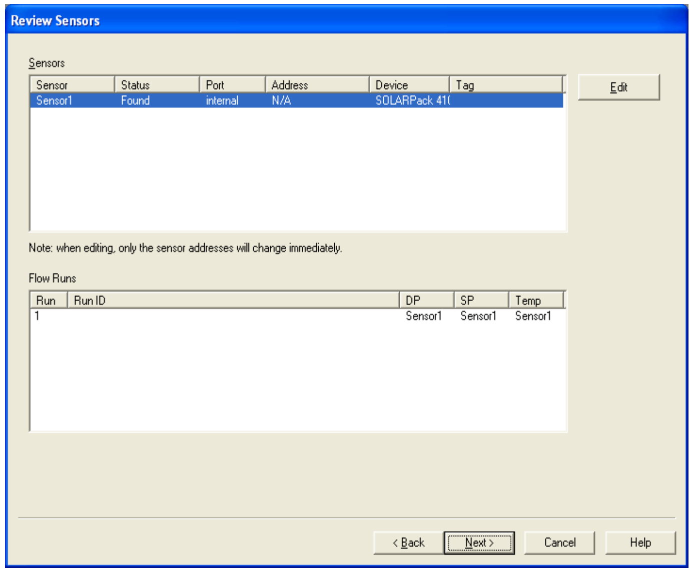
Flow Runs shows which sensors are assigned to the runs.

Select **Search for more transmitters** to search again. The next step is **Search for Transmitters**.

Select **Finish searching and review configuration** to use the current settings. This is the default button.

Review Transmitters

This step displays the transmitter assignments and allows editing the transmitter configuration.



The **Sensors** window shows the transmitters that have been configured.

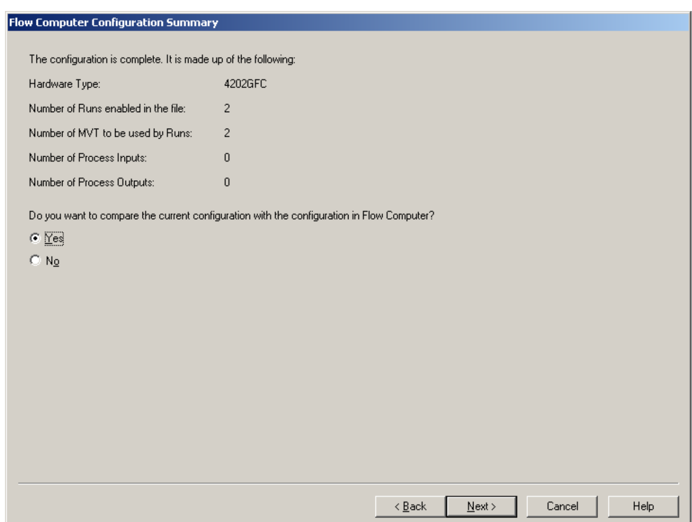
The **Flow Runs** window shows which sensors are assigned to the runs.

Click **Edit** to review and modify the settings for each transmitter. Edit opens the **Add/Edit Sensor Settings** dialog. Changes to a transmitter address will be written to the transmitter without affecting current flow computer configuration.

Once you have configured Run 1, the Flow Run ID dialog re-opens.

Flow Computer Configuration Summary

This step displays a summary of the flow computer settings.



A summary of the flow computer configuration is shown.

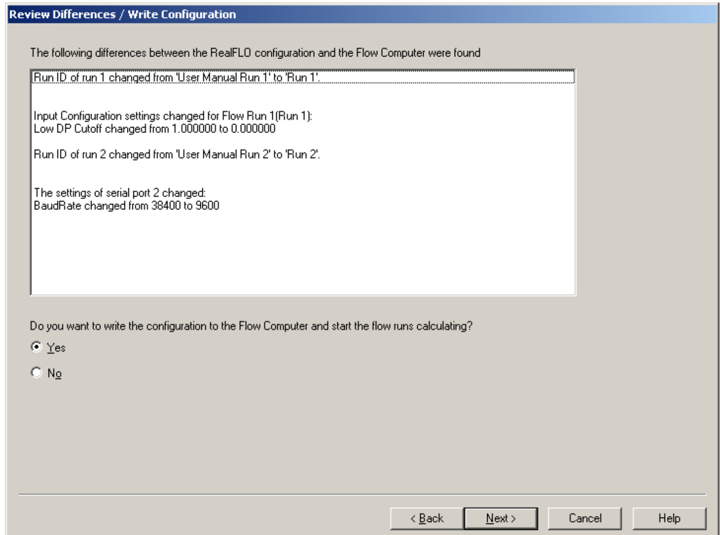
The current configuration can be compared with the configuration in the target flow computer.

Select **Yes** to compare the configurations. The next step is **Review Differences.**

Select **No** to not compare the configurations. The next step is **Save File**.

Review Differences

This step displays a summary of changes in the flow computer configuration. You can select to write to the flow computer or not.



A summary of the differences is the configuration is shown.

Select **Yes** to write the configuration to the flow computer. The configuration is written to the flow computer. The Start Executing command will be written for each flow run. The communication progress dialog shows the stages of writing.

Select **No** to write the configuration to the flow computer later.

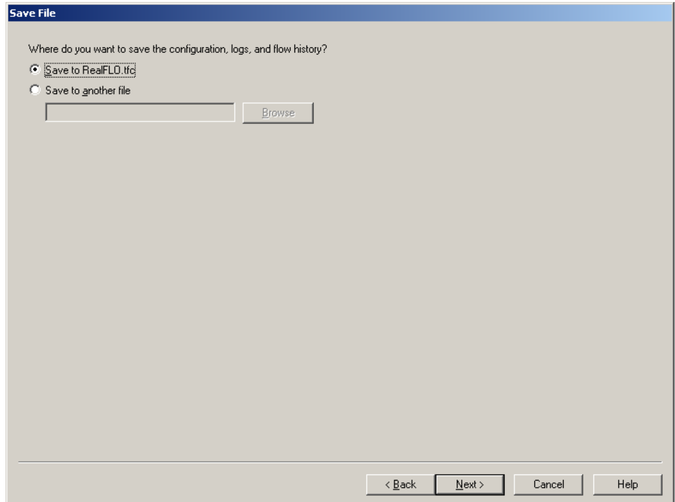
Click **Next** to perform the selected action.

In Flow Computer versions 6.73 and older, when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers. The Actual registers are not updated until a new Density calculation is started with the new values. The new values are not available to SCADA host software reading the Actual registers until a until a new Density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers and in the Actual registers. This allows a SCADA host to immediately confirm the new values were written to the flow computer. The new gas values are not used by the flow computer until a new density calculation is started.

Save File

This step selects where to save the configuration file.

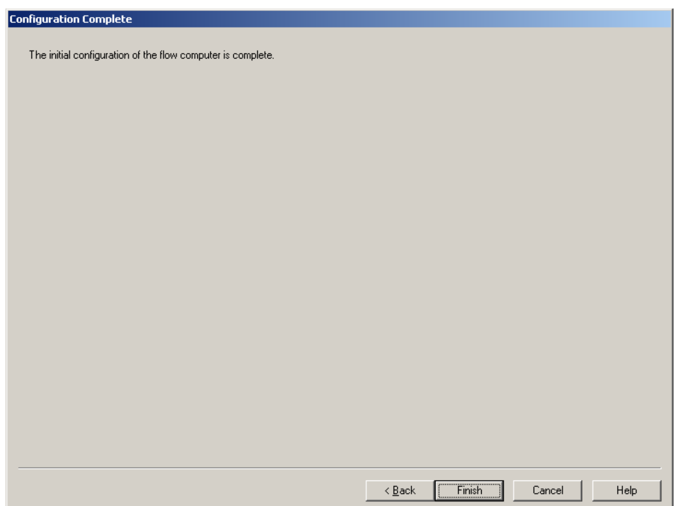


Select the **Save to Realflo.tfc** to save the configuration file to the default file location.

Select the **Save to another file** to either enter a file name or use the Browse option to open the **Save As** dialog.

Finish

This step is displayed at the end of the wizard.



Click **Finish** to close the wizard.

Notes

- Views for extra runs are closed but new ones may be opened.
- The history and event logs contain no information.
- The configuration data for supported runs in the file is set to usable values, so when the number of runs is changed there is useful data in the configuration.

Create Configuration Step-by-Step

When you choose to configure the flow computer step-by-step, the Create New File Wizard prompts you through the steps needed. The dialogs displayed are dependent upon the calculations you select.

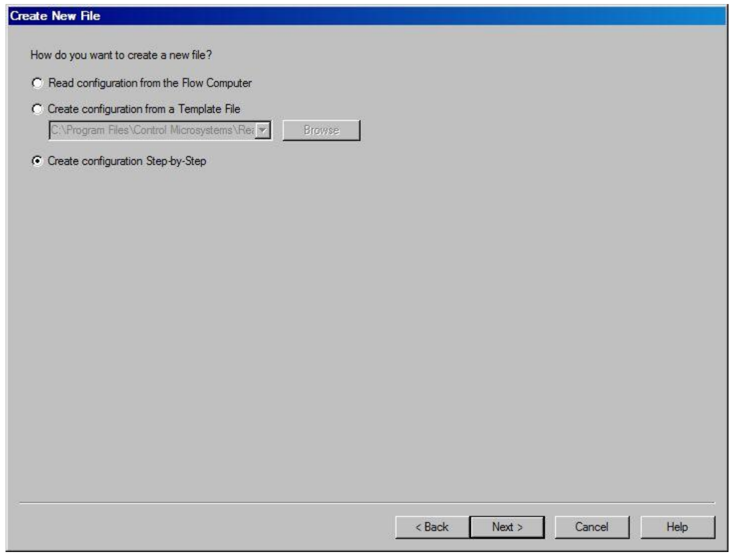
Step-by-Step Configuration Sequence for a Flow Computer

The main steps in the configuration sequence to configure flow computer step-by-step are:

- Use Create New File Dialog to select how to create a new file.
- Use Hardware and Firmware Type Dialog to configure the hardware and firmware you are using.
- Use the I/O Module Dialog to configure your I/O module (Telepace only).
- Use the Flow Computer ID Dialog to assign an ID to the flow computer.
- Use the Flow Runs Dialog to configure the number of flow runs
- Use the Flow Run ID Dialog to assign an ID to the flow run.
- Use the Flow and Compressibility Calculations to select the flow and compressibility calculations for the meter run.
- Select the Flow Run Inputs to configure the type of inputs for the flow run.
- Select the Differential Pressure Limits to configure the differential pressure calibration to use for the run.
- Configure the Static Pressure for the run.
- Configure the Static Pressure Input Limits for the run.
- Use the Static Pressure dialog to configure your sensors to compensate for the gravitation pull of the Earth according to altitude and latitude variations.
- Define the Temperature Limits for the run.
- Define the Contract Settings for the run.
- Select the Flow Calculations Dialog for the run.
- Configure the Sensor Configuration for the run.
- Review the Flow Computer Configuration Summary to confirm the configuration settings.
- Use Save File to save the new configuration.

Select the **Create a new file?** radio button from the Select File dialog to configure the flow computer step-by-step.

Create New File Dialog



- Select the Create Configuration Step-by-Step radio button.
- Click Next > to continue.

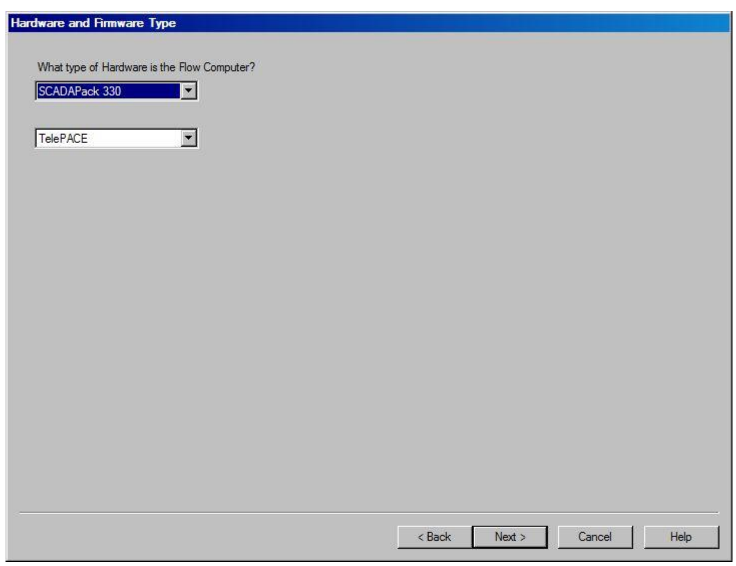
Follow the wizard steps described in the following sections to configure the flow computer.

Flow Computer Status Dialog

When configuring the flow computer step-by-step, select **No** when the Flow Computer Status dialog opens. This lets you choose the hardware type and firmware type manually see **Select Flow Computer Wizard.**

Hardware and Firmware Type Dialog

The Hardware and Firmware Type Dialog opens when you select **No** in the Flow Computer Status dialog.



First, select the **Hardware Type** from the dropdown list. The default value is SCADAPack 4202 DR. The options from which you can select are:

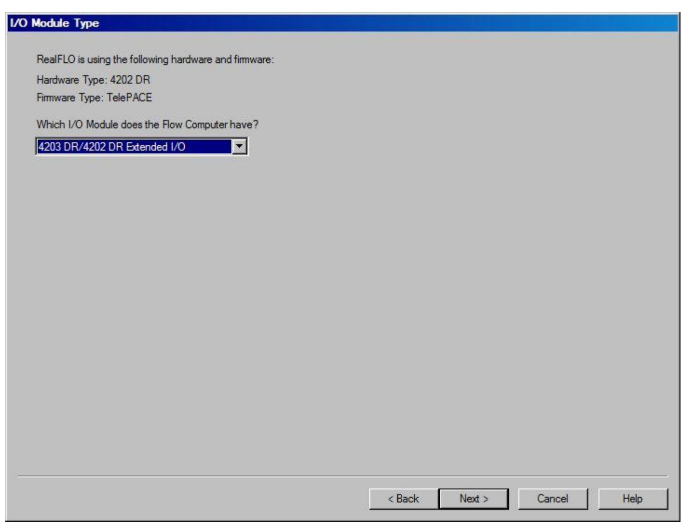
- Micro16
- SCADAPack
- SCADAPack Plus
- SCADAPack Light
- SCADAPack LP
- SCADAPack 32
- SCADAPack 32P
- 4202 DR
- SCADAPack 100: 1024K
- 4202 DS
- SCADAPack 314
- SCADAPack 330
- SCADAPack 334
- SCADAPack 350
- 4203 DR
- 4203 DS
- SolarPack 410

Second, select the **Firmware Type** from the dropdown list. The default value is Telepace. You can select ISaGRAF from the dropdown list for the firmware type.

If the firmware selected is Telepace, the **I/O Module Type Dialog** opens, followed by the **Flow Computer ID** dialog. If the firmware type selected is ISaGRAF, the Flow Computer ID dialog opens.

I/O Module Type Dialog

This step lets you select the I/O module to use for the selected Hardware type. The register assignment in the new file is set to the default register assignment for the selected hardware type.

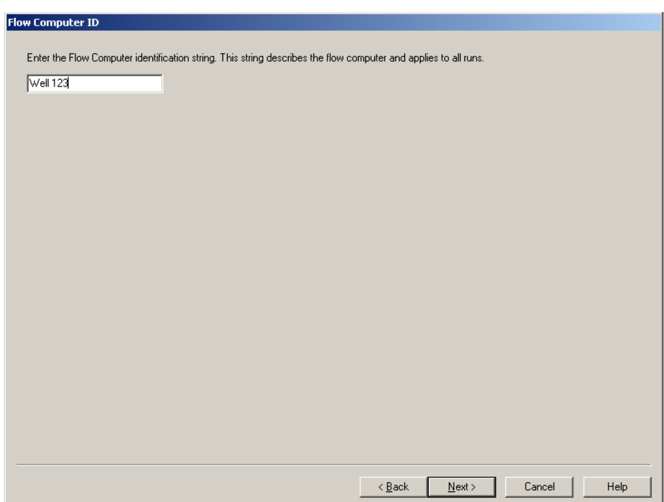


Select the I/O module for the flow computer from the dropdown list. The choices displayed depend on the flow computer hardware type.

Hardware Type	I/O Modules Available
Micro16	Controller I/O only or Backwards compatible modules.
SCADAPack	5601 I/O Module, 5604 I/O Module, or 5606 I/O Module
SCADAPack Plus	5601 I/O Module, 5604 I/O Module, or 5606 I/O Module
SCADAPack Light	5602 I/O Module
SCADAPack LP	SCADAPack LP I./O
SCADAPack 32	5601 I/O Module, 5604 I/O 10V/40mA Module 5604 I/O 5V/20mA Module 5606 I/O Module
SCADAPack 32P	SCADAPack 32P I/O
4202 DR	4202 DR or 4202 DR Extended/4203 DR I/O
SCADAPack 100: 1024K	SCADAPack 100: 1024K I/O
4202 DS	4202/4203 DS I/O
SCADAPack 314	SCADAPack 314/33x I/O
SCADAPack 330	SCADAPack 330 Controller.
SCADAPack 334	SCADAPack 33x I/O
SCADAPack 350	SCADAPack 350 10V/40mA Module SCADAPack 350 5V/20mA Module SCADAPack 357 Module
4203 DR	4202 DR Extended/4203 DR I/O
4203 DS	4202/4203 DS I/O
SolarPack 410	N/A

Flow Computer ID Dialog

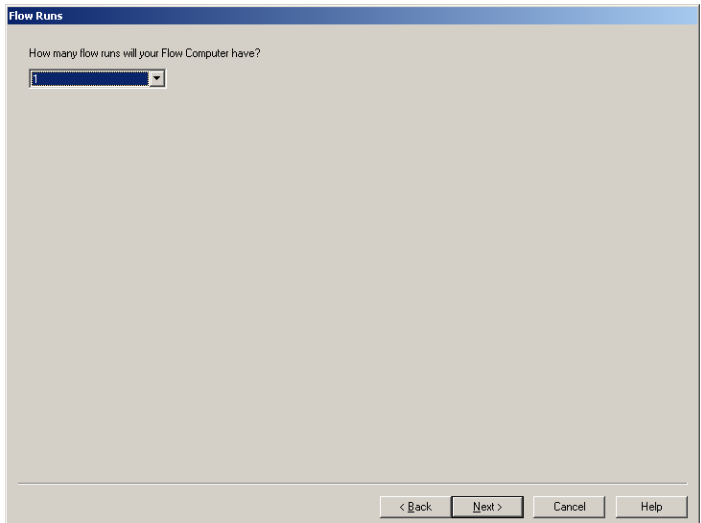
This step sets the Flow Computer ID.



Type the Flow Computer ID string in the edit box. This unique ID stops accidental mixing of data from different flow computers. The maximum length of the Flow Computer ID is eight characters. Any characters are valid. You can leave the Flow Computer ID edit box blank. The default value is blank.

Flow Runs Dialog

This step selects the number of flow runs in the flow computer. The wizard will step through the configuration of the first run and then each subsequent run if more than one run is selected.



Select the number of flow runs with the dropdown list. Valid values depend on the hardware type and the number of flow runs enabled for the flow computer. The default value is one.

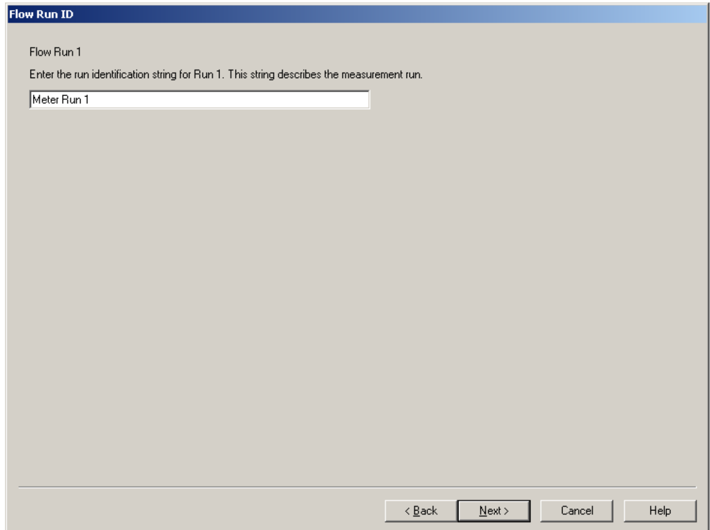
- For Micro16, SCADAPack, SCADAPack Light and SCADAPack Plus Flow Computers, the maximum number of meter runs is three.

The selection of three meter runs is available for older flow computers that could be enabled for three meter runs.

- For SCADAPack LP and SCADAPack (4202 and 4203) Flow Computers, the maximum number of meter runs is two.
- For SCADAPack 100: 1024K and SolarPack 410 Flow Computers, the maximum number of meter runs is one.
- For SCADAPack 314/330/334 and SCADAPack 350 Flow Computers the maximum number of meter runs is four.
- For SCADAPack 32 and SCADAPack 32P Flow computers the maximum number of runs you can select is ten.

Flow Run ID

This step sets the Flow Run ID for the meter run. This is the first step of a flow run configuration. The wizard will step you through the configuration of the first run and then each subsequent run if you select more than one run.



The **Flow Run ID** helps to identify the flow run. Type a string up to 32 characters long. Any characters are valid. You can leave the Flow Run ID edit box blank.

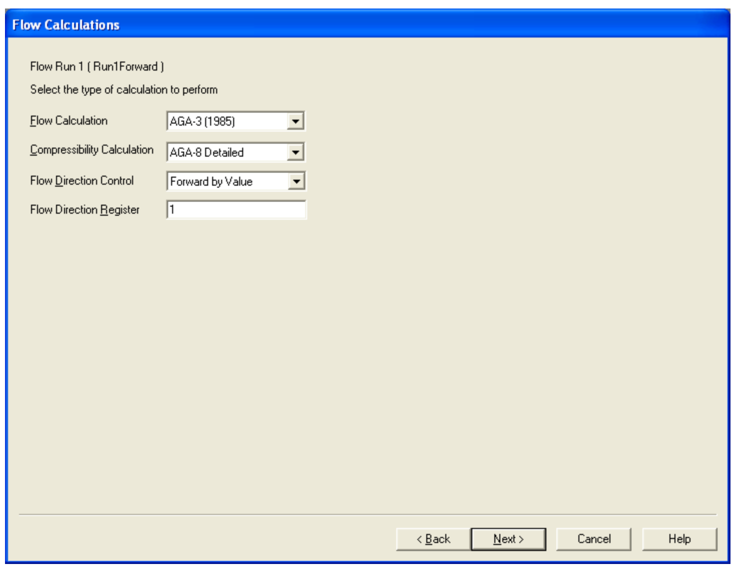
Older flow computers allow a string up to 16 characters. See the TeleBUS Protocol Interface section.

For run 1 the next step is ***Flow Calculations Dialog***.

For subsequent runs, the next step is ***Copy Run Configuration Dialog***.

Flow Calculations Dialog

This step selects the flow and compressibility calculations for the first run.



Flow Calculation selects the type of flow calculation for the meter run. Valid values are:

- AGA-3 (1985 version)
- AGA-3 (1992 version)
- AGA-7

- AGA-11 (not available for 16-bit controllers)
- V-cone calculations

The template selected determines the default value.

Compressibility Calculation selects the type of compressibility calculation for the meter run. Valid compressibility calculation values are:

- AGA-8 Detailed
- NX-19 (Not supported for PEMEX flow computers)

AGA-8 Detailed is the recommended calculation for new systems as it has superior performance compared to NX-19. NX-19 is provided for legacy systems. The template selected determines the default value.

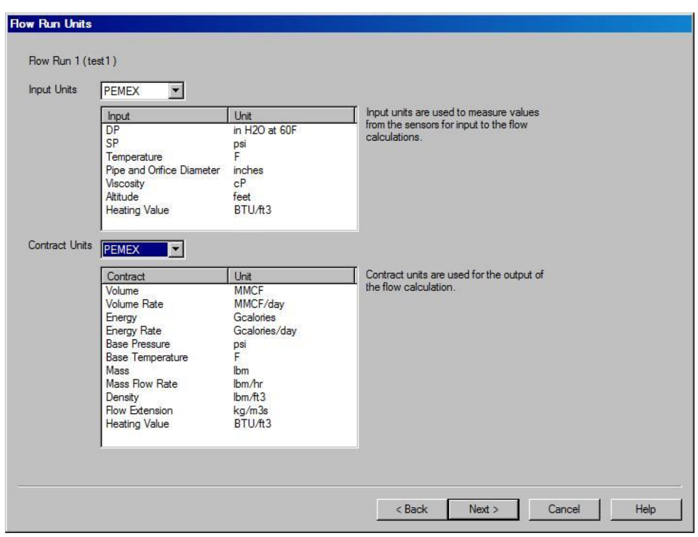
Flow Direction Control selects the direction of flow indication, forward or reverse, for a meter run.

- **Forward by Value** selection indicates the flow direction is forward when the value from a differential pressure (DP) sensor is positive or the mass flow rate value from a Coriolis meter is positive.
- **Reverse by Value** selection indicates the flow direction is reverse when the value from a differential pressure (DP) sensor is negative or the mass flow rate value from a Coriolis meter is negative.
- **Forward by Status** selection indicates the flow direction is forward when the Flow Direction Register has a value of 0 (OFF).
- **Reverse by Status** selection indicates the flow direction is reverse when the Flow Direction Register has a value of 1 (ON).

Flow Direction Register specifies which register indicates the forward or reverse flow direction status. Any valid registers for the flow computer controller can be used for this setting. The default register is 1. This edit control is disabled if **Flow Direction Control** selection is Value. This control is hidden in GOST mode flow computers.

Flow Run Units Dialog

This step selects the units that are used for input measurements and contracts.



Input Units selects the units of measurement of input values for the meter run. Inputs may be measured in different units than the calculated results. This allows you to use units that are convenient to you for measuring inputs. A dropdown box allows the selection of the following unit types. US2 is the default value.

- US1
- US2
- US3
- IP
- Metric1
- Metric2
- Metric3
- SI
- US4
- US5
- US6
- US7
- US8
- PEMEX

The reference list for the Input Units displays the parameters and units for these parameters:

- DP (Differential pressure)
- SP (Static pressure)
- Temperature
- Pipe and Orifice Diameter
- Viscosity
- Altitude
- Heating value

Contract Units selects the units of measurement of contract values. These units are used for the calculated results. A dropdown box allows the selection of the following unit types. The default value is US2.

- US1
- US2
- US3
- IP
- Metric1
- Metric2
- Metric3

- SI
- US4
- US5
- US6
- US7
- US8
- PEMEX

The reference list for the Contract Units displays the parameters and units for these parameters when used for the contract. The parameters displayed depend on the contract units selected. The parameters are:

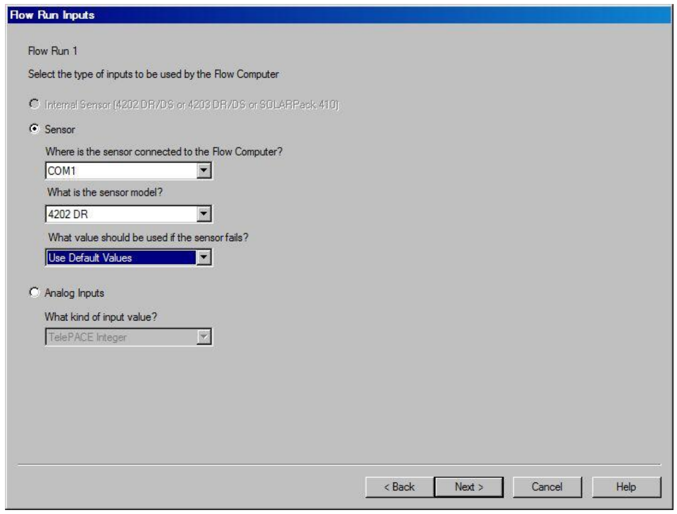
- Volume
- Volume Rate
- Energy
- Energy Rate
- Base Pressure
- Base Temperature
- Mass
- Mass Flow Rate
- Density
- Flow Extension
- Heating Value

Flow Run Inputs

This step lets you configure the flow run inputs. One of two configuration dialogs is presented based on the input type you configure.

- **Sensor Inputs**
- **Analog Inputs**

Sensor Inputs



- **Select Internal Sensor (4202 DR/DS or 4203DR/DS or SolarPack 410)** to use a SCADAPack internal transmitter as the input device. The transmitter is the input for pressure, differential pressure, and temperature. This is the only valid selection for run 1of a SCADAPack flow computer. Other options are disabled.
- Select **Sensor** to use a multivariable transmitter as the input device. The transmitter is the input for pressure, differential pressure, and temperature. This is the default selection, except for run 1 of a SCADAPack controller.
- The **Where is sensor connected to the Flow Computer** parameter enables the ability to select the serial or LAN port where the sensor is connected to the flow computer. Selections vary according to the flow-computer type. The default value is com1. Valid selections can include:
  - com1
  - com2
  - com3
  - com4
  - LAN
- The **What is the sensor model** parameter selects the multivariable transmitter (MVT) type. The selections available are:
  - 3095FB
  - 4101
  - 4102
  - 4202 DR
  - 4202 DS
  - 4203 DR
  - 4203 DS
- The **What value should be used if the sensor fails** parameter selects the specified value in this field as the live input value when communicating with a sensor. The dropdown list lets you select:

- Use Last Known Good Value
- Use Default Value

When you open a file using an older file format, Realflo sets the default value of the **Values on Sensor Fail** field to **Use Last Known Good.**

When the status to a sensor changes and you select the **Use Default Value** option, this is added to the Event Log.

- For flow computers 6.70 and later, when communication to a sensor fails and the configuration option “Use Last Known Good Value” is set to “Use Default Value,” the flow computer needs to use the specified default value in the configuration in place of a live input value.
- When communication to a sensor is restored and the configuration option for the **Value on Sensor Fail** field is set to use the default value, the flow computer uses the input value from the sensor as the live input value.
- For flow computers prior to 6.70, the value on sensor fail is ``Ùse Last Known Good Value.”

Analog Inputs

Select **Analog Inputs** to use analog inputs to measure pressure, differential pressure, and temperature.

Valid values are:

- Telepace Integer
- ISaGRAF Integer
- Float
- Raw Float

The default value is Telepace integer if Telepace firmware is running and ISaGRAF integer if ISaGRAF firmware is running.

For AGA-7 calculations, the value is fixed and set automatically. The value is Telepace Long if Telepace firmware is running and ISaGRAF integer if ISaGRAF firmware is running.

The next step is ***Differential Pressure Input Limits*** if AGA-3 or V-Cone is configured

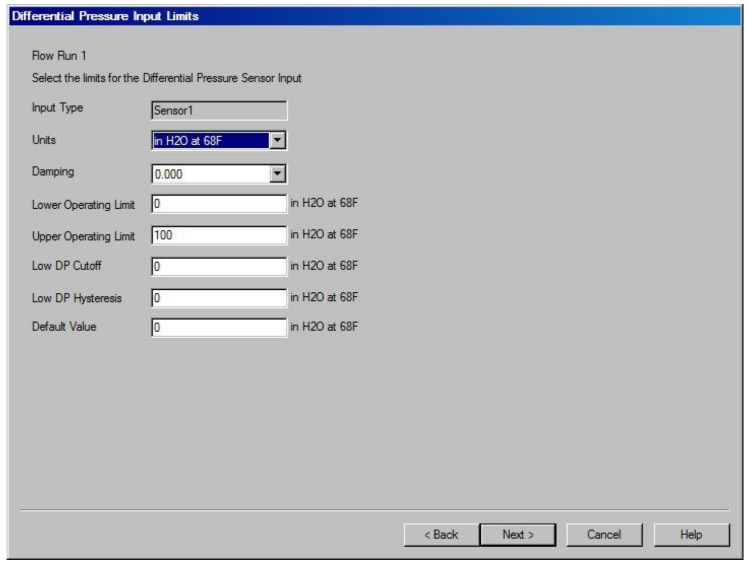
If AGA-7 is configured, the next step is ***Turbine Settings***.

Differential Pressure Input Limits

This step lets you configure the differential pressure input limits. One of two configuration dialogs is presented based on the input type you configure.

- ***Sensor Inputs***
- ***Analog Inputs***

Sensor Inputs



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

Units are the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display, the transmitter uses these units. Valid values depend on the MVT type:

- For SCADAPack transmtters, valid units are: inches H2O at 68°F, Pascal (Pa) and kiloPascal (kPa). The default is inches H2O at 68°F.
- For the 3095 MVT valid units are: inches H2O at 60°F, Pascal (Pa), kiloPascal (kPa) and inches H2O at 68°F. The default is inches H2O at 60°F.

Damping is the response time of the transmitter. It is used to smooth the process variable reading when there are rapid input variations.

- For SCADAPack transmitters the valid values are 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 seconds. The default value is 0 (damping off).
- For the 3095 MVT the valid values are 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824 and 27.648. The default is 0.864.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The default value is 0. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The default value is the upper range limit of the transmitter. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Low DP Cutoff is the differential pressure where flow accumulation will stop and needs to be less than the UOL. The default value is 0. Valid values depend on the transmitter; refer to the transmitter band or user manual.

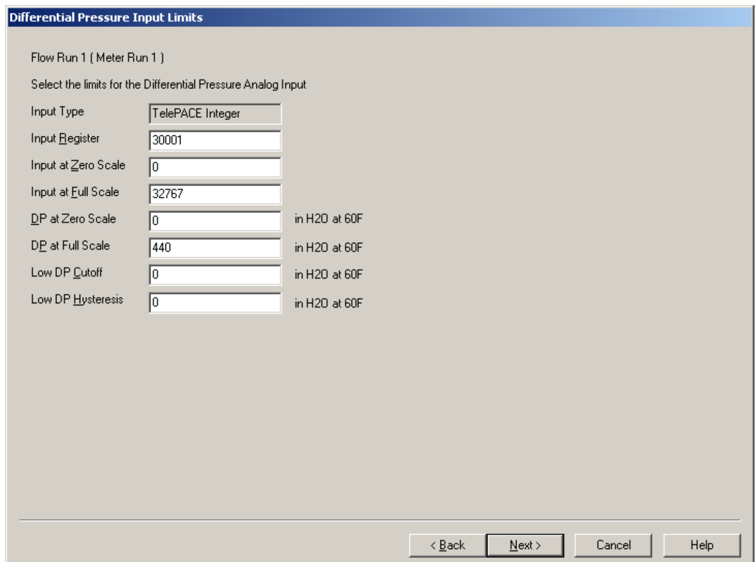
Low DP Hysteresis is the amount by which the differential pressure needs to rise above the Low DP Cutoff for flow accumulation to start. It may be a value using the DP units or may be a percentage of the operating span. The operating span is the difference between the Upper Operating Limit and the Lower Operating limit. Values depend on the transmitter. The flow accumulation level needs to be less than the Upper Operating Limit. The default value is 0.

Default Value is enabled if you configured the field using the Flow Run Inputs dialog. Type the live input value to use when communicating with a sensor. The default value is 0.

If you configured sensor inputs, go to the ***Static Pressure Options Dialog*** section.

Analog Inputs

The dialog below opens when analog inputs are selected.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The default value is 0. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The default value is 32767. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

DP at Zero Scale is the pressure that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The default value is 0.

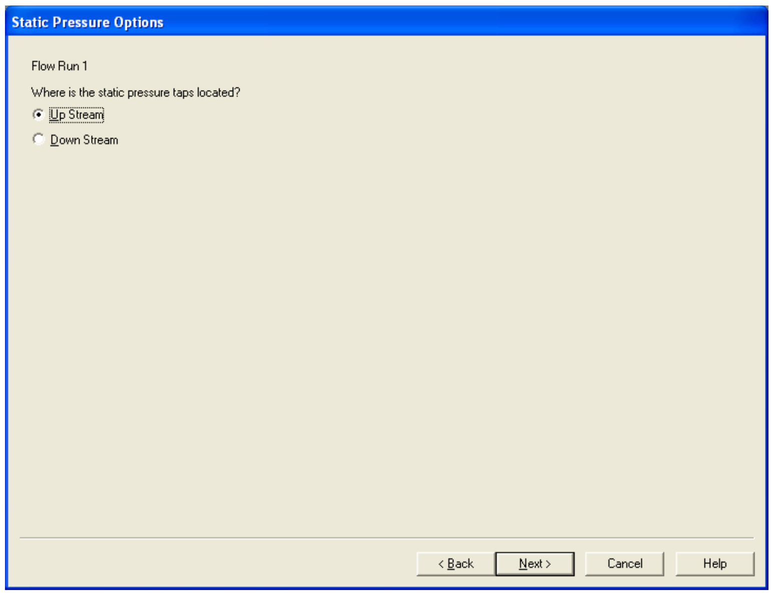
DP at Full Scale is the pressure that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The default value is 16.

Low DP Cutoff is the differential pressure where flow accumulation will stop and needs to be less than the UOL. The default value is 0. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Low DP Hysteresis is the amount by which the differential pressure needs to rise above the Low DP Cutoff for flow accumulation to start. It may be a value using the DP units or may be a percentage of the operating span. The operating span is the difference between the Upper Operating Limit and the Lower Operating limit. Values depend on the transmitter. The flow accumulation level needs to be less than the Upper Operating Limit. The default value is 0.

Static Pressure Options Dialog

This step lets you select how the static pressure is measured.



The pressure tap may be upstream or downstream of the orifice plate for AGA-3.

- Select **Up Stream** for an upstream static pressure tap. This is the default value. The control is disabled for AGA-7 and V-Cone calculations.
- Select **Down Stream** for a downstream static pressure tap. The control is disabled for AGA-7 and V-Cone calculations.

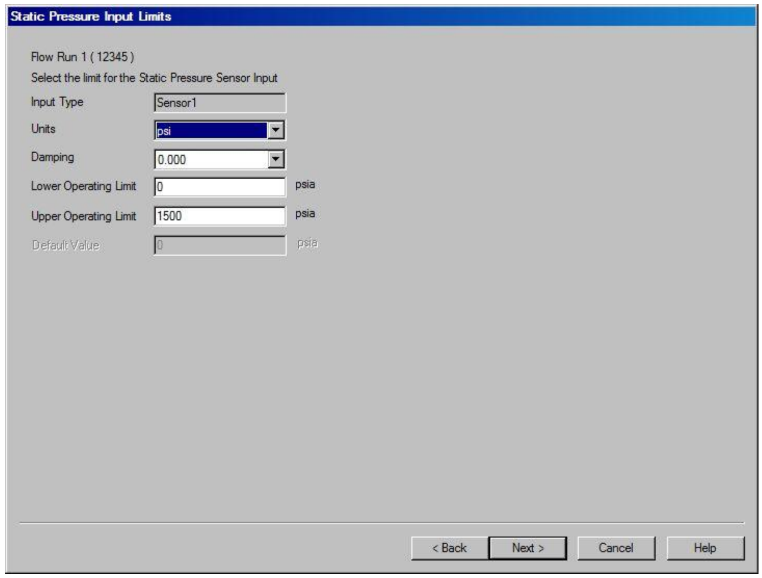
Static Pressure Input Limits

This step defines the limits for the temperature input. One of two configuration dialogs is presented based on the Input Type configured for static pressure limits:

- Sensor Inputs
- Analog Inputs

Sensor Inputs

The dialog below is presented when sensor inputs are used.



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

Units is the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display it uses these units. Valid values are kiloPascal, MegaPascal, and psi (pounds per square inch). The default is psi.

Damping is the response time of the transmitter. It is used to smooth the process variable reading when there are rapid input variations.

- For SCADAPack transmitters the valid values are 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 seconds. The default value is 0 (damping off).
- For the 3095 MVT the valid values are 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824 and 27.648. The default is 0.864.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The default value is 0. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The default value is the upper range limit of the transmitter. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Default Value is enabled if you gage pressure using the Static Pressure Options. Type the live input value to use when communicating with a sensor. The template selected determines the default value displayed.

The pressure sensor may measure absolute or gage pressure.

- Select **Absolute Pressure** to measure absolute static pressure. This is the default value unless the Compressibility Calculation type is set to NX-19. The Static Pressure is set to Gage and the Atmospheric pressure is 14.7psi when NX-19 is selected.
- Select **Gage Pressure** to measure gage static pressure.

- Type the **Atmospheric Pressure** measured at the site. This control is disabled and set to zero if absolute pressure is selected.

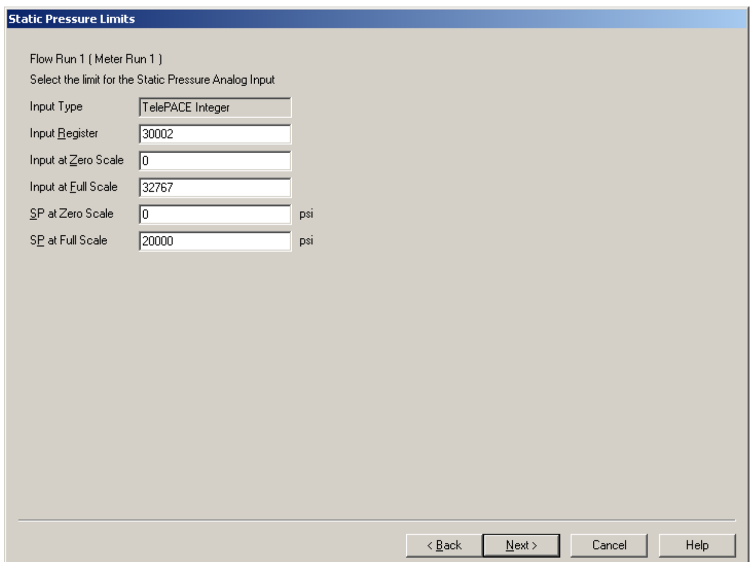
The atmospheric pressure entered needs to be greater than zero. The maximum upper limits for atmospheric pressure are:

30	psi	for US1, US2, US3, US4, US5, US6, US7, US8, and PEMEX units
4320	lbf/ft2	for IP units
207	kPa	for Metric1 units
2.07	bar	for Metric2 units
0.207	MPa	for Metric3 units
207000	Pa	for SI units

If you configured sensor inputs, see the ***Static Pressure Compensation*** section.

Analog Inputs

The dialog below is presented when analog inputs are used.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The default value is 0. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

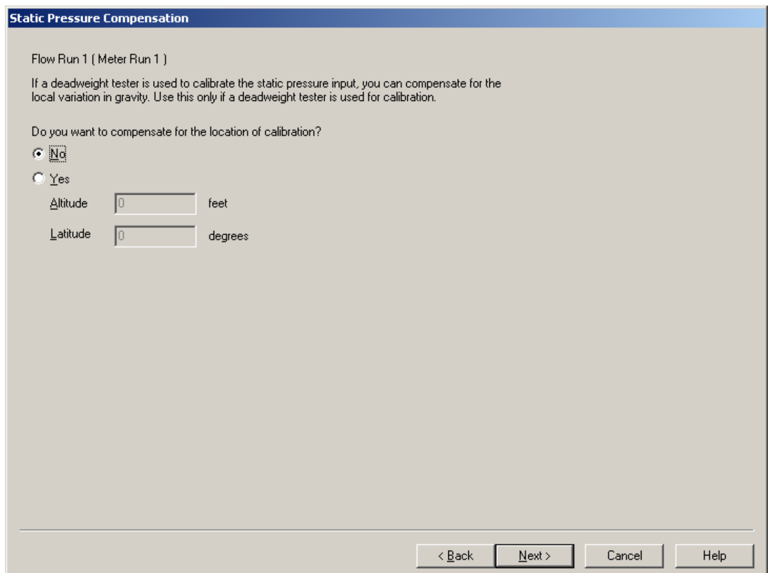
Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The default value is 32767. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

SP at Zero Scale is the pressure that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The default value is 0.

SP at Full Scale is the pressure that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The default value is 20000.

Static Pressure Compensation

This step selects if compensation is applied for the location where calibration was performed. If you configured sensors or analog inputs from the Static Pressure Limits dialog, this is the next step in the configuration sequence.



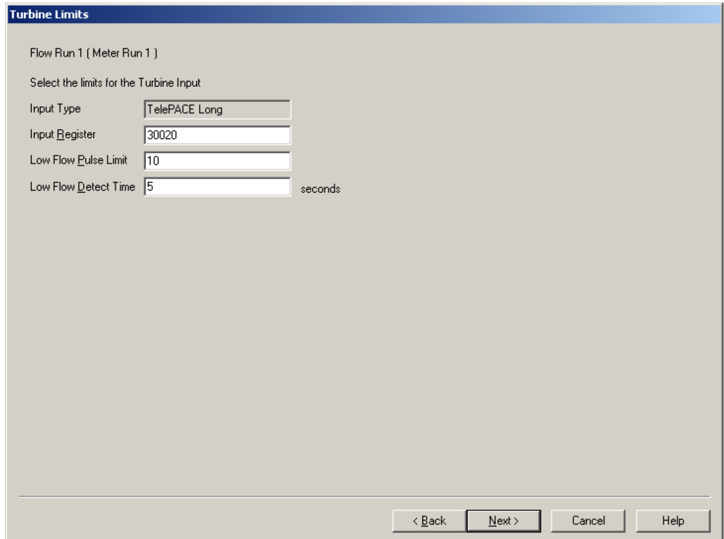
Select **No** if compensation is not required. This is the default value.

Select **Yes** to compensate for the altitude and latitude.

- Type the **Altitude** of the location. Valid values are -30000 to 30000. The default value is 0. This control is disabled if No is selected.
- Type the **Latitude** of the location. Valid values are -90 to 90. The default value is 0. This control is disabled if No is selected.

Turbine Settings

This step configures the turbine input for AGA-7 calculations.



Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Low Flow Pulse Limit is the number of pulses below which a low flow alarm will occur. The default value is 10.

Low Flow Detect Time is the length of time the number of pulses needs to remain below the Low Flow Pulse Limit for a low flow alarm to occur. Valid values are 1 to 5 seconds. The default value is 5.

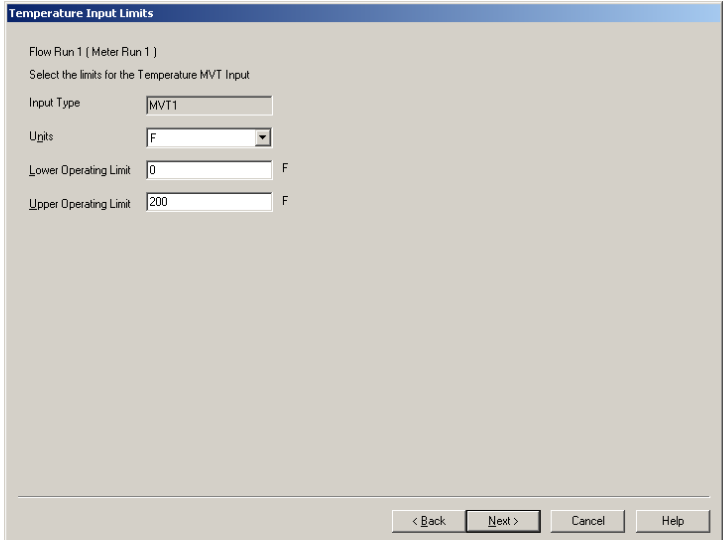
Temperature Limits

This step lets you define the limits for the temperature input. One of two configuration dialogs is presented based on the Input Type configured for static pressure limits:

- Sensor Inputs
- Analog Inputs

Sensor Inputs

The following dialog is presented when sensor (MVT) inputs are used.



Input Type is a read-only field that identifies the sensor number for which you are setting the parameters using this dialog.

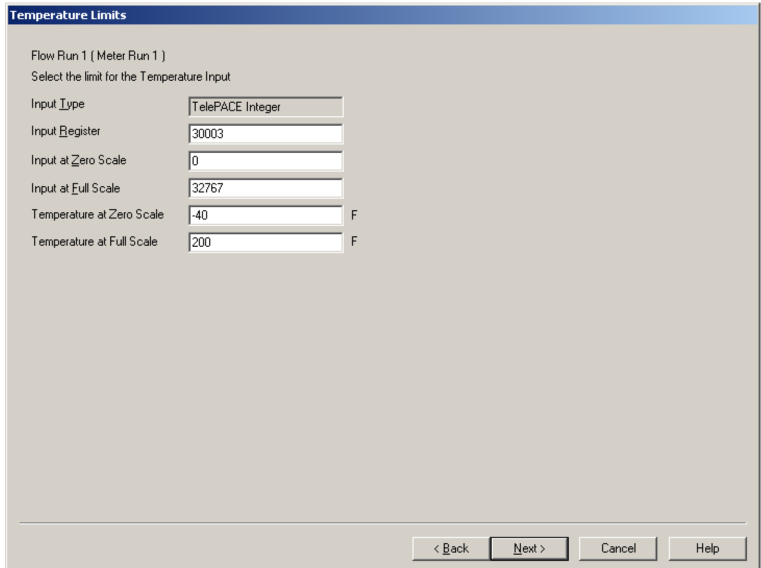
Units is the differential pressure units. Values read from the transmitter are in these units. If the transmitter has a local display it uses these units. Valid values are kiloPascal, MegaPascal, and psi (pounds per square inch). The default is psi.

Lower Operating Limit (LOL) is the lowest valid value from the sensor and needs to be less than the UOL. Alarms occur if the value is less than the LOL. The default value is 0. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Upper Operating Limit (UOL) is the highest valid value from the sensor and needs to be greater than the LOL. Alarms occur if the value is greater than the UOL. The default value is the upper range limit of the transmitter. Valid values depend on the transmitter; refer to the transmitter band or user manual.

Analog Inputs

The following dialog is presented when analog inputs are used.



Input Type is a read-only field that identifies the input type for which you are setting the parameters using this dialog.

Input Register is the register address where the input value is stored. Valid values are 30001 to 39999 or 40001 to 49999. The default is selected based on the run number so that inputs have unique registers.

Input at Zero Scale is value read from the sensor, in unscaled I/O units, when the sensor is at zero scale. Valid values depend on the input type. The default value is 0. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

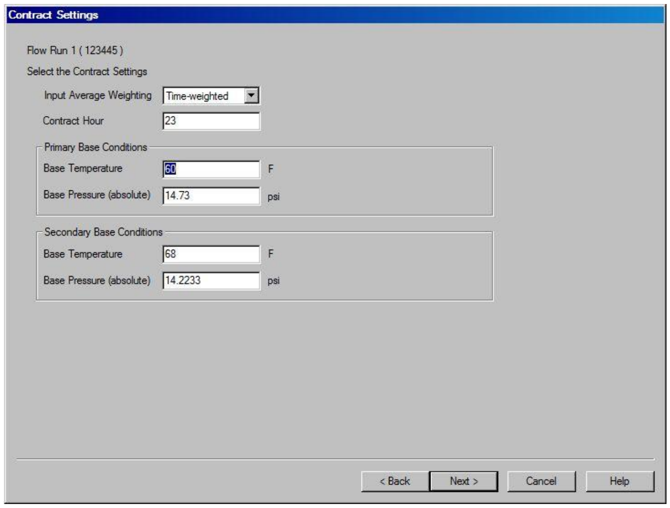
Input at Full Scale is value read from the sensor, in unscaled I/O units, when the sensor is at full scale. Valid values depend on the input type. The default value is 32767. This is enabled for Telepace integer, raw float and ISaGRAF integer types and disabled otherwise.

Temperature at Zero Scale is the temperature that corresponds to the zero scale input, or if the input does not require scaling, the minimum pressure that can be read from the sensor. Valid values depend on the input type. The default value is –40.

Temperature at Full Scale is the temperature that corresponds to the full-scale input, or if the input does not require scaling, the maximum pressure that can be read from the sensor. Valid values depend on the input type. The default value is 200.

Contract Settings

This step sets the contract settings for the run.



Input Average Weighting is the weighting method of the linear inputs. This applies to the differential pressure, static pressure, and temperature. Valid values are time-weighted or flow-weighted (see Input Averaging on page 948 for more information). The default is time-weighted.

Contract Hour is the hour of the day that starts a new contract day specified using a 24-hour clock. The contract day begins at 00 minutes and 00 seconds of the specified hour. Valid values are 0 to 23. The default value is 0 (midnight).

Standard Base Conditions are the default **Base Temperature** and **Base Pressure (absolute)** values.

- **Base Temperature** is the reference temperature to which contract flow values are corrected. Valid values are -40 to 200. The default value is given in the table below.
- **Base Pressure** is the reference pressure to which contract flow values are corrected. The base pressure is measured as absolute pressure (not a gauge pressure). Valid values are 0 to 32000. The default value is given in the table below.

Contract Units	Standard Base Temperature	Standard Base Pressure
US1	60 F	14.73 psi
US2	60 F	14.73 psi
US3	60 F	14.73 psi
IP	60 F	2116.2281 lbf/ft^2
Metric1	15 C	101.325 kPa
Metric2	15 C	1.01325 bar
Metric3	15 C	0.101325 MPa
SI	288.15 K	101325 Pa
US4	60 F	14.73 psi
US5	60 F	14.73 psi
US6	60 F	14.73 psi
US7	60 F	14.73 psi
US8	60 F	14.73 psi

Contract Units	Standard Base Temperature	Standard Base Pressure
PEMEX	60 F	14.73 psi

Realflo for PEMEX flow computers provide a second set of base conditions. **PEMEX Base Conditions** are the default **Base Temperature** and **Base Pressure (absolute)** values when Realflo is operating in PEMEX mode.

- **Base Temperature** is the reference temperature to which contract flow values are corrected. The default is listed in the table below for each type of contract unit.
- **Base Pressure** is the reference pressure to which contract flow values are corrected. The base pressure is measured as absolute pressure (not a gauge pressure). Valid values are 0 to 32000. The default values are listed in the table below for each contract unit.

Contract Units	Standard Base Temperature	Standard Base Pressure
US1	60 F	14.73 psi
US2	60 F	14.73 psi
US3	60 F	14.73 psi
IP	60 F	2116.2281 lbf/ft^2
Metric1	15 C	101.325 kPa
Metric2	15 C	1.01325 bar
Metric3	15 C	0.101325 MPa
SI	288.15 K	101325 Pa
US4	60 F	14.73 psi
US5	60 F	14.73 psi
US6	60 F	14.73 psi
US7	60 F	14.73 psi
US8	60 F	14.73 psi
PEMEX	68 F	14.73 psi

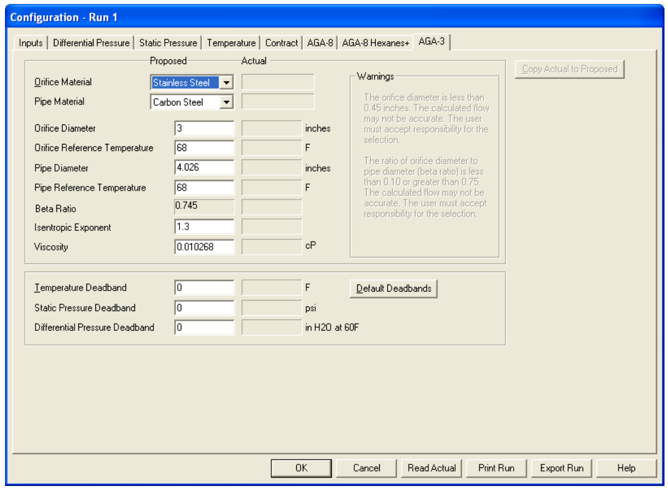
Flow Calculations

When configuring a flow computer, you can configure it to use the following calculations:

- AGA-Settings
- AGA-3 Deadband Settings
- AGA-7 Settings
- AGA-11 Settings

AGA-3 Settings

This step lets you set the AGA-3 calculation parameters.



Orifice Material is the material the orifice plate for the meter run is made of. Valid values are Stainless Steel, Monel, and Carbon Steel. The default value is Stainless Steel.

Pipe Material is the material the meter run pipe is made of. Valid values are Stainless Steel, Monel, and Carbon Steel. The default value is Carbon Steel.

Orifice Diameter is the diameter of the meter run orifice. The default value is 3 inches.

Orifice reference temperature is the temperature at which the diameter of the meter run orifice was measured. The default value is 68°F.

Pipe Diameter is the measurement of the meter run pipe inside diameter. The default value is 4.026 inches.

Pipe reference temperature is temperature at which the meter run pipe diameter was measured. The default value is 68°F.

Beta Ratio is the ratio of orifice diameter to pipe diameter. It is displayed for information purposes only and cannot be edited.

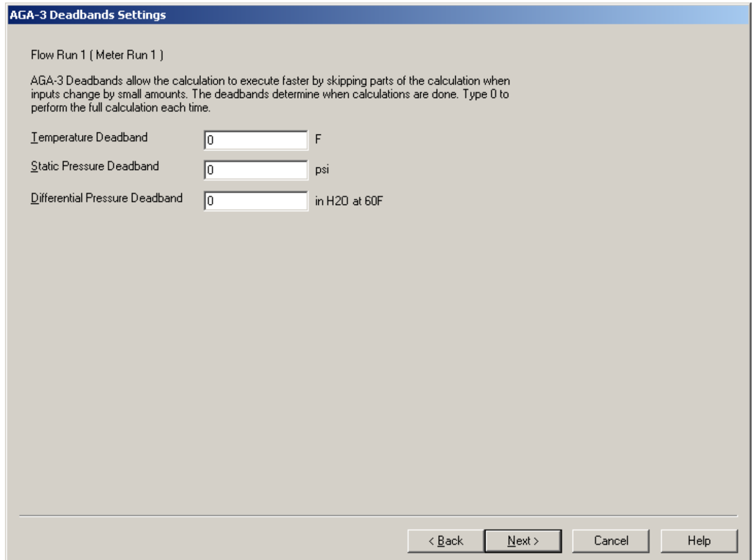
Realflo displays messages if the beta ratio is outside recommended limits.

Isentropic Exponent is a thermodynamic property of gas used to predict the relationships between pressure, temperature, volume and energy. If you are unsure of this value, a typical value of 1.3 is commonly used. The default value is 1.3.

Viscosity is a measure of the resistance of a measured gas to flow. Valid values are 0 to 1. The default value is 0.010268 centipoise.

AGA-3 Deadband Settings

This step lets you set AGA-3 calculation deadbands.



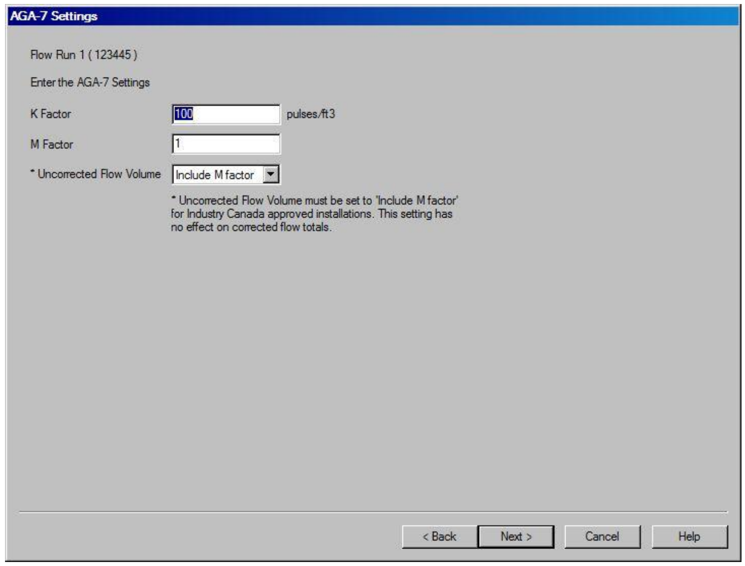
Temperature Deadband is the tolerated change in the flowing temperature before temperature dependent factors in the flow calculation are recalculated. Changes in the temperature smaller than the deadband will be ignored in determining the result. The default value is 0. The upper limit is 7°F or 4°C.

Static Pressure Deadband is the tolerated change in the static pressure before static pressure dependent factors in the flow calculation are recalculated. Changes in the static pressure smaller than the deadband will be ignored in determining the result. A static pressure deadband setting of up to four percent of the typical static pressure level should have a small effect on the accuracy of the AGA-3 calculation. The default value is 0. The upper limit is 800 psi or 5500 kPa or the equivalent in other units.

Differential Pressure Deadband is the tolerated change in the differential pressure before differential pressure dependent factors in the flow calculation are recalculated. Changes in the differential pressure smaller than the deadband will be ignored in determining the result. A change of N in the differential pressure input will cause a change of 0.5 N in the calculation volume at base conditions. It is recommended that the differential pressure deadband be set to zero. The default value is 0. The upper limit is 4.5 inWC or 1.1 kPa or the equivalent in other units.

AGA-7 Settings

This step lets you define AGA-7 settings.



K Factor is the number of pulses per unit volume of the turbine meter. Valid values are 0.001 to 1000000. The default value is 100.

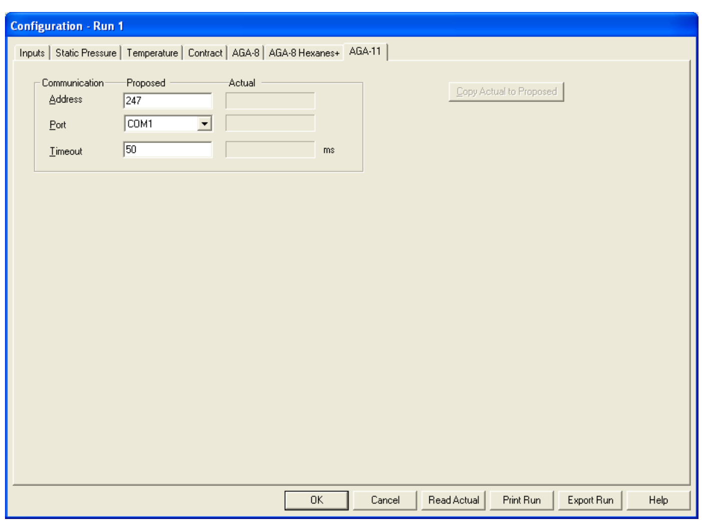
M Factor is the adjustment to the number of pulses per unit volume for the turbine meter compared to an ideal meter. Valid values are 0.001 to 1000. The default value is 1.

Uncorrected Flow Volume is the accumulated uncorrected flow volume at base conditions.

The Uncorrected Flow Volume control is available in Realflo versions 6.20 and higher.

AGA -11 Settings

AGA-11 configuration defines parameters unique to the AGA-11 calculation. The AGA-11 calculation communicates with a Coriolis meter for the calculation. The AGA-11 configuration sets the communication parameters for communication between the Coriolis meter and the flow computer.



Address

This is the Modbus address of the Coriolis Meter for serial communications. Multiple Coriolis meters using the same serial port on the flow computer needs to each have a unique Modbus address. Valid Modbus addresses are between 1 and 247. The default address is 247.

Port

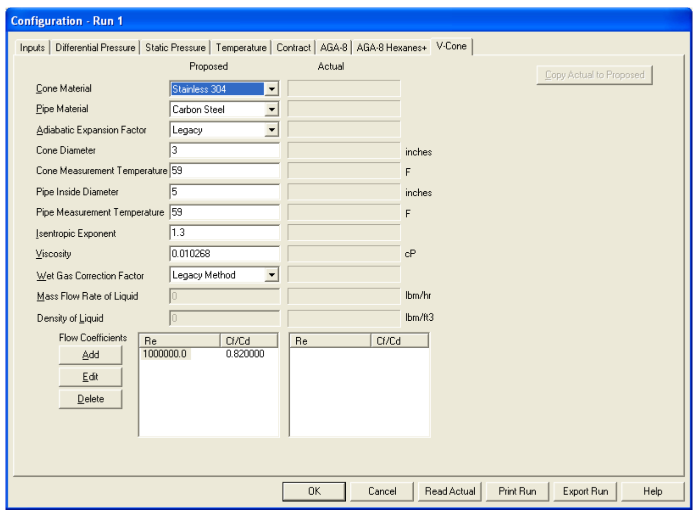
This is the communication port on the flow computer that will be used to communicate with the Coriolis meter. Valid port selections depend on the type of controller the flow computer running on. The default port is the first valid port available on the controller.

Timeout

This is the time the flow computer will wait for a response for Modbus read commands send to the Coriolis meter. When the timeout time is exceeded the command fails and an alarm is added to the flow computer alarm list. Valid timeout values are from 0 to 1000 ms. The default value is 50 ms.

V-Cone Settings

V-Cone Configuration defines parameters unique to the V-Cone calculation.



Cone Material

This is the material of the V-cone. Valid values are Carbon Steel, Stainless 304, and Stainless 316. The default value is determined by the template selected.

Pipe Material

This is the material from which the meter run pipe is made. Valid values are Carbon Steel, Stainless 304, and Stainless 316. The default value is determined by the template selected.

Adiabatic Expansion Factor

The **Adiabatic Expansion Factor** drop down list selects which calculation is used for the adiabatic expansion factor of the calculation.

- Select **Legacy Calculation** to use the older calculation method. This is the default selection. Flow computers prior to version 6.71 support only this selection.
- Select **V-Cone** to use the V-Cone specific calculation. This selection should be used with V-Cone devices.

- Select **Wafer-Cone** to use the Wafer-Cone specific calculation. This selection should be used with Wafer-Cone devices.

This control is disabled and forced to **Legacy Calculation** if the controller type is not one of SCADAPack 32, SCADAPack 32P, SCADAPack 314/330/334, SCADAPack 350 SCADAPack 4203 or SolarPack 410.

When **reading** from a flow computer that does not support the adiabatic expansion factor configuration, the method will be set to Legacy Calculation.

When **writing** to a flow computer that does not support the adiabatic expansion factor method, the configuration registers will be ignored and the expansion factor will not be written.

Cone Diameter

The diameter of the meter run cone used for the flow calculation. The measurement units are displayed depending on the input units selected. The default value is 3 inches.

Cone Measurement Temperature

This is the reference temperature at which the cone diameter for the meter run was measured. The measurement units are displayed depending on the input units selected. The default value is 59 degrees F.

Pipe Inside Diameter

This is the measurement of the meter run pipe inside diameter. The measurement units are displayed depending on the input units selected. The default value is 5 inches.

Pipe reference temperature

The temperature at which the meter run pipe diameter was measured. The measurement units are displayed depending on the input units selected. The default value is 59 degrees.

Isentropic Exponent

In general, this is a thermodynamic property of gas used to predict the relationships between pressure, temperature, volume and energy. If you are unsure of this value a typical value of 1.3 is commonly used. The default value is 1.3.

Viscosity

This is the viscosity of the measured gas. In general, this is the resistance of a gas or semi-fluid resistance to flow. The measurement units are displayed depending on the input units selected. Valid values are 0 to 1. The default value is 0.010268 centiPoise.

Wet Gas Correction Factor

The Wet Gas Correction Factor Method drop down list selects which calculation is used for the wet gas correction factor of the calculation.

- Select **Legacy Method** to use the older correction method. This is the default selection. Flow computers prior to version 6.73 support only this selection.
- Select **V-Cone or Wafer Cone** to use the V-Cone and Wafer Cone specific calculation. This selection should be used with V-Cone or Wafer Cone devices.

This control is disabled and forced to **Legacy Calculation** if the controller type is not one of SCADAPack 32, SCADAPack 32P, SCADAPack 314/330/334, SCADAPack 350 SCADAPack 4203 or SolarPack 410.

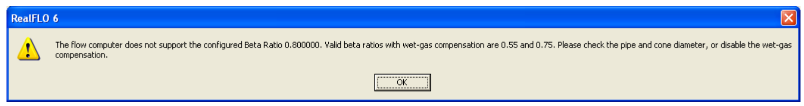
The V-Cone or Wafer Cone supported **Beta Ratios** are:

For Fr (Froude Number) < 5 supported Beta Ratio is 0.55.

For Fr (Froude Number) < 5 supported Beta Ratio is 0.75.

For Fr (Froude Number) > 5 supported Beta Ratio is 0.75.

When **V-Cone or Wafer Cone** is selected and if the current Beta ratio is not supported when executing verification, a message is displayed.



When **V-Cone or Wafer Cone** is selected, configuration of the fixed wet gas factor parameter, as set in the Contract tab, is disabled.

When **Legacy Method** is selected, configuration of the parameters used by the V-Cone or Wafer Cone method is disabled.

Mass Flow Rate of Liquid

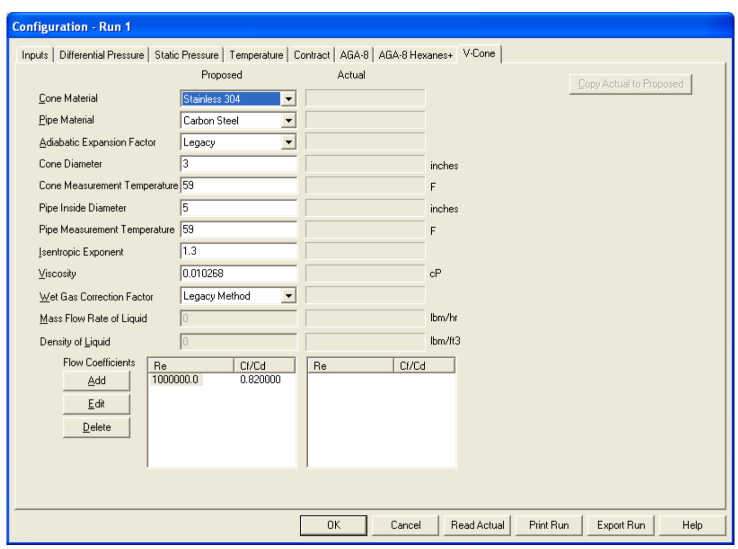
The Mass flow rate of liquid at flow conditions parameter is used by the V-Cone or Wafer Cone method and can be configured when **V-Cone or Wafer Cone** is selected. This information needs to be gathered using a sampling method or a tracer method. The default is 0.

Density of Liquid

The Density of liquid at flow conditions parameter is used by the V-Cone or Wafer Cone method and can be configured when **V-Cone or Wafer Cone** is selected. The default is 0.

V-Cone Coefficients

This step lets you define the V-Cone coefficients.

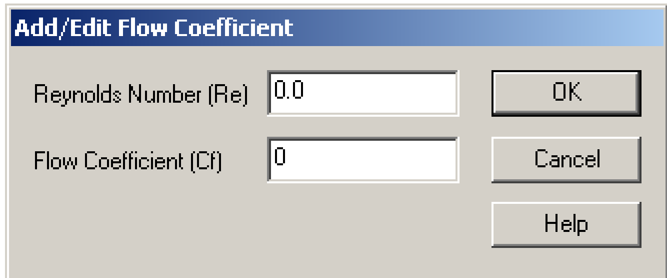


Enter the V-Cone coefficient pairs from the meter sizing report. The default list contains one pair: Re = 1000000; Cf = 0.82.

Click **Add** to add a coefficient pair.

In the original McCrometer V-Cone Application Sizing sheet that is included with V-Cone meters uses the terminology Cd (discharge coefficient) rather than Cf (flow coefficient). You will need to use the Re and Cd values from the V-Cone Application Sizing sheet for the Re and Cf entries. If the Re value is the same for all entries in the table only the first pair is used.

McCrometer now supplies one value of Cd in the sizing document. You need to enter one Re/Cd pair only. See the McCrometer Application Sizing sheet for the Re/Cd pair for your meter.



To edit a coefficient pair in the table:

- Select a row in the list.
- Click **Edit** to open the Add/Edit Flow Coefficient dialog.

To delete a coefficient pair in the table:

- Select a row in the list.
- Click **Delete** to delete the pair form the list.

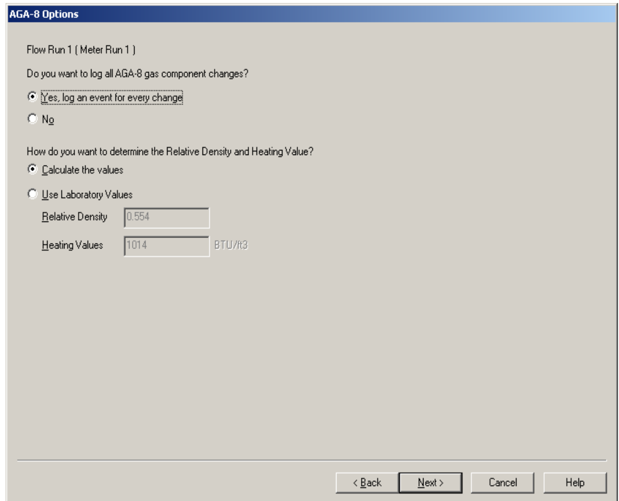
Compressibility Calculations

When configuring a flow computer, you can configure it to use the following compressibility calculations:

- ***AGA-8 Settings***
- ***AGA-8 Hexanes+ Settings***
- ***AGA-8 Gas Composition***
- ***NX-19 Settings***

AGA-8 Settings

This step sets AGA-8 calculation options.



Events can be logged each time an AGA-8 gas component changes.

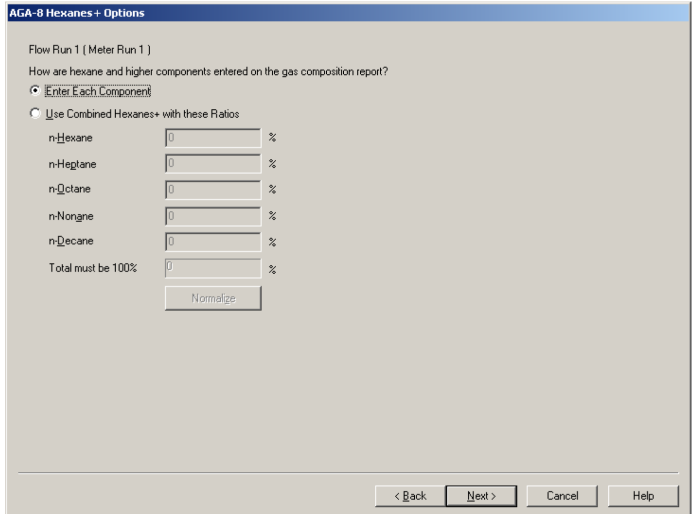
- Select **Yes** to log each change to the gas composition. Use this option if the gas composition changes infrequently. This is the default selection.
- Select **No** to skip logging changes. Use this option if you are making frequent changes to the gas composition.

The Relative Density and Heating values can be calculated from the AGA-8 calculation or determined in a laboratory.

- Select **Calculate the Values** to have AGA-8 calculate the values.
- Select **Use Laboratory Values** to used fixed values.
- **Relative Density** sets the real relative density of the gas. Valid values are 0.07 to 1.52. The default value is 0.554. This control is disabled if **Calculate the Values** is selected.
- **Heating Value** sets the heating value of the gas. Valid values are 0 to 1800 BTU(60)/ ft^3 or the equivalent in the selected units. The default value is 1014 BTU(60)/ft^3 or the equivalent in the selected units. This control is disabled if **Calculate the Values** is selected.

AGA-8 Hexanes+ Settings

This step chooses if Hexane and higher components are entered individually or as a single combined value.



Gas composition can be measured with individual values for hexane and higher components or use a combined value.

Select **Enter Each Component** to use individual values for the higher components. This is the default selection.

Select **Use Combined Hexanes+ with these Ratios** to use a combined value. Type the ratios of the higher components.

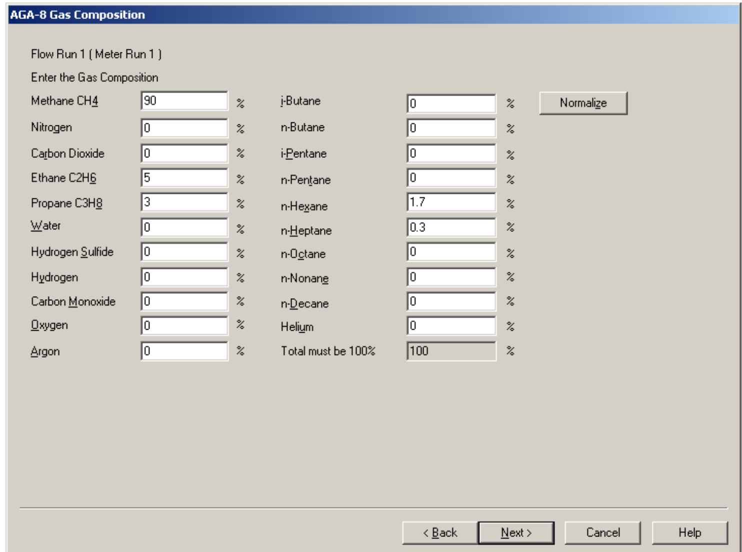
- **n-Hexane** defines the percentage of the Hexanes+ contributed by n-Hexane.
- **n-Heptane** defines the percentage of the Hexanes+ contributed by n-Heptane.
- **n-Octane** defines the percentage of the Hexanes+ contributed by n-Octane.
- **n-Nonane** defines the percentage of the Hexanes+ contributed by n-Nonane.
- **n-Decane** defines the percentage of the Hexanes+ contributed by n-Decane.
- The **Total** field displays the sum of portions. This value cannot be edited. The total of portions needs to be 100 percent.

AGA-8 Gas Composition

This step defines the AGA-8 gas composition. One of two configuration dialogs opens based on whether Hexane and higher components are entered individually or as a single combined value.

Individual Components

The dialog below lets you enter combined Hexanes+ composition.

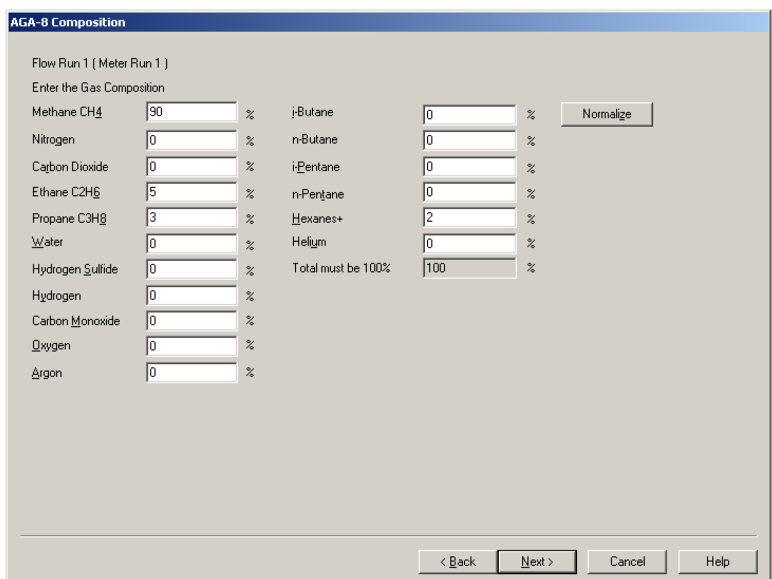


Type the gas composition according to the laboratory analysis. The total of components needs to be 100 percent.

Normalize adjusts non-zero components so that the total of components is 1.0000 (or 100.00 percent). The ratio to each other for the components remains the same.

Combined Hexanes+

The dialog below lets you enter combined Hexanes+ composition.

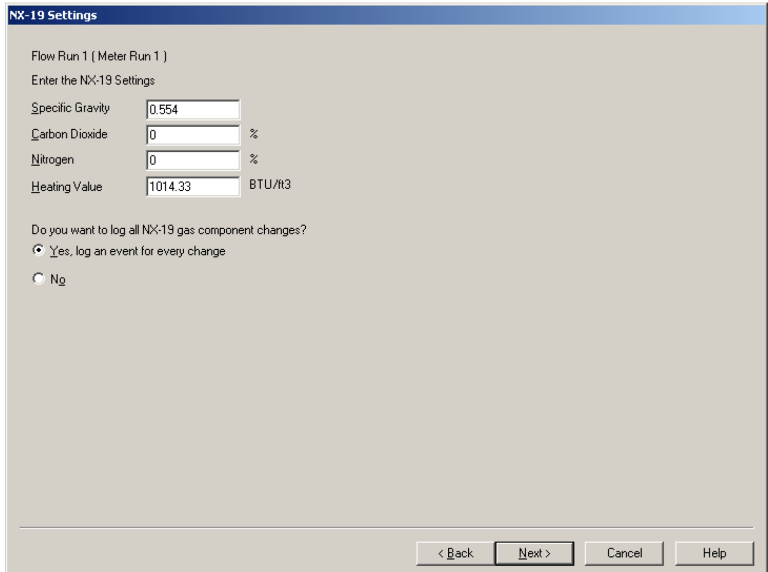


Type the gas composition according to the laboratory analysis. The total of components needs to be 100 percent.

Normalize adjusts non-zero components so that the total of components is 1.0000 (or 100.00 percent). The components remain in their current ratio to each other.

NX-19 Settings

This step lets you define the NX-19 calculation. This is not supported for PEMEX flow computers.



Specific Gravity is the specific gravity of the gas being measured. Valid values are 0.554 to 1.000. The default value is 0.554.

Carbon Dioxide is the percent of carbon dioxide in the gas being measured. This value needs to be in the range 0 to 15. The default value is 0.

Nitrogen is the percent of nitrogen in the gas being measured. This value needs to be in the range 0 to 15.

Heating Value is the heating value of the gas being measured. Valid values are 0 to 1800 BTU(60)/ft^3 or the equivalent in the selected units. The default value is 1014.33 BTU(60)/ft3.

Events can be logged each time the NX-19 configuration changes.

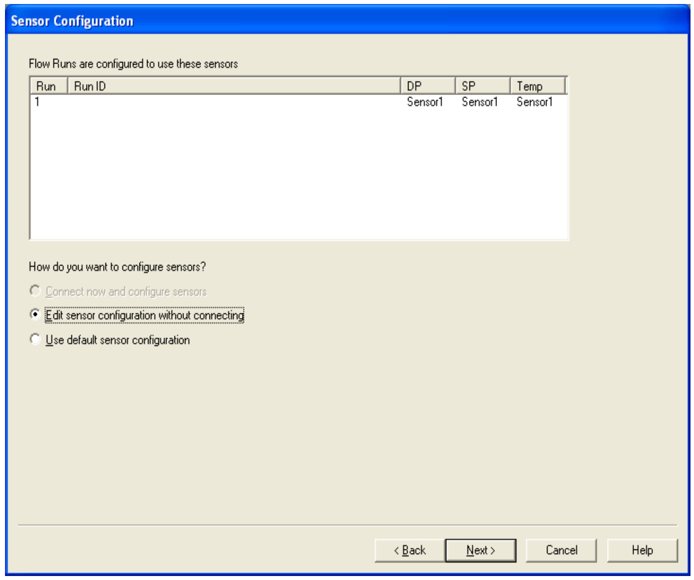
- Select **Yes** to log each change to the configuration. Use this option if the configuration changes infrequently. This is the default selection.
- Select **No** to skip logging changes. Use this option if you are making frequent changes to the configuration.

Sensor Configuration Parameters

The next step is MVT Configuration if any transmitters were used in the input configuration. Otherwise the next step is ***Flow Computer Configuration Summary***.

Sensor Configuration

This step selects how the transmitters are to be configured.



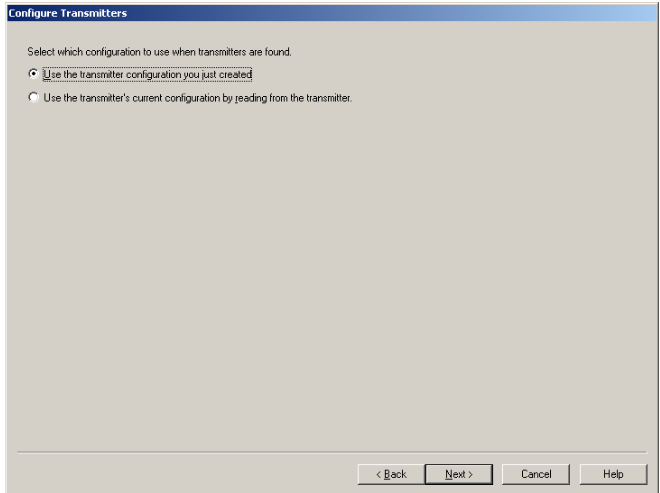
The **Flow Runs are configured to use these transmitters** window is a table that shows each of the configured flow run numbers, its Flow Run ID and the transmitter that it uses for the differential pressure (DP), static pressure (SP) and temperature sensors. If an analog input is used for the flow run AIN will be displayed in the coresponding DP, SP, or Temp column.

The **How do you want to configure sensors?** option lets you select how to continue configuring the sensors. The three options are:

- **Connect now and configure transmitters** to connect to the flow computer and configure the attached transmitters. This selection is disabled if the flow computer configuration was selected to be completed offline in the Flow Computer Status step. If you choose this option, go to the ***Configure Connected Transmitters*** section to continue.
- **Edit sensor configuration without connecting** to proceed directly to the editing pages, without connecting to the flow computer. If you choose this option, go to the ***Review Sensors Dialog*** section to continue.
- **Use default sensor configuration** to complete the configuration without changing the sensor configuration. Sensor configuration will be set to default values. If you choose this option, the next step is ***Finish***.

Configure Connected Transmitters

This step lets you select to either use the Realflo configuration data or the configuration from a pre-configured transmitter.

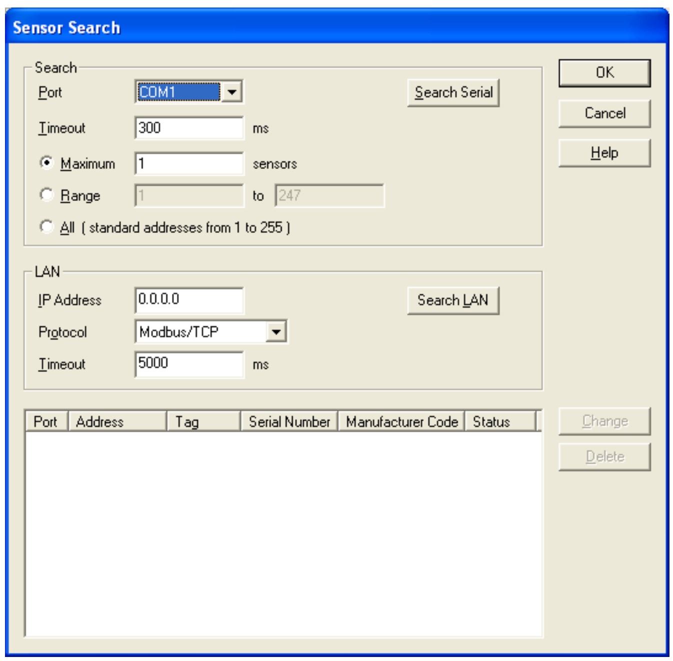


Select **Use the configuration from Realflo** to use the configuration data from the Realflo file. This is the default setting.

Select **Read the configuration from the transmitter** to read configuration from a pre-configured transmitter.

Sensor Search

This step searches for sensors connected to the flow computer serial ports or LAN port.



Search Serial Option

Select **Search Serial** to search for transmitters connected to a serial port of the flow computer.

The **Port** parameter selects the flow computer serial port where the sensor is attached. Valid values are com1, com2, com3, and com4. The default value is com2 for a SCADAPack controller and com1 for other controllers.

The **Timeout** parameter specifies the length of time the flow computer will wait for a response from a sensor. Valid values are 100 ms to 10000 ms. The default is 300 ms.

Select **Maximum** to search for a number of MVT transmitters. The search operation will stop after finding the specified number of transmitters. The valid value is from 1 to 255. The default is 1.

Select **Range** to search the addresses in a specified range. The range to search for is typed in the edit boxes to the right of the radio button. The value in *To* edit control needs to be equal or great than the value in the first edit control. The maximum search range that can be typed is for 255 transmitters. The default range is 1 to 247.

- Range Search supports addresses 1 to 255 in standard Modbus mode, and 1 to 65534 in extended address mode. The address mode of the flow computer serial port needs to be set to extended to search for transmitters with extended addresses.

Select **All** to search the addresses of all transmitters connected with the serial port selected in *Port*. Up to 255 addresses are searched.

Click **Next** to start the search for sensors or 4000 transmitters. A search process dialog is displayed so that the search operation can be cancelled at any time.

Search LAN Option

Select **Search LAN** to search for transmitters connected to a LAN port of the flow computer.

The **IP Address** parameter specifies the IP address of a 4000 transmitter. Valid entries are IP addresses in the format nnn.nnn.nnn.nnn where nnn are values between 0 and 255.

The **Protocol** parameter selects the type of IP protocol that will be used to query the transmitter. Valid IP protocol selections are Modbus/TCP and Modbus RTU in UDP.

The IP port (for example port 502) for the selected protocol needs to be the same in the flow computer and the 4000 transmitter.

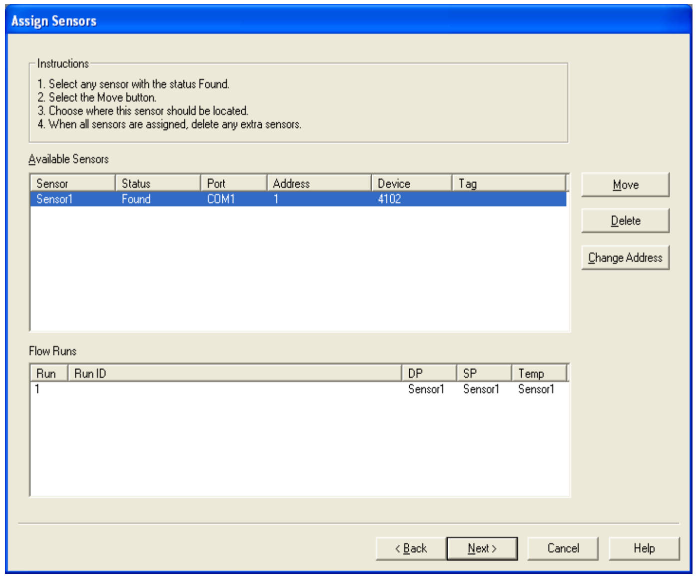
The **Timeout** parameter specifies the length of time the flow computer will wait for a response from a 4000 transmitter. Valid values are 100 to 10000 milliseconds. The default is 5000 ms.

Click **Next** to start the search for MVT transmitters or 4000 transmitters. A search process dialog is displayed so that the search operation can be cancelled at any time.

If no transmitters were found, a message is displayed and the search step is displayed again.

Assign Sensors

This step lets you assign found transmitters to flow runs.



The **Available Sensors** pane shows the transmitters that have been configured and the transmitters that were found by the search. There may be more transmitters in the list than there are runs.

The **Sensor** column indicates the transmitter slots that have been configured. Transmitters that were found but not assigned are listed as *Not assigned*.

The **Status** column indicates if configuration data for the transmitter exists.

- ***Found*** indicates a transmitter has been configured and the search found one with the same port, address and device type.
- ***Missing*** indicates a transmitter has been configured but the search did not find one with the same port, address, and device type.

The **Port** column displays the serial or LAN port the flow computer is using to communicate with the transmitter.

The **Address** column displays the Modbus station address or IP address of the transmitter.

The **Tag** column displays the Tag Name assigned to the transmitter. You can leave this column blank if a Tag Name has not been assigned to the transmitter.

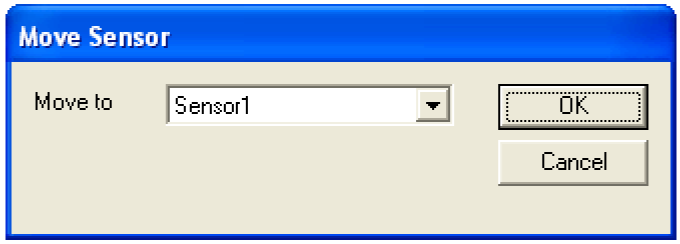
The **Device** type column displays the transmitter type. Valid values are 3095FB, 4101, 4102, 4202 DR, 4202 DS, 4203 DR, or 4203 DS.

The **Flow Runs** window shows which MVTs are assigned to the runs.

To Change the order of the sensors:

- Select a sensor in **Available Sensors** window.
- Click **Move.**

The Move Sensor dialog opens:



- In the Move Sensor dialog, use **Move To** selection to select the new location
- Click **OK**.

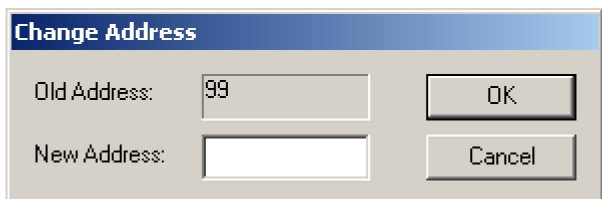
To delete a sensor:

- Select a transmitter in Available Sensors.
- Click Delete.

To change the address of a Sensor:

- Select a transmitter in Available Sensors.
- Click Change Address.

The Change Address dialog opens:



- Enter a new address for the transmitter in the **New Address:** edit box.
- Click **OK**.

Click **Next** when the transmitters are moved to the correct location.

Next is disabled if there are *Not Assigned* transmitters still in the list.

The next step is ***Search for More Transmitters Dialog***.

Notes

The following actions may occur when moving a sensor.

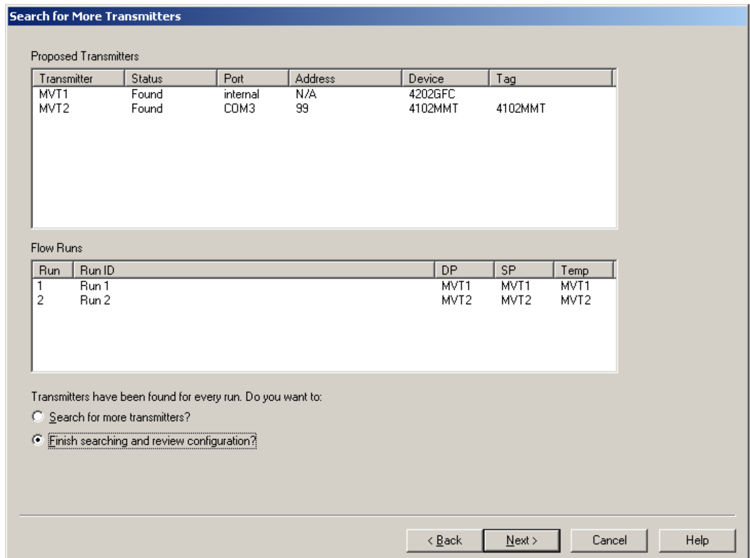
- Moving one sensor to another results in the both swapping positions.
- When Use the configuration from Realflo is selected, assigning a Not assigned transmitter to a Sensor with status Missing and device type matching result in the sensor adopting the transmitter's port and address and retaining the rest of the sensor configuration. The sensor, being assigned, will disappear from the list.
- When Read the configuration from the transmitter is selected, assigning a Not assigned transmitter to a sensor with status Missing and device type matching results in the sensor adopting the transmitter's configuration. The transmitter, being assigned, will disappear from the list.
- Assigning a Not assigned transmitter to a sensor with status Missing and device type not matching will result in the sensor adopting the

transmitter's configuration. The transmitter, being assigned, will disappear from the list.

- Other assignments are not permitted.

Search for More Transmitters Dialog

This step displays the current sensor assignments and asks if more searches are needed.



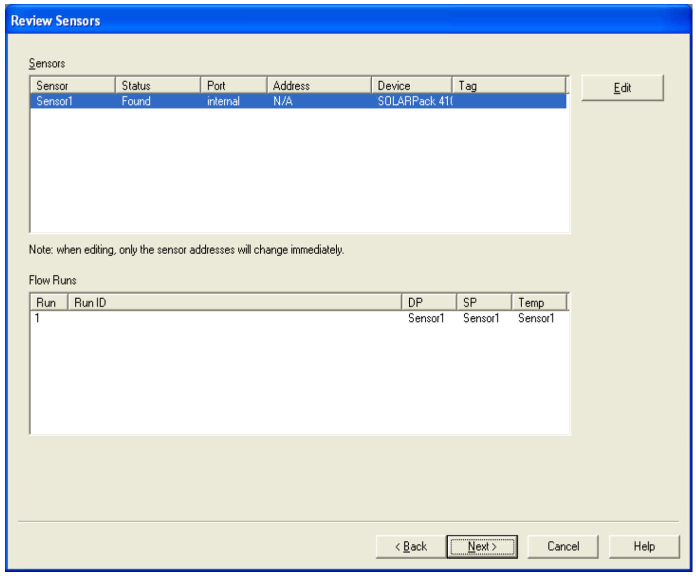
Proposed Sensors shows the transmitters that have been configured and the transmitters that were found by the search.

Flow Runs shows which sensors are assigned to which runs.

- Select Search for more transmitters to search again.
- Select Finish searching and review configuration to use the current settings. This is the default radio button.

Review Sensors Dialog

This step displays the transmitter assignments and allows you to edit the transmitter configuration.



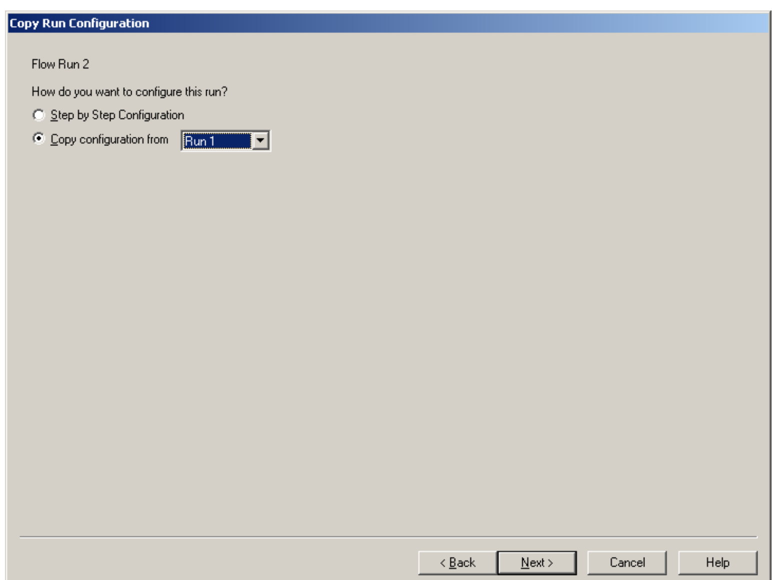
The **Sensors** pane shows the transmitters that have been configured.

The **Flow Runs** pane shows which sensors are assigned to the runs.

Click **Edit** to review and modify the settings for each transmitter. Edit opens the **Add/Edit Sensor Settings** dialog. Changes to a transmitter address will be written to the transmitter without affecting current flow computer configuration.

Copy Run Configuration Dialog

The Copy Run step is displayed only if you selected more than one run is selected in the Number of Flow Runs step and you have configured the first run.

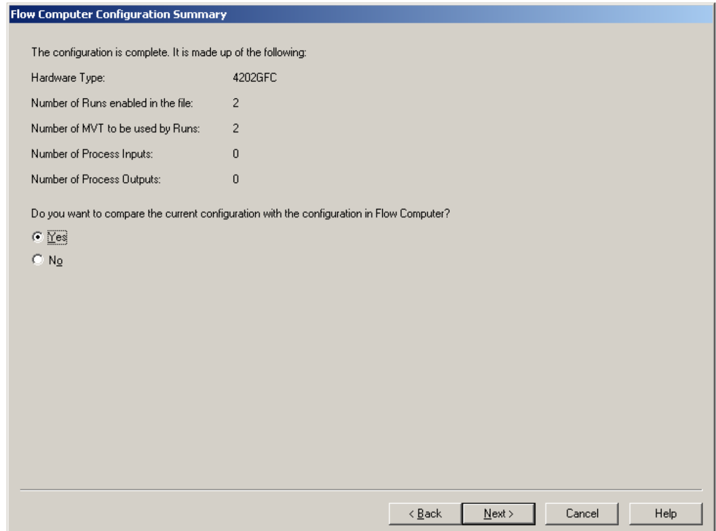


The second flow run, and subsequent runs, may be configured step-by-step or by copying the configuration of a previous run.

- Select Set by **Step configuration** to configure another run using the wizard without copying Run 1.

Flow Computer Configuration Summary

This step displays a summary of the flow computer settings.



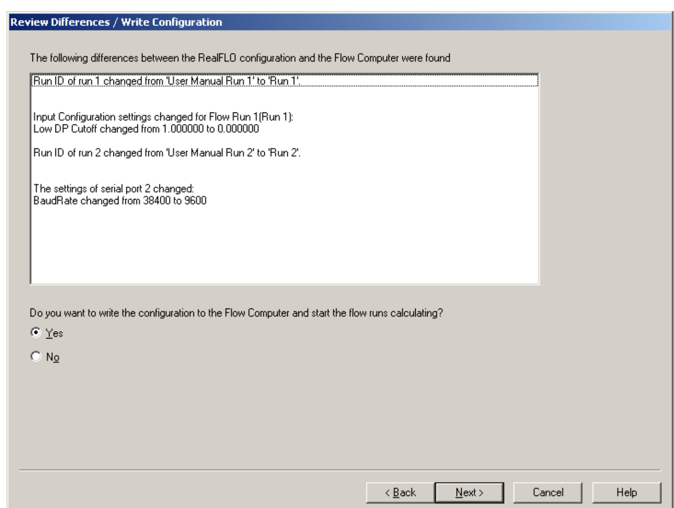
A summary of the flow computer configuration is shown.

The current configuration can be compared with the configuration in the target flow computer.

- Select **Yes** to compare the configurations.
- Select **No** to not compare the configurations.

Review Differences

This step displays a summary of changes in the flow computer configuration. You can select to write to the flow computer or not.



The summary shows the differences in the configuration.

Select **Yes** to write the configuration to the flow computer. The configuration is written to the flow computer. The Start Executing command will be written for each flow run. The communication progress dialog shows the stages of writing.

Select **No** to write the configuration to the flow computer later.

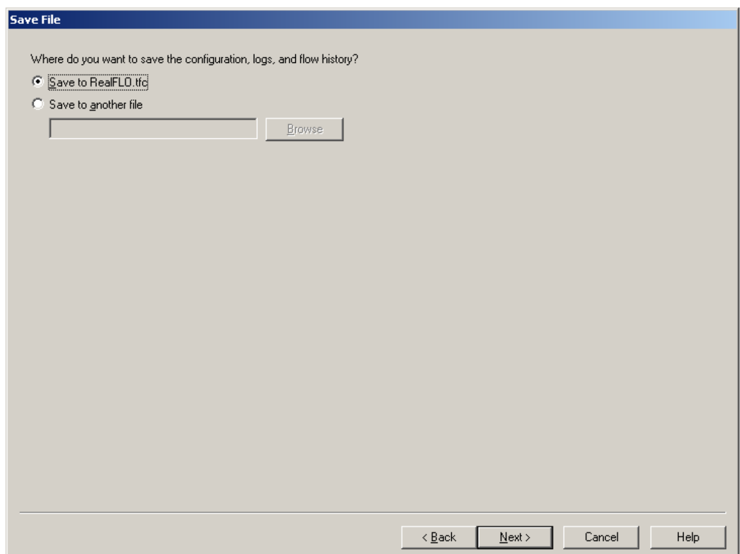
Click **Next** to perform the selected action.

In Flow Computer versions 6.73 and older, when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers. The Actual registers are not updated until a new Density calculation is started with the new values. The new values are not available to SCADA host software reading the Actual registers until a until a new Density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers and in the Actual registers. This allows a SCADA host to immediately confirm the new values were written to the flow computer. The new gas values are not used by the flow computer until a new density calculation is started.

Save File

This step lets you select where to save the configuration file.

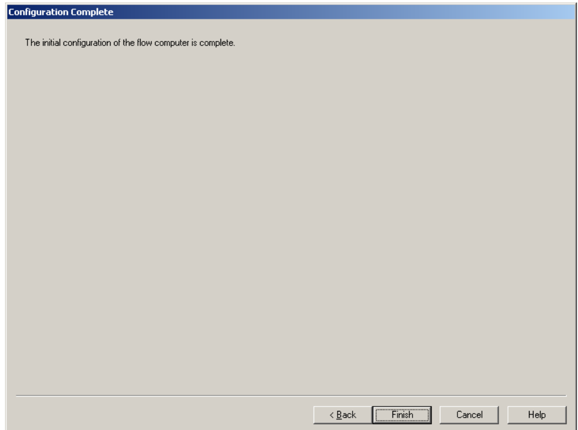


Select **Save to Realflo.tfc** to save the configuration file to the default file location.

Select the **Save to another file** to either enter a file name or use the Browse option to open the **Save As** dialog.

Finish

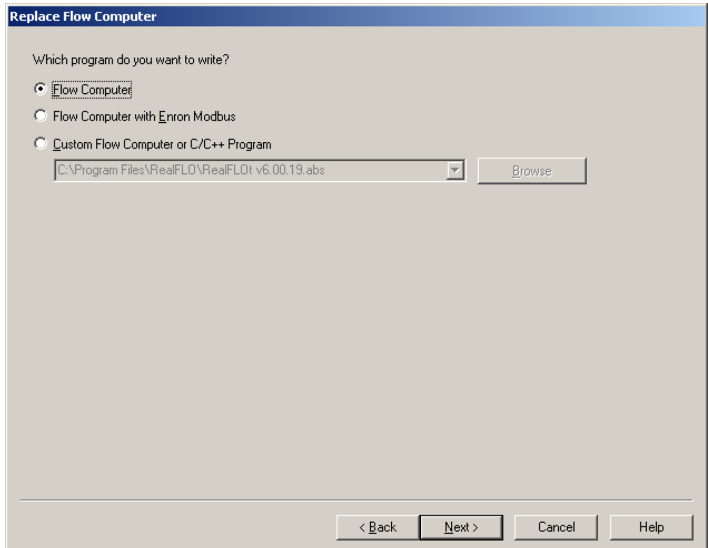
This step is displayed at the end of the wizard.



Click **Finish** to close the wizard.

Replace Flow Computer Wizard

This step selects the flow computer file to write and writes the file to the flow computer.



Use the Replace Flow Computer dialog to select the flow computer program to write to the flow computer.

Select **Flow Computer** to write a basic flow computer program. Realflo selects the correct program file for the flow computer from the folder Realflo was started from, typically **C:\Program Files\Control Microsystems\Realflo**.

- The file selected will be **Realflot v#.##.#.abs** for Telepace firmware and **Realfloi v#.##.#.abs** for ISaGRAF firmware on 16-bit SCADAPack controllers, where #.##.# is the flow computer version number.

This option is disabled if the controller type is a SCADAPack 32, SCADAPack 314/330/334, SCADAPack 350, SCADAPack 4203 and SolarPack 410.

Select **Flow Computer with Enron Modbus** to write a flow computer program with Enron Modbus support. Realflo selects the correct program file for the flow computer from the folder Realflo was started from, typically **C:\Program Files\Control Microsystems\Realflo**.

Flow computer files available will depend on the Realflo operating mode and the controller type.

Standard Flow Computer Files

- **RFEnront v#.##.#.abs** for Telepace firmware and **RFEnroni v#.##.#.abs** for ISaGRAF firmware for 16-bit SCADAPack controllers.
- **Realflot v#.##.#.out** for Telepace SCADAPack 350 firmware and **Realfloi v#.##.#.out** for ISaGRAF SCADAPack 350 firmware.
- **Realflo33xt v#.##.#.out** for Telepace SCADAPack 330/334 firmware and **Realflo33xi v#.##.#.out** for ISaGRAF SCADAPack 330/334 firmware.
- **Realflo31xt v#.##.#.out** for Telepace SCADAPack 314 firmware and **Realflo31xi v#.##.#.out** for ISaGRAF SCADAPack 314 firmware.

- **Realflo4203t v#.##.#.out** for Telepace SCADAPack 4203 firmware and **Realflo4203i v#.##.#.out** for ISaGRAF SCADAPack 4203 firmware.
- **Realflo410t v#.##.#.out** for SolarPack 410 firmware.
- **Realflot v#.##.#.mot** for Telepace SCADAPack 32 firmware and **Realfloi v#.##.#.mot** for ISaGRAF SCADAPack 32 firmware.

GOST Flow Computer Files

- **Realflo_GOST_t v#.##.#.abs** for Telepace firmware and **Realflo_GOST_i v#.##.#.abs** for ISaGRAF firmware for 16-bit SCADAPack controllers.
- **Realflo_GOST_33xt v#.##.#.out** for Telepace SCADAPack 330/334 firmware and **Realflo_GOST_33xi v#.##.#.out** for ISaGRAF SCADAPack 330/334 firmware.
- **Realflo_GOST_31xt v#.##.#.out** for Telepace SCADAPack 330/334 firmware and **Realflo_GOST_31xi v#.##.#.out** for ISaGRAF SCADAPack 330/334 firmware.
- **Realflo_GOST_4203t v#.##.#.out** for Telepace SCADAPack 4203 firmware and **Realflo_GOST_4203i v#.##.#.out** for ISaGRAF SCADAPack 4203 firmware.
- **Realflo_GOST_410t v#.##.#.out** for SolarPack 410 firmware.

Realflot v#.##.#.mot for Telepace SCADAPack 32 firmware and **Realfloi v#.##.#.mot** for ISaGRAF SCADAPack 32 firmware.

PEMEX Flow Computer Files

- **Realflo_PEMEX_t v#.##.#.abs** for Telepace firmware and **Realflo_PEMEX_i v#.##.#.abs** for ISaGRAF firmware for 16-bit SCADAPack controllers.
- **Realflo_PEMEX_33xt v#.##.#.out** for Telepace SCADAPack 330/334 firmware and **Realflo_PEMEX_33xi v#.##.#.out** for ISaGRAF SCADAPack 330/334 firmware.
- **Realflo_PEMEX_31xt v#.##.#.out** for Telepace SCADAPack 330/334 firmware and **Realflo_PEMEX_31xi v#.##.#.out** for ISaGRAF SCADAPack 330/334 firmware.
- **Realflo_PEMEX_4203t v#.##.#.out** for Telepace SCADAPack 4203 firmware and **Realflo_PEMEX_4203i v#.##.#.out** for ISaGRAF SCADAPack 4203 firmware.
- **Realflo_PEMEX_410t v#.##.#.out** for SolarPack 410 firmware.
- **Realflot v#.##.#.mot** for Telepace SCADAPack 32 firmware and **Realfloi v#.##.#.mot** for ISaGRAF SCADAPack 32 firmware.

Select **Customer Flow Computer or C/C++ Program** to write any C/C++ program to the flow computer. Select the file to write by:

- Entering the file name in the edit box.
- Selecting a recently used file by clicking the down arrow.
- Using the **Browse** button to select a file. The Browse button opens a file open dialog. The dialog shows files of type **ABS** if the flow computer is a SCADAPack. **OUT**, if the flow computer is a SCADAPack 314/330/334,

SCADAPack 350 or SCADAPack 4203, or **MOT** if the flow computer is a SCADAPack 32.

The **Back** button returns to the previous step.

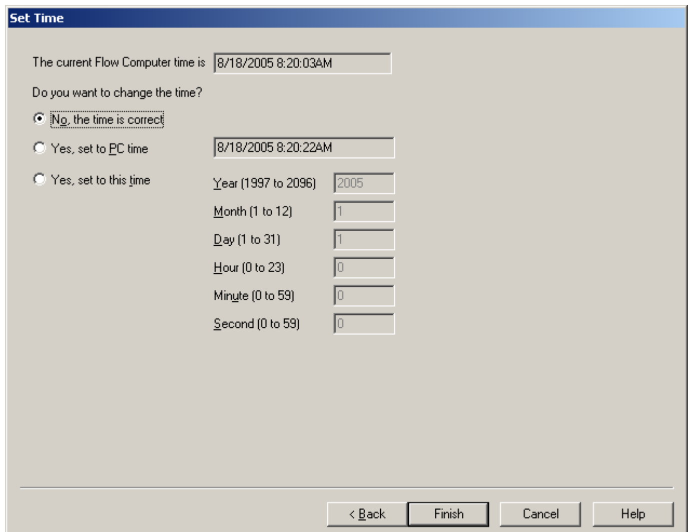
The **Next** button writes the flow computer file and moves to the next step, Set Time.

The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Set Time

This step sets the time in the flow computer. Setting the time allows that configuration events are recorded with the correct time.



The following controls are available from the Real Time Clock dialog.

The current Flow Computer Time shows the current time and date in the flow computer. It is updated continuously while the dialog is open. The time and date are displayed in the short time format as defined in the Windows Control Panel.

The **Yes, set to PC Time** radio button selects setting the controller time to match the PC time. The current PC time and date are shown to the right of the button. The time and date are displayed in the short format as defined in the Windows Control Panel.

The **Yes, set to this time** radio button selects setting the time and date to the values specified by the user in the **Year**, **Month**, **Day**, **Hour**, **Minute** and **Second** controls. If the Set to User Entered Time radio button is not selected these controls are grayed.

The **Back** button returns to the previous step.

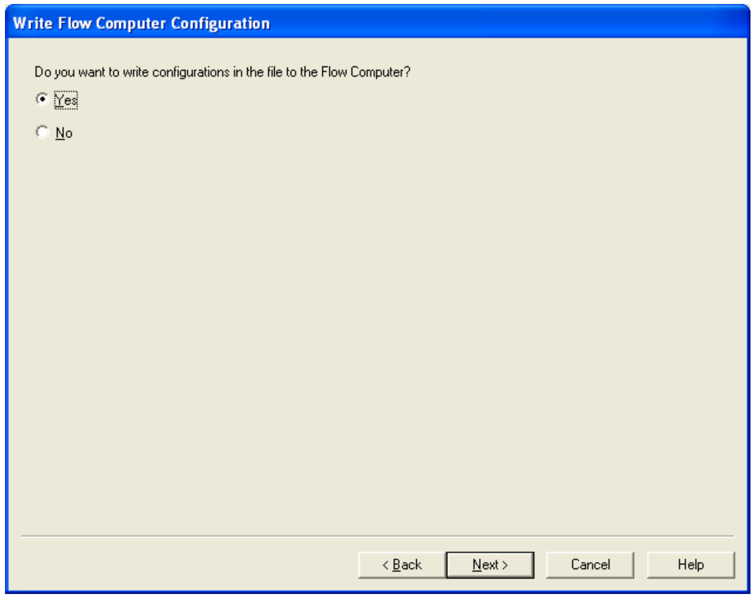
The **Finish** button writes the time and ends the wizard.

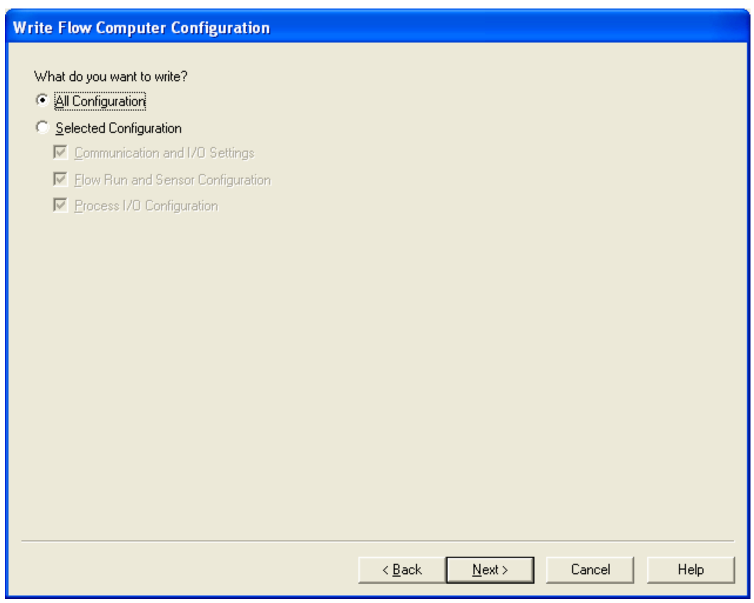
The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Write Flow Computer Configuration

The Write Configuration command is used to write all or selected parts of the Flow Computer Configuration. When selected the command displays the Write Flow Computer Configuration dialog as shown below.





The **All Configuration** radio button, when selected, results in the writing of all configuration data from the flow computer.

The **Selected Configuration** radio button enables specific configuration data to be written to the flow computer.

- Select **Communication and I/O Settings** to write the serial port, register assignment configuration information and mapping table.
- Select **Flow Run and MVT Configuration** to write the flow run configuration and the MVT transmitter configuration.

- Select **Process I/O Configuration** to write the Process I/O configuration.

Click on the **OK** button to write the selected items to the flow computer.

Click the **Cancel** button to cancel the operation and close the dialog.

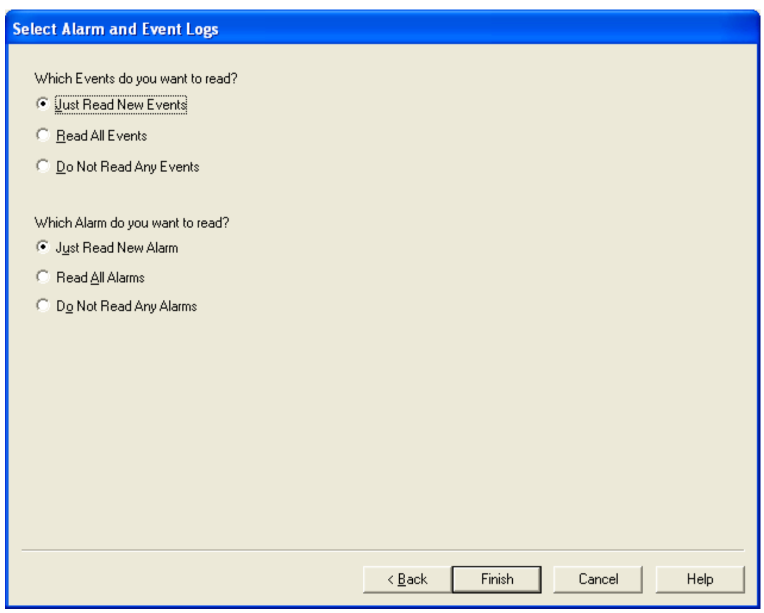
- The Flow Computer ID is checked before writing. If the Flow Computer ID does not match the ID in the dialog Realflo displays a message.
- An error occurs if Controller Configuration is selected and the flow computer type is different from the flow computer type selected in the Controller Type dialog. A message is displayed.

In Flow Computer versions 6.73 and older, when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers. The Actual registers are not updated until a new Density calculation is started with the new values. The new values are not available to SCADA host software reading the Actual registers until a until a new Density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when AGA-8 gas ratios or NX-19 gas quality values are written to the flow computer the new gas ratios are updated in the Proposed registers and in the Actual registers. This allows a SCADA host to immediately confirm the new values were written to the flow computer. The new gas values are not used by the flow computer until a new density calculation is started.

Read Alarm and Event Logs

This step selects whether the alarms and events in the flow computer are read.



The **Which Events do you want to read?** section has the following selections.

- Select **Just Read New Events** to read unacknowledged events in the flow computer. If the operator has Write authorization then the events will be acknowledged after reading the new events. If the events in the log are not acknowledged, the event log will fill with 700 events. Operator activity will be stopped until the events are read and acknowledged. This is the default selection.

- Select **Read All Events** to read all events in the flow computer. Do not acknowledge the events.
- Select **Do Not Read Any Events** to skip reading events.

The **Which Alarms do you want to read?** section has the following selections.

- Select **Just Read New Alarms** to read unacknowledged alarms in the flow computer. If the operator has Write authorization then the alarms will be acknowledged after reading the new alarms. If the alarms in the log are not acknowledged, the alarm log will wrap around at 300 alarms. This is the default selection.
- Select **Read All Alarms** to read all alarms in the flow computer. Do not acknowledge the alarms.
- Select **Do Not Read Any Alarms** to skip reading alarms.

The **Back** button returns to the previous step.

The **Next** button reads the selected alarms and events and moves to the next step, Select Hourly History.

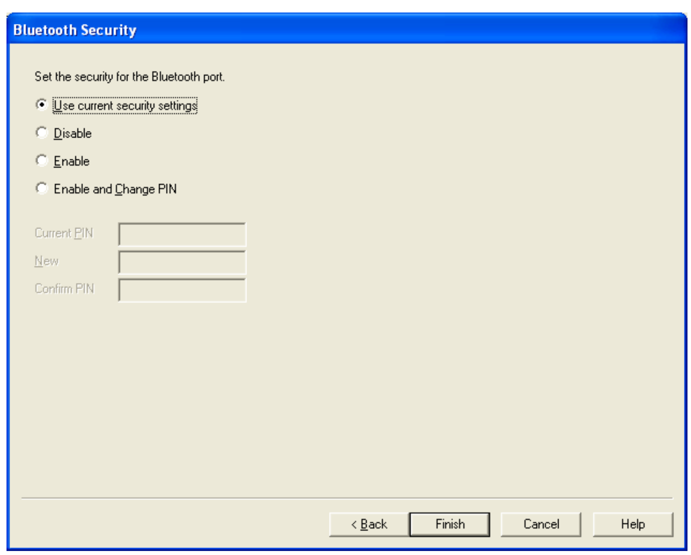
The **Cancel** button closes the dialog and stops the wizard.

The **Help** button opens the on-line manual.

Bluetooth Security

If a *Bluetooth* connection was used to replace the flow computer in a SolarPack 410 the last step is setting the *Bluetooth* security.

The *Bluetooth* Security Settings dialog specifies how *Bluetooth* security is configured in the SolarPack 410 controller. Opening the dialog reads the current settings from the controller. The dialog does not open if the settings can't be read.



***Bluetooth* Security** selects if security is enabled or not. Select **Use current security settings** to maintain the security settings that have already been established. Select **Disable** to operate the *Bluetooth* radio without security. Select **Enable** to use authentication and encryption. Select **Enable and Change PIN** to use authentication and encryption with a new PIN.

Current PIN specifies the current value of the PIN. Valid values are up to 10 alphanumeric characters (a to z, A to Z, and 0 to 9). The PIN is case sensitive. Characters entered are masked. Copy and paste are disabled (so the user needs to type the PIN). The factory default PIN is **default**.

New PIN specifies the new value of the PIN. This control is enabled if **Enable and Change PIN** is selected. Valid values are up to 10 alphanumeric characters (a to z, A to Z, and 0 to 9). The PIN is case sensitive. Characters entered are masked. Copy and paste are disabled (so the user needs to type the PIN).

Confirm New PIN specifies the new value of the PIN. This control is enabled if **Enable and Change PIN** is selected. Valid values are up to 10 alphanumeric characters (a to z, A to Z, and 0 to 9). The PIN is case sensitive. Characters entered are masked. Copy and paste are disabled (so the user needs to type the PIN).

The two values of the new PIN need to match before any settings are written to the controller.

Click **Finish** to write the new settings to the controller. A message is displayed if the settings cannot be written to the controller and the dialog remains open.

Click **Cancel** to close the dialog without making any changes.

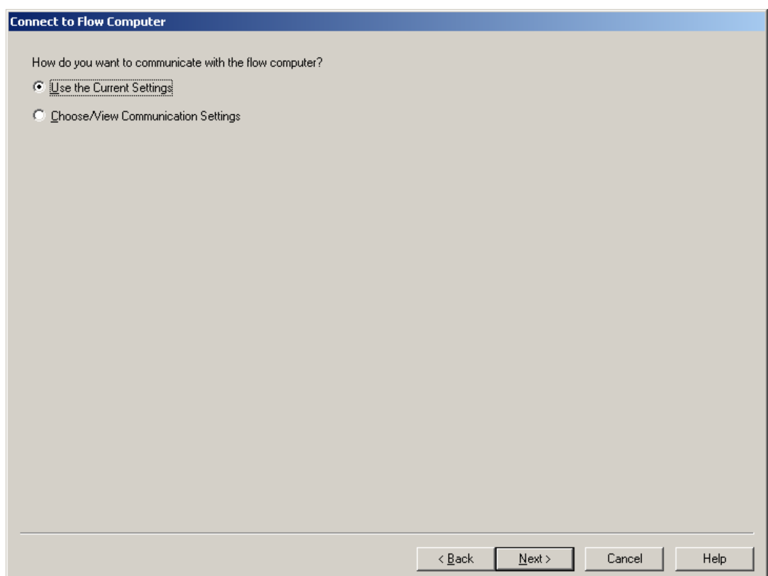
Read Logs and Flow History Wizard

The Read Logs and Flow History wizard will lead you through the steps to connect to a flow computer and read the alarm and event logs and the flow history.

- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.
- **Cancel** cancels the operation and closes the wizard. Steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.
- **Help** opens the user manual.

Connect to Flow Computer

This step lets you define the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two selections.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo. (The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are: COM 1 (serial port on the PC), 9600 baud, no parity, 8 Data bits, and 1 Stop bit. The default Modbus address Realflo will connect to is station 1.

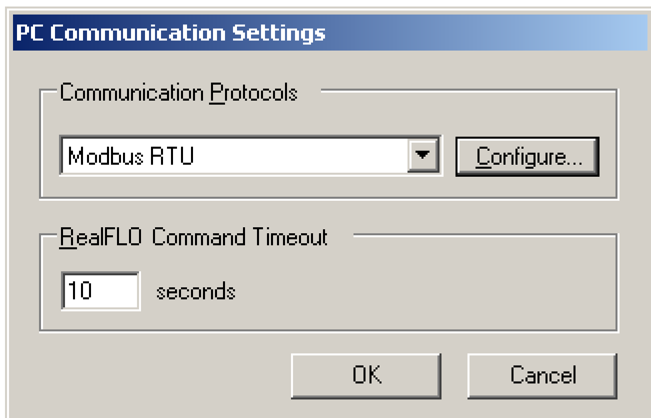
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click the **Next>** button to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

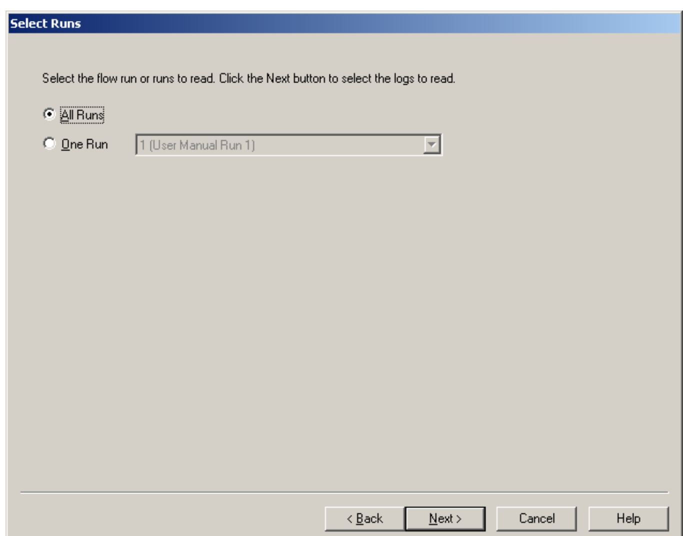
See the section **Communication** >> **PC Communication Settings Command** in the **Realflo Expert Mode Reference** section of this manual for complete details on the parameter settings in this dialog.

You need to know the communication settings for the connection to the flow computer to use this step.



Select Runs to Read

This step selects the flow run or runs to read.



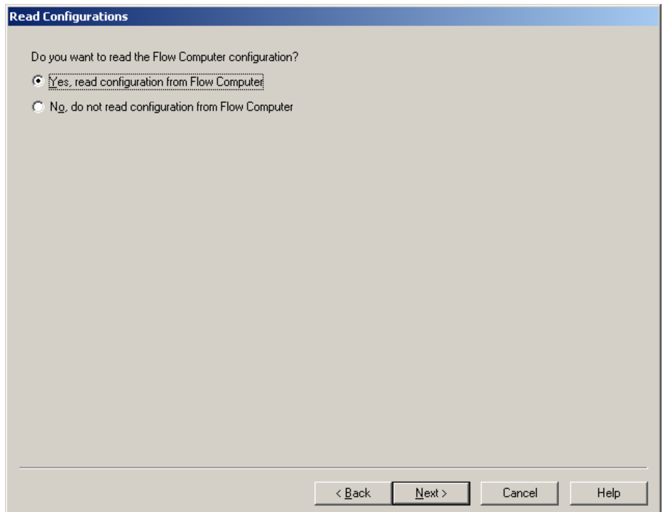
The **Select the Flow Run or Runs to Read selection** determines if data for all runs or for a single run is read.

- The All Runs radio button selects reading data for all runs.

- The Selected Run radio button selects reading from a single run. The drop-down list selects the run to be read.
- Click the Next> button to move to the next step in the wizard.

Select Flow Computer Configuration

This step selects whether the flow computer configuration is read from the flow computer with the logs and history.

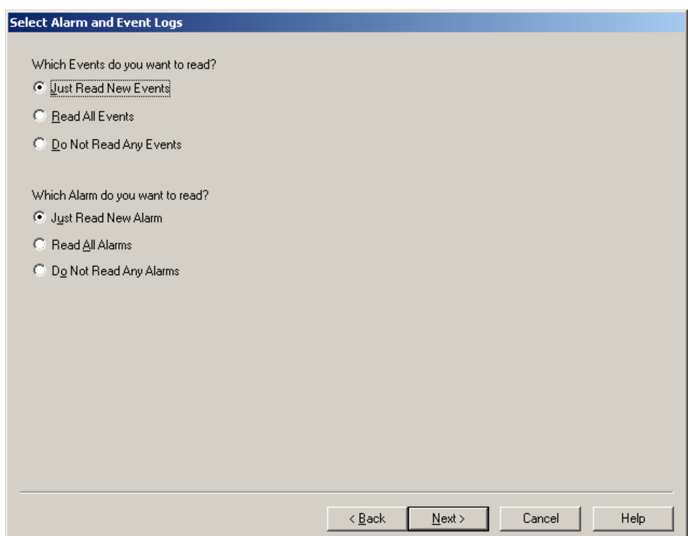


Select **Yes** to read the flow run configuration.

Select **No** to not read the flow run configuration.

Select Alarm and Event Logs to Read

This step selects which alarms and events to read.



The **Which Events do you want to read?** selection determines which events to read from the flow computer.

- Select **Just Read New Events** to read unacknowledged events in the flow computer. If the operator has **View, Read and Write Data** or **Administrator** authorization then the events will be acknowledged after reading the new events. If the events in the log are not acknowledged, the event log will fill with 700 events. Operator activity will be prevented until the events are read and acknowledged. The control is grayed under the following conditions:

  - The event log is not selected.
  - The user has **Read and View** account privileges.
  - The **Restrict Realflo users to reading all alarms and events** option is selected in the Expert Mode Options menu.

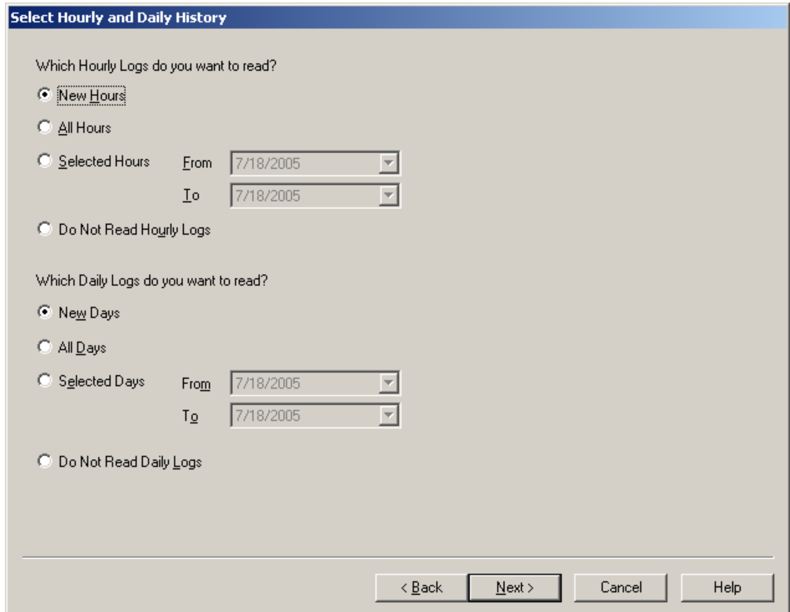
- Select **Read All Events** to read all events in the flow computer. This control is grayed if the Event Log control is not selected.
- Select **Do Not Read Any Events** to skip reading of events from the flow computer.

The **Which Alarms to you want to read?** selection determines which alarm logs to read from the flow computer.

- Select **Just Read New Alarms** to read unacknowledged alarms in the flow computer. If the operator has **View, Read and Write Data** or **Administrator** authorization then the alarms will be acknowledged after reading the new events. If the events in the log are not acknowledged, the alarm log will fill with 300 events. Operator activity will be prevented until the alarms are read and acknowledged. The control is grayed under the following conditions:
- The alarm log is not selected.
- The user has **Read and View** account privileges.
- The **Restrict Realflo users to reading all alarms and events** option is selected in the Expert Mode Options menu.
- The **Read All Alarms** radio button selects the reading of all alarms in the controller. The control is grayed if the Alarm control is not selected.
- The **Do Not Read Any Alarms** button selects not to read alarms from the flow computer.
- Click the **Next>** button to move to the next step in the wizard.

Select Hourly and Daily History to Read

This step selects which hourly and daily logs to read.



The **Which Hourly Logs do you want to read?** selection determines which hourly history is read.

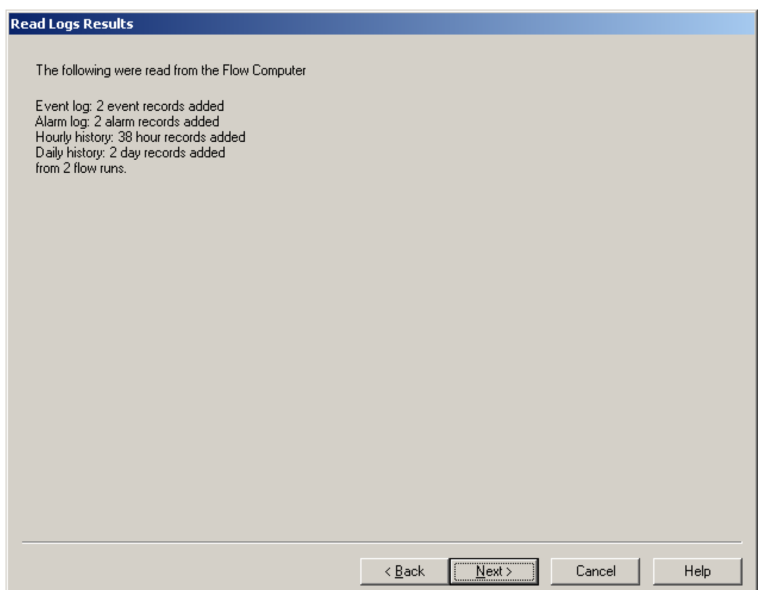
- Select **New Hours** to read hourly history for hours after those current in the file. If the file is empty then Realflo will read all hourly history stored in the flow computer. This is the default selection.
- Select **All Days** to read hourly history for all days stored in the flow computer.
- Select **Selected Hours** to read hourly history for the range of days selected with the From and to drop-down lists. Records are read for the contract days whose first hour is within the date range. Records for the contract day are read, regardless of their calendar date. This may result in records with calendar days outside the range being added to the log. For example, if the contract day is configured to start at 7:00 AM. Reading hourly history for September 23 would return the records where the first record in a day was between 7:00 on the 23rd to 6:59:59 AM on the 24th.
- The **From** control contains the oldest previous day for which the hourly history is to be read. The initial value is the current day. Change this date to avoid reading data that has previously been read into the log.
- The **to** control contains the recent previous day for which the hourly history is to be read. The initial value is the current day. The allowed range is the same or greater than the value in the **From** control. Change this date when wanting to read older data only. Leaving this date at its default will result in the recent data being read.
- Select the **Do Not Read Hourly Logs** to skip the reading of hourly logs.

The **Which Daily Logs do you want to read?** selection determines which hourly history is read.

- Select **New Days** to read daily history for days after those in the current file. If the file is empty then Realflo will read hourly history stored in the flow computer. This is the default selection.

- Select **All Days** to read daily history for all days stored in the flow computer.
- Select **Selected Days** to read daily history for the range of days selected with the From and to drop-down lists. Records are read for the contract days whose first record is within the date range. Records for the contract day are read, regardless of their calendar date. This may result in records with calendar days outside the range being added to the log. For example, if the contract day is configured to start at 7:00 AM. Reading daily history for September 23 would return the daily records whose end time is in the range 7:00 on the 23^{rd} to 6:59:59 AM on the 24^{th}.
- The **From** control contains the oldest previous day for which the daily history is to be read. The initial value is the current day. Change this date to avoid reading data that has previously been read into the log.
- The **to** control contains the recent previous day for which the daily history is to be read. The initial value is the current day. The allowed range is the same or greater than the value in the **From** control. Change this date when wanting to read older data only. Leaving this date at its default will result in the recent data being read.
- Select the **Do Not Read Hourly Logs** to skip the reading of hourly logs.
- Click the **Next>** button to read the selected logs and history from the runs selected and move to the next step in the wizard.

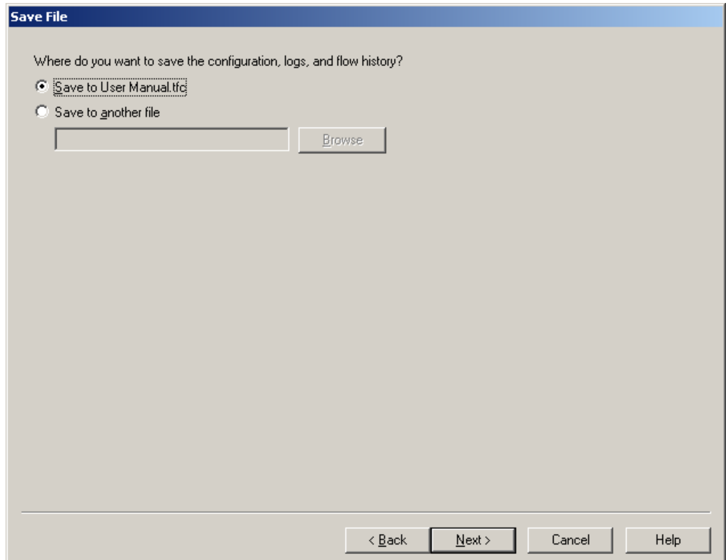
The Read Logs Results page displays the results of the Read Logs and History.



- Click the **Next>** button to move to the next step in the wizard.

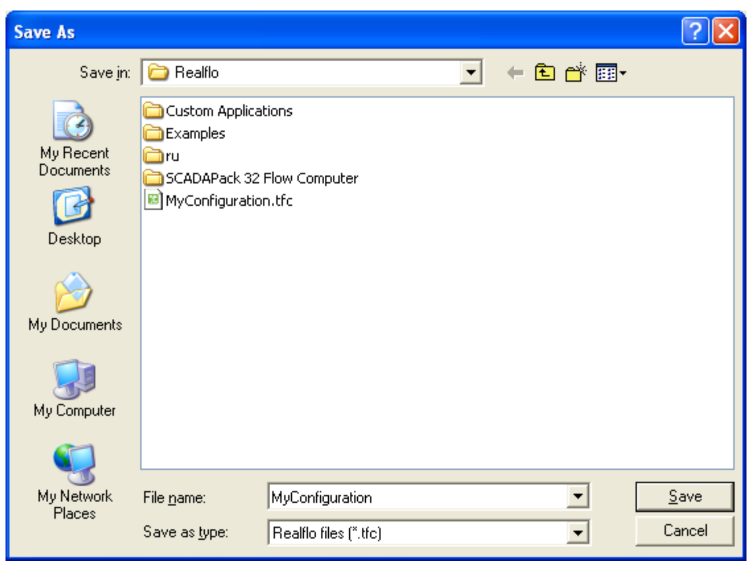
Save Data

This step saves the flow run configuration, if selected, and the logs and history.



Select **Save to *File name.tfc*** to save the data read to the currently opened file. The name of the current file is shown in place of *file name.tfc.*

Select **Save to another file** and enter a file name or click the Browse button to open the Save As dialog.



The following options allow you to specify the name and location of the file you're about to save:

The **Save in:** box lists the available folders and files.

The **File name:** box allows entry of a new file name to save a file with a different name. Realflo adds the extension you specify in the *Save As type* box.

The **Save as type:** box lists the types of files Realflo can save. Realflo can open flow computer (TFC) files and flow computer Template files (RTC).

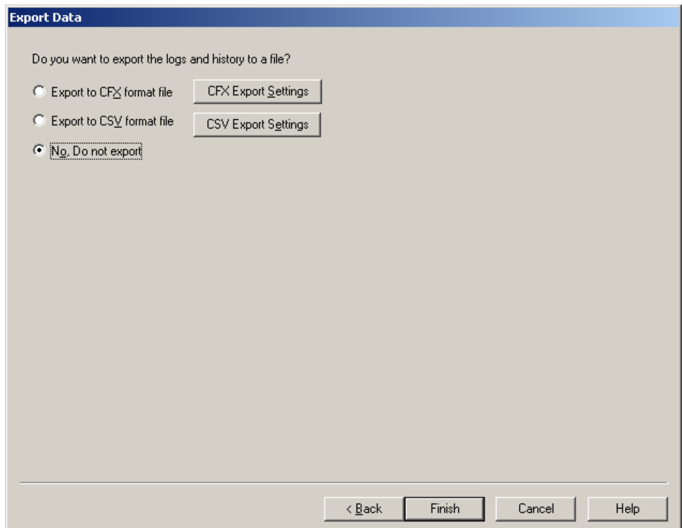
If the open file is a flow computer file and the Save as Type is a template file, Realflo will ask if the flow computer file should be saved before converting it to a template.

Save saves the file to the specified location.

The **Cancel** button closes the dialog without saving.

Export Data

This step selects the file type to export data to.



Select **Export to CFX format file** to export the logs and history to a Flow-Cal CFX format file. This format is designed for importing into Flow-Cal. Data is exported to the CFX file from one flow run. The file includes data from the configuration, current readings, alarm log, event log and hourly history log.

- When this option is selected the **Export Data to CFX** dialog is opened when the **Finish** button is clicked.
- The **CFX Export Setting** button opens the CFX Export Settings dialog. The parameters for this dialog are described in the CFX Export Settings section below.

Select **Export to CSV format file** to export the logs and history to a CSV (comma-separated values) format file. This format can be read by spreadsheet and database software.

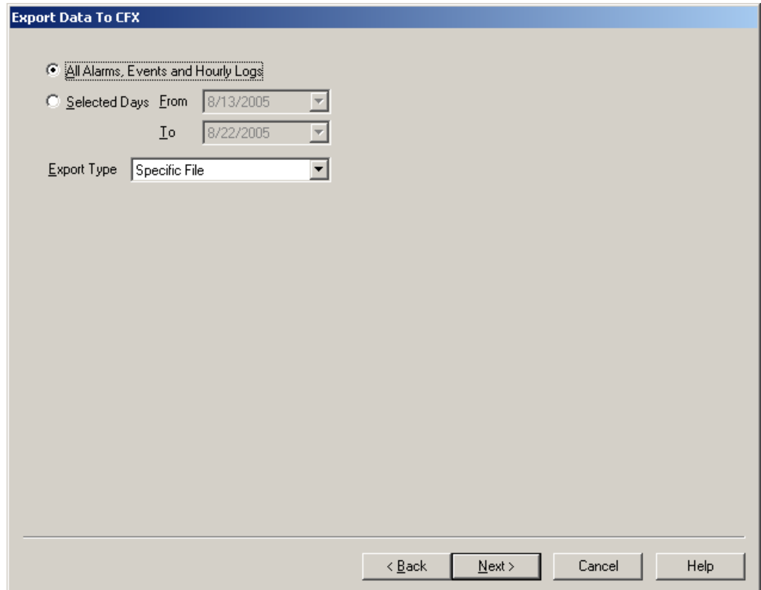
- When this option is selected the **Export Data to CSV** dialog is opened when the **Finish** button is clicked.
- The **CSV Export Setting** button opens the CSV Export Settings dialog. The parameters for this dialog are described in the CSV Export Settings section below.

Select **No, Do not export** to skip the Export Data step.

- When this option is selected the dialog is closed and the Read Logs Flow History wizard is ended when the **Finish** button is clicked.

Export Data to CFX

This step selects what data to export to CFX.



Select **All Alarms, Events and Hourly Logs** to select all of the data in the flow run. This is the default button.

Select **Selected Days** to select the data from the contract days in the **From** and **To** dropdown lists.

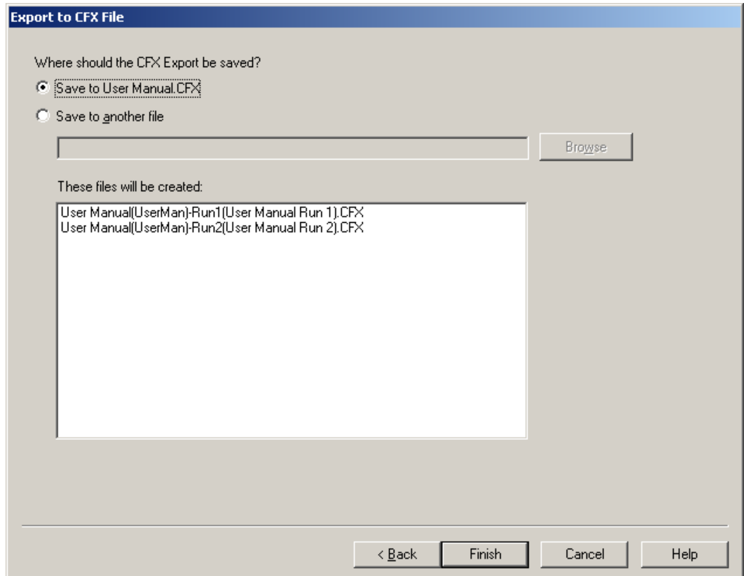
- The **From** dropdown list selects the oldest contract day. This control is enabled when the **Selected Days** radio button is selected.
- The **To** dropdown list selects the recent contract day. This control is enabled when the **Selected Days** radio button is selected.

The **Export Type** dropdown list selects how export files are stored.

- Select Specific File to export to a single file. A standard file save dialog opens to allow you to select the file name. The default file name is <Realflo file name>(<FC ID>) - <Run Number> (<Run ID>).CFX.
- Select Dated CFX to export one file per day to a single folder per run. Realflo exports one file for each day. The file name is based on the time and date according to the CFX standard (YYYYMMDD.CFX).

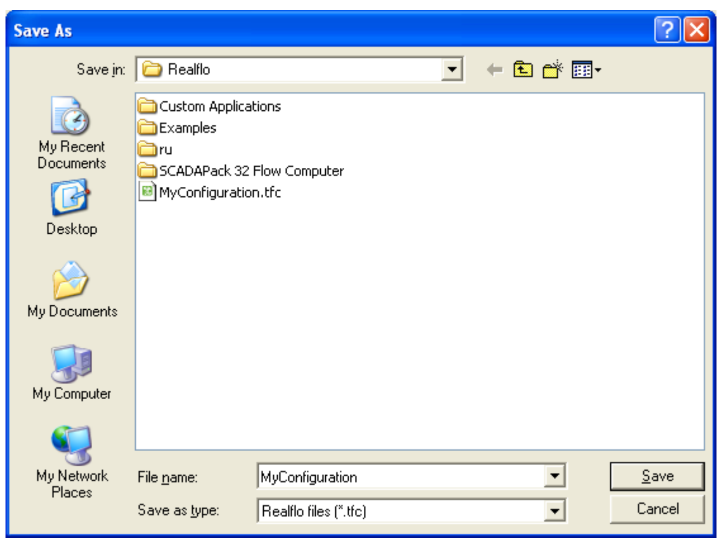
Save CFX Export

This step selects where to save the CFX export.



Select **Save to *File name.CFX*** to save the CFX Export data to the currently opened file. The name of the current file is shown in place of *file name.CFX.* The files that that will be created are shown in the display window.

Select **Save to another file** to save the CFX Export data to a different file name and location. Enter the name in the window or select **Browse** to open the Save As dialog and select a name and location.



The **Save As** dialog allows you to specify the file to export the data to.

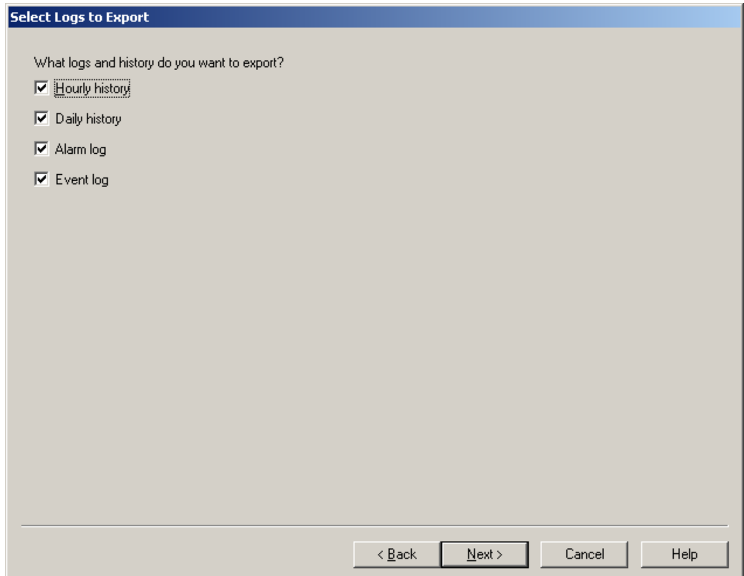
Save exports the data to the selected file.

Cancel the export command and closes the dialogs.

- Click the **Next>** button to complete the Read Logs and Flow history wizard and close the dialog.

Export Data to CSV

This step selects what data to export to CSV.



Select **Hourly history** to export the hourly history data.

Select **Daily history** to export the daily history data.

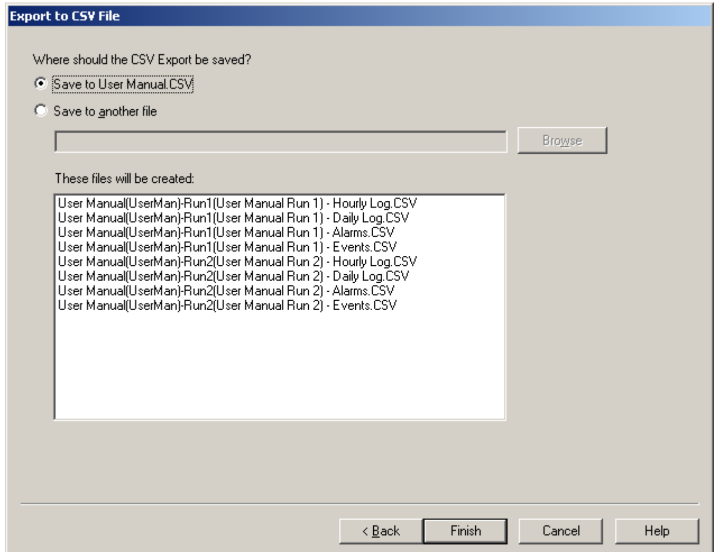
Select **Alarm log** to export the alarm log data.

Select **Event log** to export the event log data.

The **Next>** button moves to the Save CSV Export step in the wizard.

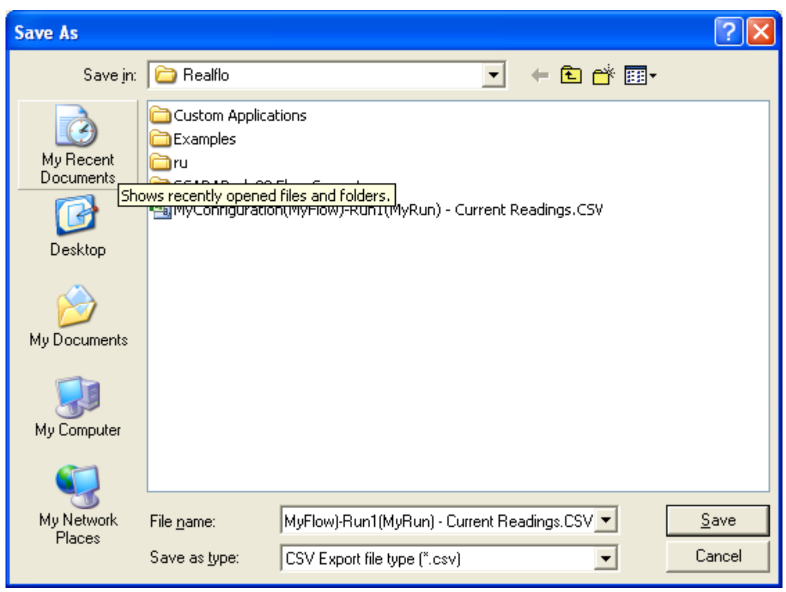
Save CSV Export

This step selects where to save the CSV export.



Select **Save to *File name.CSV*** to save the CSV Export data to the currently opened file. The name of the current file is shown in place of *file name.CSV.* The files that that will be created are shown in the display window.

Select **Save to another file** to save the CSV Export data to a different file name and location. Enter the name in the window or select **Browse** to open the Save As dialog and select a name and location.



You may change the file name to any suitable name. The suggested file name format is defined in the **CSV Export Options** command.

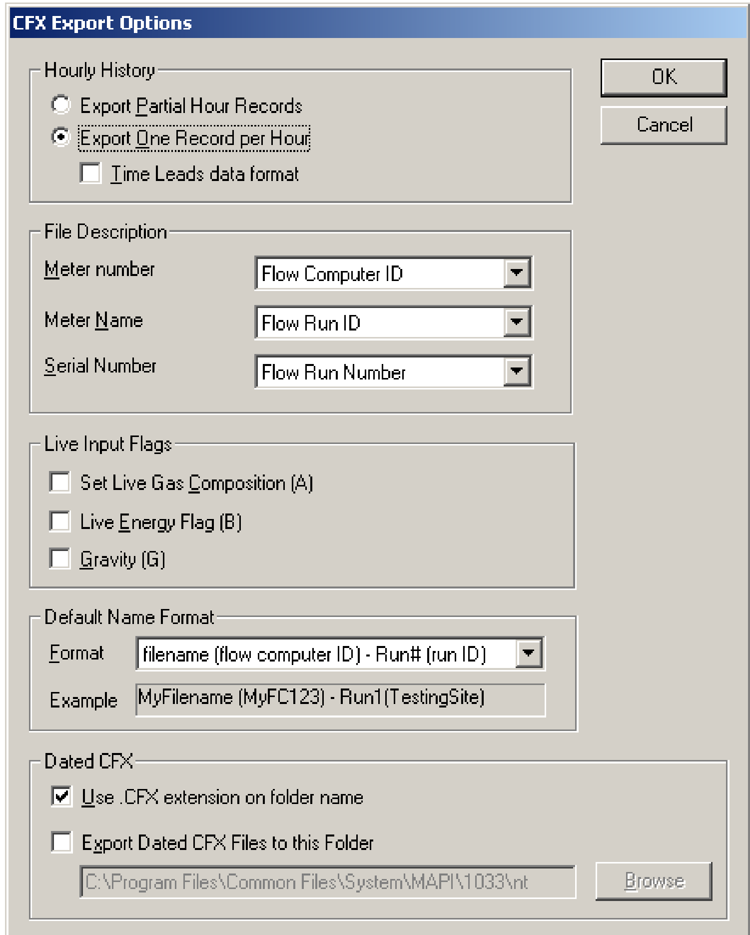
The **Save As** file selection dialog appears for views. The Save As dialog allows you to specify the file to export the data to.

The **Save** button in the **Save As** dialog exports the data to the selected file.

The **Cancel** button in the **Save As** dialog cancels the export command and closes dialogs.

CFX Export Settings

The CFX Export Options dialog sets options for exporting to Flow-Cal CFX files. The settings in this dialog apply to files opened by Realflo. They are stored in the Windows registry.



The Hourly History section defines how records from the hourly history are exported.

- Select **Export Partial Hour Records** to export of the records as they appear in Realflo. Some hours may contain more than one record due to power disconnection or configuration changes. This is the default selection.
- Select **Export One Record per Hour** to export only one record per hour. Multiple records within an hour are merged into a single record for exporting. Hours that are not yet complete are not merged or exported.

The following hourly record fields are summed: volume, mass, energy, pulses (turbine type).

The following hourly record fields are averaged: termperature, static pressure, differential pressure (orifice types), relative density, flow product or flow extension. See Input Averaging on page 948 for more information.

- Select **Time Leads Data Format** to export the date and time at the start of the period. The time stamp on the record is the time at the start of the hour, even if the first record to be merged started later than that time. This option is enabled only when **Export One Record per Hour** is checked. This option is unchecked by default.

The **File Description** section defines some descriptive parameters in the CFX file.

- **Meter Number** defines the meter number parameter. The options are *none*, *Flow Computer ID*, *Flow Run ID* and *Flow Run Number*. The default value is *Flow Computer ID*. The parameter is 17 characters long in the file.
- **Meter Name** defines the meter name parameter. The options are *none*, *Flow Computer ID*, *Flow Run ID* and *Flow Run Number*. The default value is *Flow Run ID*. The parameter is 49 characters long in the file.
- **Serial Number** defines the meter serial number parameter in the file. The options are *none*, *Flow Computer ID*, *Flow Run ID* and *Flow Run Number*. The default value is *Flow Run Number*. The parameter is 11 characters long in the file.

The **Live Inputs Flags** section defines which live input flags are set by Realflo. The CFX file contains four flags in the Live Inputs parameter. Realflo sets the T (temperature) flag to Y (live data). The other flags are normally set to N (not live), but can be modified using the following options.

- Check **Set Live Gas Composition Flag** when there is a program that updates the gas composition. This is flag A (analysis). This option is unchecked by default.
- Check **Set Live Energy Flag** when there is a program that updates the energy. This is flag B (heating value). This option is unchecked by default.
- Check **Set Live Gravity Flag** when there is a program that updates the specific gravity (relative density). This is flag G (gravity). This option is unchecked by default.

The **Default Name Format** section defines what file names Realflo suggests when exporting. The names are combinations of the file name; Flow Computer ID; flow run number; and flow run ID.

- **Format** selects the name format. The valid values are listed below. The default is to include all information.
    - file name (Flow Computer ID) - Run# (run ID)
    - file name (Flow Computer ID) - Run#
    - file name (Flow Computer ID) - run ID
    - file name - Run# (run ID)
    - file name - Run#
    - file name - run ID
    - Flow Computer ID - Run# (run ID)
    - Flow Computer ID - Run#
    - Flow Computer ID - run ID
    - Run# (run ID)

    - run ID

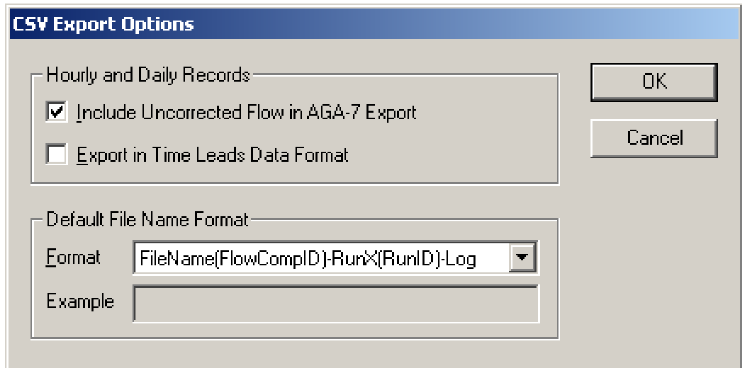
- The **Example** control shows the file name that will be suggested for the current file.

The **Dated CFX** section defines where and how CFX files are exported.

- Select **Use .CFX extension on folder names** to create folders with a CFX extension when exporting Dated CFX files. The data for each month is stored in its own folder when using the Dated CFX format. The folder name may have a CFX extension or not. This option is unchecked by default.
- Select **Export Dated CFX Files to the Folder** to define a common folder for exports. Exported data will be placed in this folder. The option is unchecked by default. When checked, the edit control holds the destination folder that will appear in the Save As dialog. Use Browse to search for another folder.

CSV Export Settings

The CSV Export Options command defines whether optional data is exported to CSV files. The settings in this dialog apply to files opened by Realflo. They are stored in the Windows registry.



The **Hourly and Daily Records** section of the dialog defines optional data to include and how the data is time stamped.

- Select the **Include Uncorrected Flow in AGA-7 Export** option to export the Uncorrected Data column from the Hourly History Log and Daily History Log. This option applies to AGA-7 only. The option is unchecked by default.
- Select the **Export in Time Leads Data Format** option to export time stamps that mark the start of the period. Uncheck the option to export time stamps that mark the end of the period (Realflo format). This applies to the the Hourly History and Daily History only. The control is unchecked by default.

The **Default File Name Format** section defines the file name that is suggested by Realflo when data is exported. The names are combinations of the file name; Flow Computer ID; flow run number; and flow run ID.

- The **Format** list selects the name format. The name is made up of the identifier format and a view format. The valid values for the identifier are listed below. The default is to include all information.
  - file name (Flow Computer ID) - Run# (run ID) - Type
  - file name (Flow Computer ID) - Run# - Type
  - file name (Flow Computer ID) - run ID - Type
  - file name - Run# (run ID) - Type
  - file name - Run# - Type
  - file name - run ID - Type
  - Flow Computer ID - Run# (run ID) - Type
  - Flow Computer ID - Run# - Type
  - Flow Computer ID - run ID - Type
  - Run# (run ID) - Type
  - run ID - Type

When the logs are exported the word **Type** is replaced by the following, according to the export selected.

- Alarms
- Events
- Hourly Log
- Daily Log
- Current Readings
- Custom View Name

- The **Example** control shows the file name that will be suggested for the current file.

Calibrate Inputs Wizard

The Calibrate Inputs wizard is used to calibrate the temperature sensor, static pressure sensor, and differential pressure sensor or pulse counter input. The calibration dialogs lead you through the calibration procedure.

When more than one sensor is selected, they are each forced and then the calibration cycle will be allowed for each sensor in turn. This allows multiple variable transmitters such as the MVT to be calibrated.

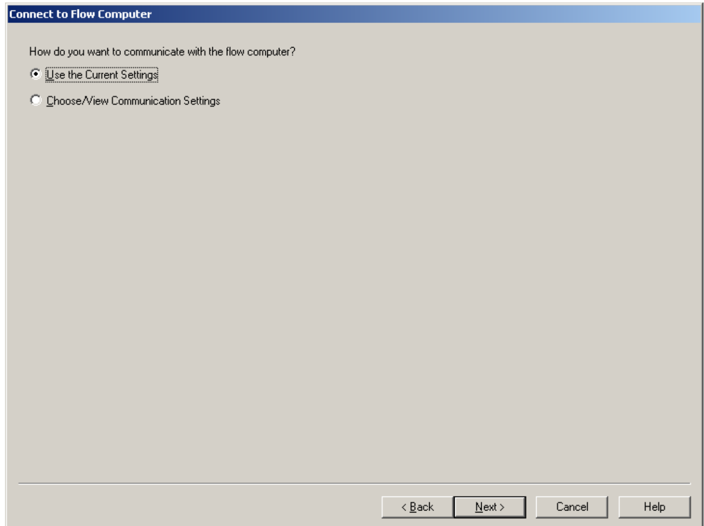
⚠ WARNING
The same input sensor can be used for more than one flow run. When the sensor is calibrated for one run, Realflo only forces the input value for that run. When the sensor is disconnected to do the calibration, the live input to the other run will be disconnected and the value will not be correct. The flow computer does not support forcing of inputs during calibration on more than one run.

For each step in the wizard a dialog is presented to enter the parameters for the step. Each dialog contains four buttons to allow navigation through the wizard.

- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.
- **Cancel** cancels the operation and closes the wizard. All steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.
- **Help** opens the user manual.

Connect to Flow Computer

The connect to flow computer step defines the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two selections.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo. (The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are: COM 1 (serial port on the PC), 9600 baud, no parity, 8 Data bits, and 1 Stop bit. The default Modbus address Realflo will connect to is station 1.

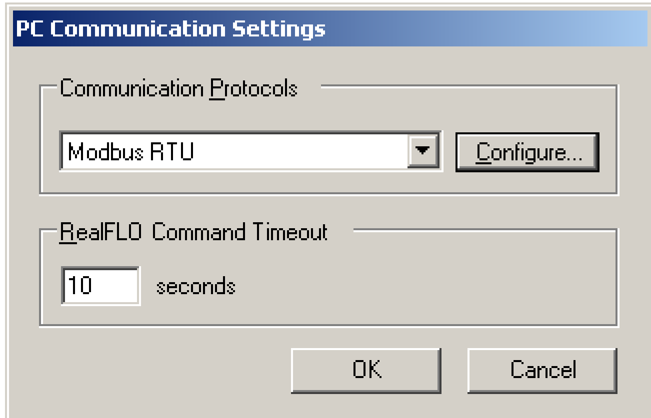
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click the **Next>** button to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

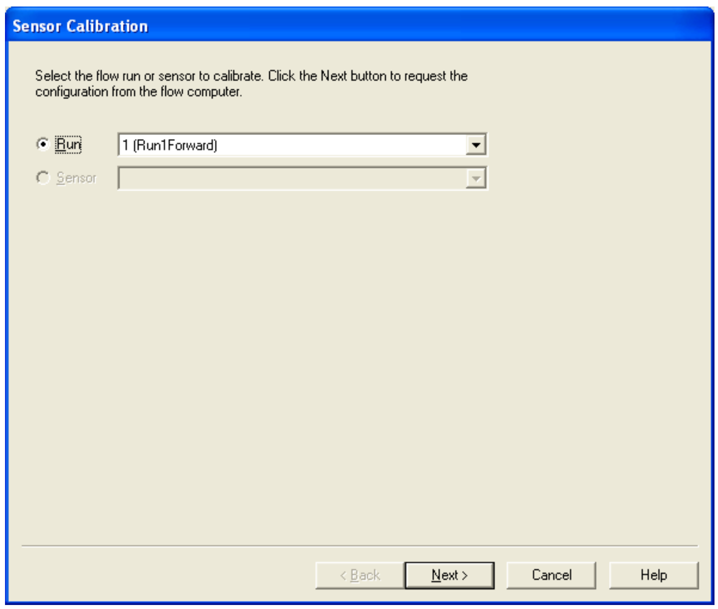
See the section **Communication** >> **PC Communication Settings Command** in the **Realflo Expert Mode Reference** section of this manual for complete details on the parameter settings in this dialog.

You need to know the communication settings for the connection to the flow computer to use this step.



Sensor Calibration

When the ***Calibration*** wizard is selected the Sensor Calibration dialog is displayed. The **Run**, or **Sensor**, to be calibrated is selected from this dialog.



The Sensor Calibration dialog allows the selection meter run or MVT for calibration.

Select the **Run** radio button and then select a meter run to calibrate. Transmitters used for the meter run may be calibrated. This section is disabled if runs are using sensors

- Follow the steps in the **Run Calibration Procedure**.

Select **Sensor** radio button and select one of the sensor tags to calibrate a sensor. Sensor tags that have been configured will be in sensor selection box.

- Follow the steps in the **Sensor Calibration Procedure**.

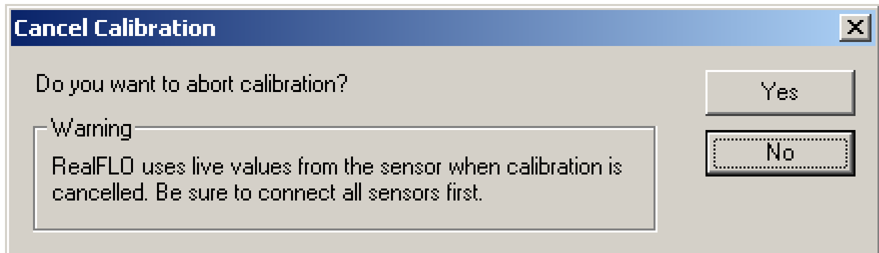
The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The back button is not enabled on the first step since there is no previous step.

The **Next>** button starts the calibration procedure. After the Run, or sensor, is selected, the configuration for the run is read from the flow computer. The Run, or sensor, calibration page for the run is then displayed.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

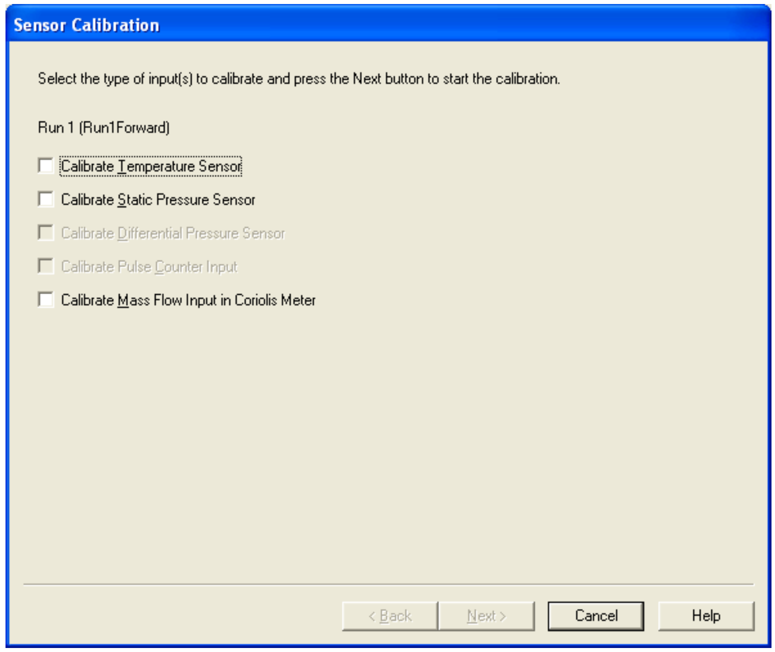
Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Run Calibration Procedure

When the **Run** radio button is selected the Run Calibration dialog is displayed. The transmitters for the run are selected for calibration from this dialog.

WARNING
The same input sensor can be used for more than one flow run. When the sensor is calibrated for one run, Realflo only forces the input value for that run. When the sensor is disconnected to do the calibration, the live input to the other run will be disconnected and the value will not be correct. The flow computer does not support forcing of inputs during calibration on more than one run.



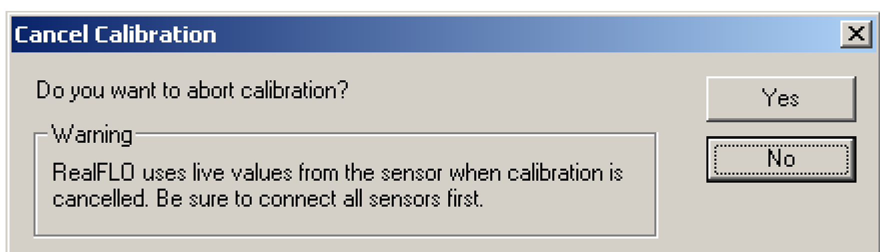
Select the sensors to be calibrated by checking the appropriate boxes. More than one sensor may be selected for calibration.

The **<Back** button is not enabled as this is the initial step.

The **Next>** button completes the selections and opens the Step 1: Force Value dialog.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



The same input sensor can be used for more than one flow run. When the sensor is calibrated for one run, Realflo only forces the input value for that run. When the sensor is disconnected to do the calibration, the live input to the other run will be disconnected and the value will not be correct. The flow computer does not support forcing of inputs during calibration on more than one run.

WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

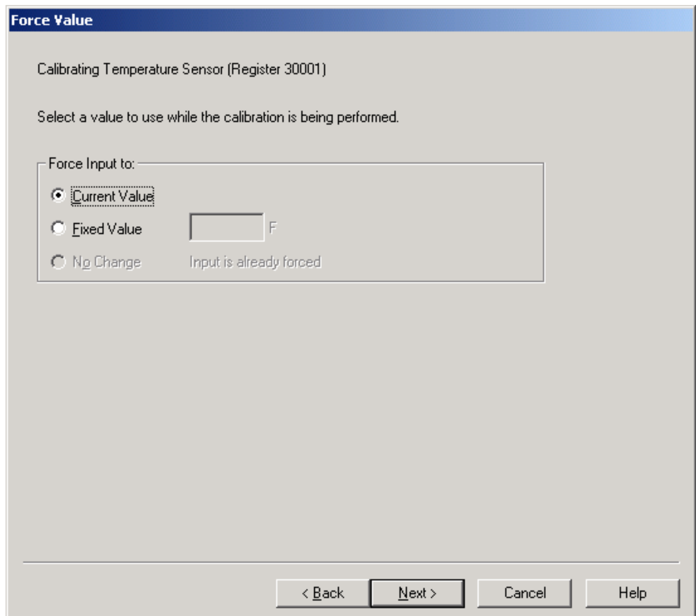
Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 1: Force Value

The flow calculations continue to execute while calibrating sensors. The sensor value needs to be forced to either the current value or a fixed value during calibration. This dialog lets you select the current value of the input or a fixed value of your choice.

When more than one sensor is selected, they need to each be forced to a current or fixed value before any of the other steps are performed. A ***Step 1: Force Value*** dialog will be presented for each sensor selected for calibration.



The input register associated with this input is displayed to aid you in determining which input you are calibrating.

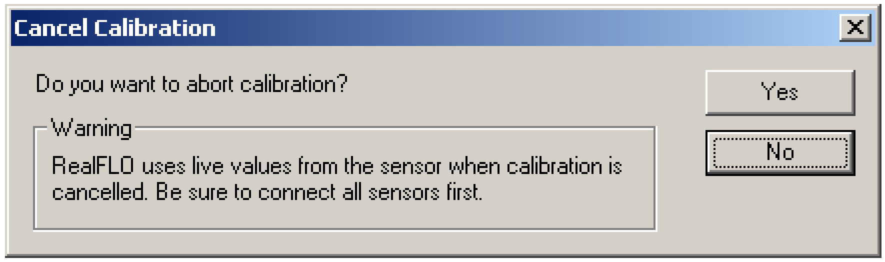
- Check the **Current Value** radio button to use the current value for the sensor.
- Check the **Fixed Value** radio button and enter a value to use for the calibration in the entry box.
- The **No Change** radio button will be selected if the value is currently forced. (You may still select one of the other two radio buttons if desired).

The **<Back** button returns to the previous step. Backing up does not erase events from the Flow Computer event log.

When the **Next>** button is pressed Realflo records the start of calibration for the sensor in the event log. The sensor input is forced. The sensor can now be removed from the process.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



WARNING

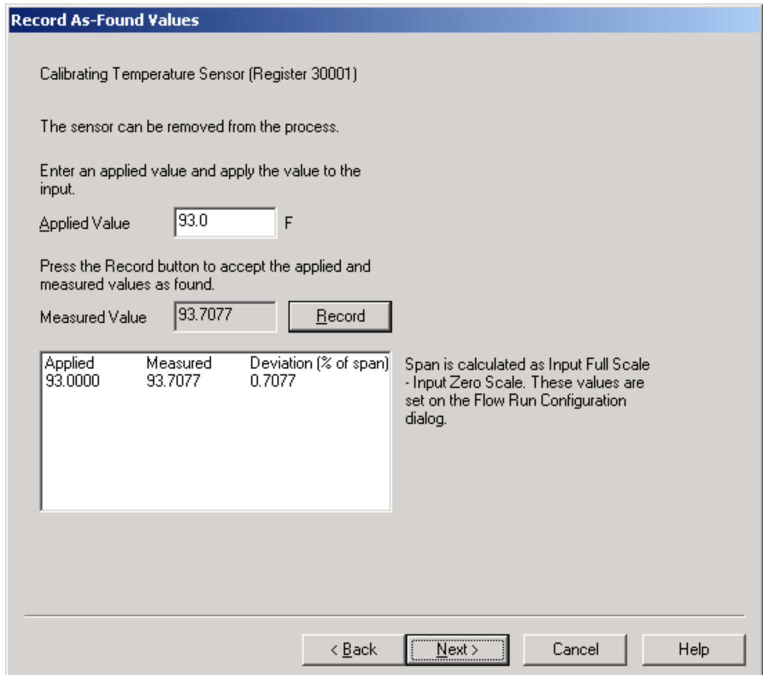
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 2: Record As Found Values

As-found readings indicate how the sensor was calibrated before adjustment. These can be used to correct flow measurement errors resulting from an out of calibration sensor. Follow the procedure your company has set for taking as-found readings. You needs to record at least one "as-found" reading.



To take as-found readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.
- The measured value from the process in the **Measured Value** box. When it has settled, click on the **Record** button to record an as-found reading.

Repeat the process to record additional readings.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

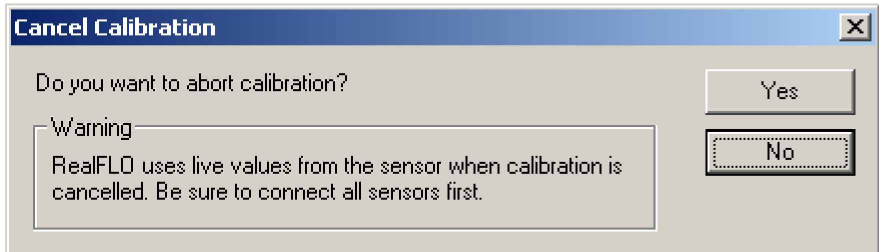
```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

<Back returns to the previous step. Backing up does not erase events from the flow computer event log.

Next> proceeds to the next step.

The **Cancel** button is greyed and an **as found** reading needs to be recorded.

When you click **Cancel** to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



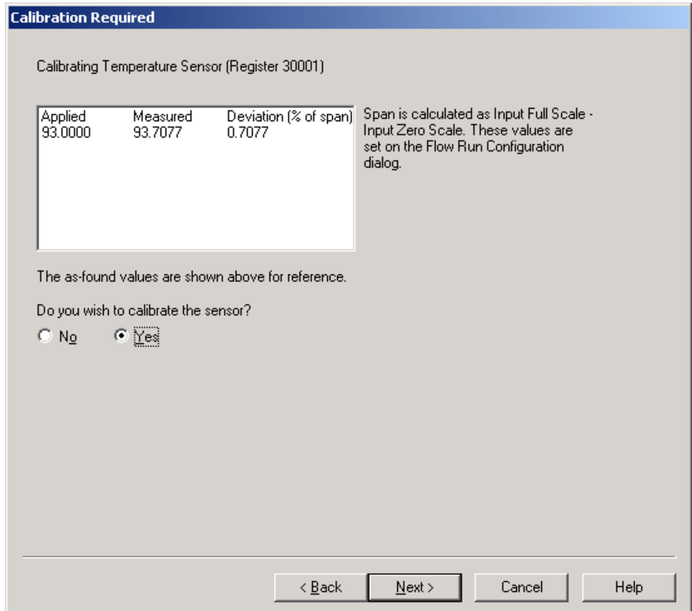
WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 3: Calibration Required

The as-found readings indicate if calibration is required. Examine the list of as-found readings. If the sensor is in need of calibration, select **Yes**. Otherwise select **No**.



As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

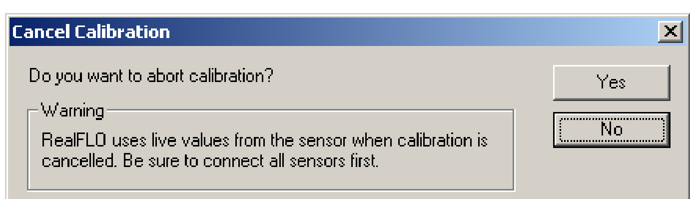
```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The **Next>** button proceeds to the next step.

The **Cancel** button is grayed and an as found reading needs to be recorded.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



⚠ WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be

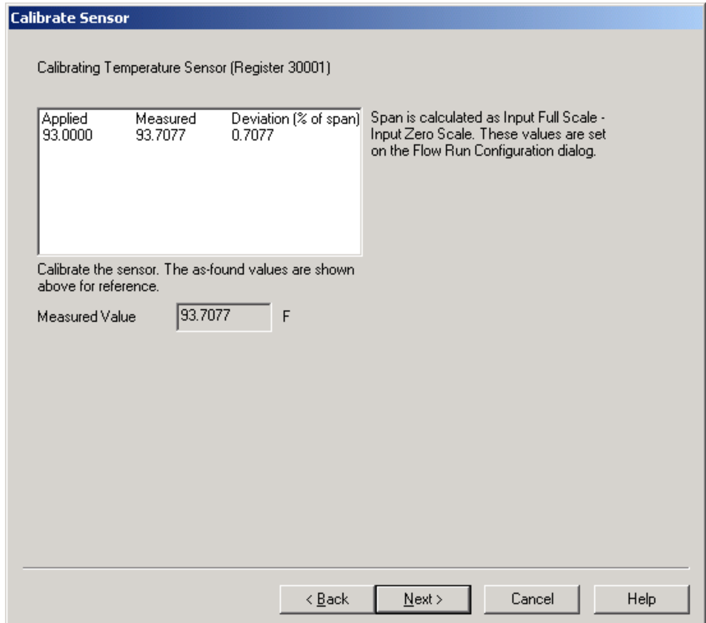
sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 4: Calibrate Sensor

This dialog aids you in calibrating a sensor by displaying the measured value from the sensor and the as-found readings.



Follow the procedure your company or the sensor supplier has set to calibrate the sensor. When the sensor calibration is complete, you may wish to check the as-left measurements that will be recorded in the next step. This confirms that you have calibrated the sensor correctly before placing it back in service.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

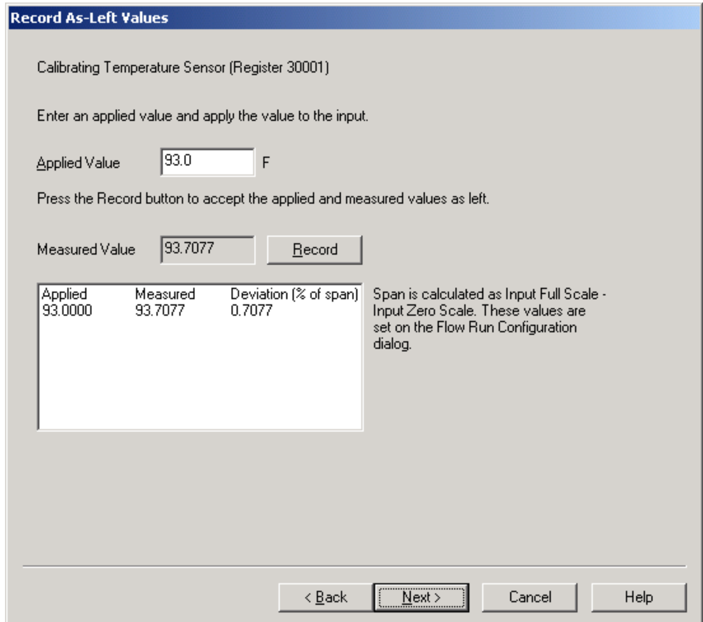
For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

Click on the **Next>** button when the calibration is complete.

Calibration Step 5: Record As Left Values

As-left readings indicate how the sensor was calibrated. These can be used to verify sensor calibration. Follow the procedure your company has set for taking as-left readings. You need to record at least one as-left reading.



To take as-left readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.
- When the measured value from the process has settled, click on the **Record** button to record an as-left reading.

Repeat the process to record additional readings.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

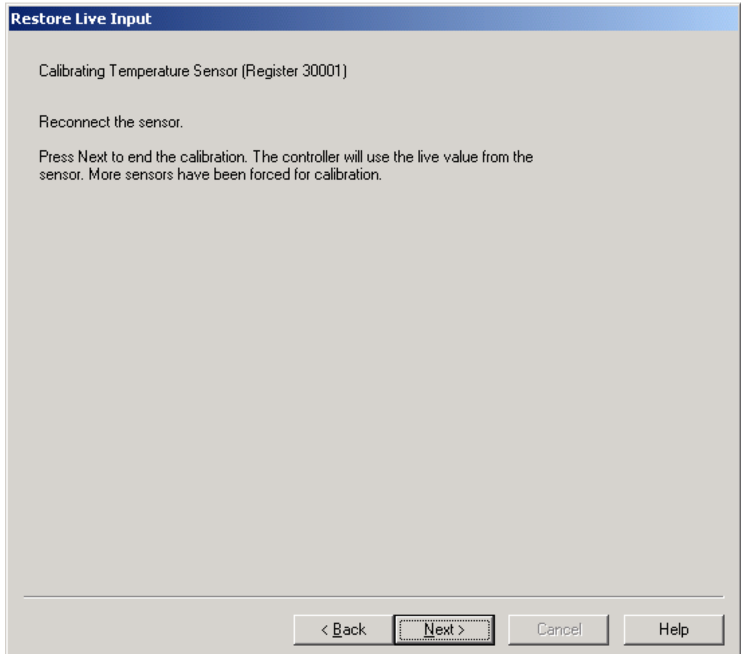
For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

- When the required readings are taken, click on the **Next>** button.

Calibration Step 6: Restore Live Input

The sensors need to be reconnected to the process and the input hardware before calibration is complete. Reconnect sensors and verify connections are correct.

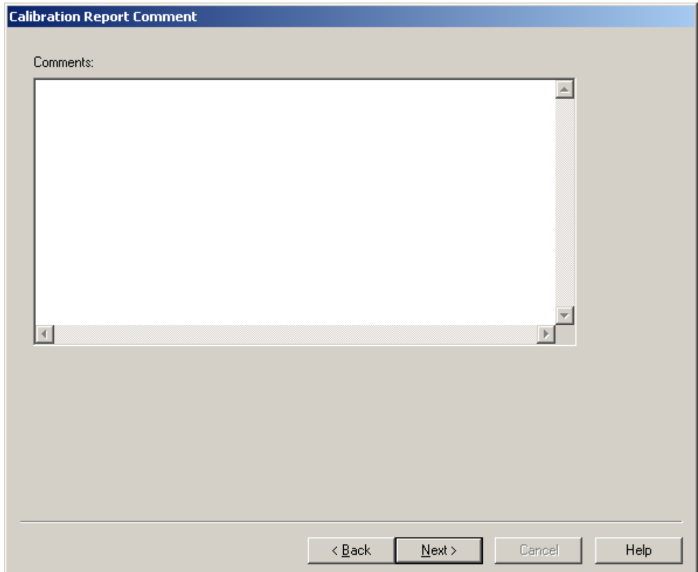


- Click on the **Next** button when the sensor is connected.

WARNING
The live value from all sensors is used as soon as you click **Next.** Be sure to connect al sensors first.

Calibration Step 6: Calibration Report Comment

Realflo creates, stores, and prints calibration reports for each calibration session performed. Comments may be added to the calibration report using the Calibration Report Comment dialog as shown below.

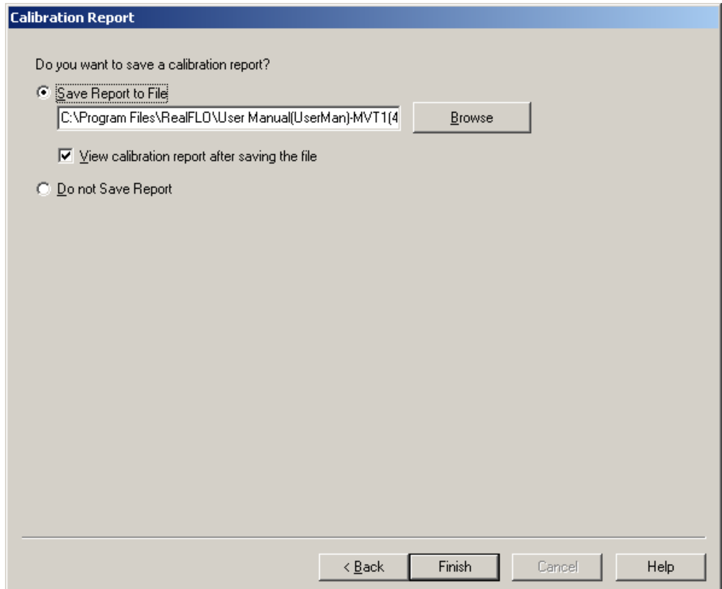


Enter any comments or leave the window blank.

- Click the **Next** button when completed entering comments.

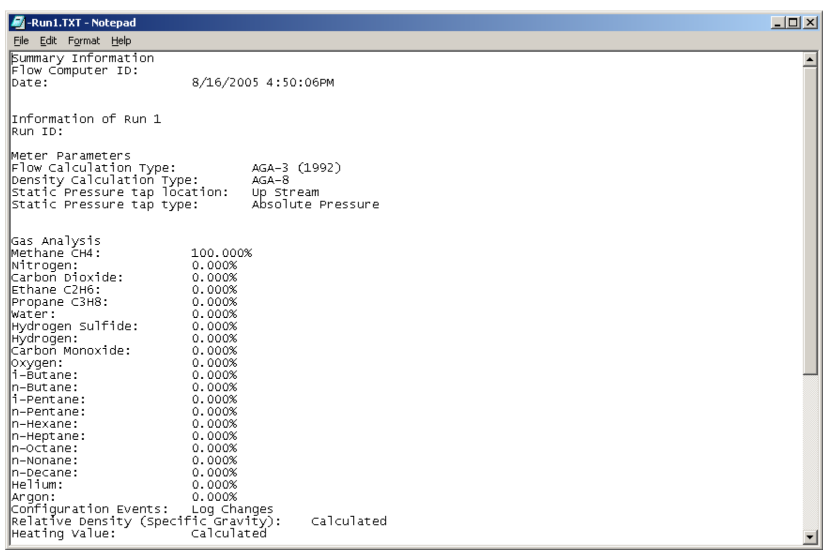
Calibration Step 7: Calibration Report

The Calibration Report dialog allows the saving of the calibration report.



- Select **Save Report to File** to save the report.
    - Type the name of the report in the Save Report to File window. The default location and name are specified on the ***Calibration Report Options*** dialog.
    - Select **Browse** to select a different file name.
- Check **View Calibration Report After Saving the File** to view the saved calibration report file. Default is checked.
- Select **Do not Save Report** to skip saving the calibration report.
- Click the Finis button to complete the calibration process.

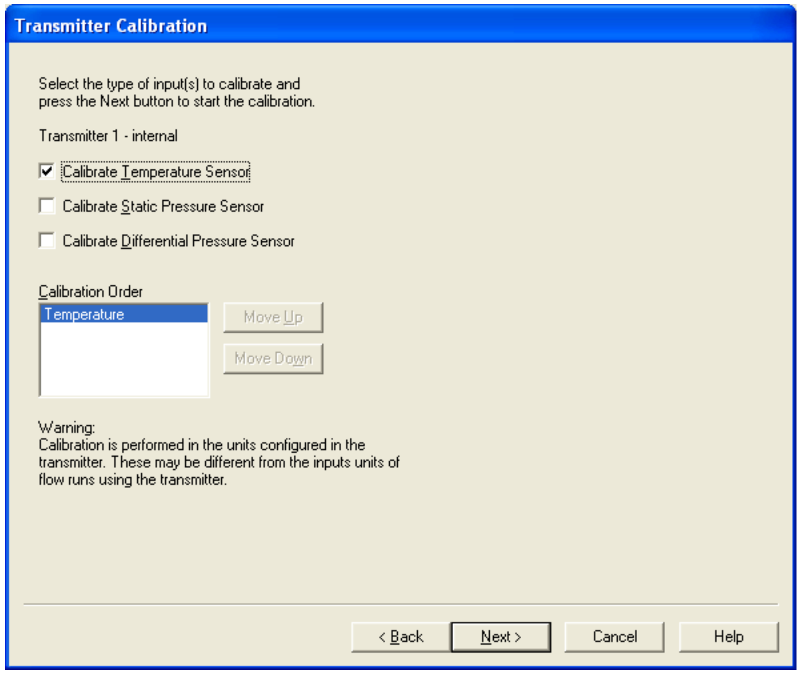
If selected the Calibration report will be displayed as shown below.




```
Summary Information
Flow Computer ID:
Date:                   8/16/2005 4:50:06PM


Information of Run 1
Run ID:

Meter Parameters
Flow Calculation Type:          AGA-3 (1992)
Density Calculation Type:       AGA-8
Static Pressure tap location:   Up Stream
Static Pressure tap type:       Absolute Pressure


Gas Analysis
Methane CH4:            100.000%
Nitrogen:               0.000%
Carbon Dioxide:         0.000%
Ethane C2H6:            0.000%
Propane C3H8:           0.000%
Water:                  0.000%
Hydrogen Sulfide:       0.000%
Hydrogen:               0.000%
Carbon Monoxide:        0.000%
Oxygen:                 0.000%
i-Butane:               0.000%
n-Butane:               0.000%
i-Pentane:              0.000%
n-Pentane:              0.000%
n-Hexane:               0.000%
n-Heptane:              0.000%
n-Octane:               0.000%
n-Nonane:               0.000%
n-Decane:               0.000%
Helium:                 0.000%
Argon:                  0.000%
Configuration Events:   Log Changes
Relative Density (Specific Gravity):    Calculated
Heating Value:          Calculated
```

MVT Calibration Procedure

When the MVT radio button is selected in the Sensor Calibration dialog the MVT Calibration dialog is displayed.



The transmitter number, transmitter tag name, the communication port and the transmitter address associated with this MVT transmitter are displayed to aid you in determining which input you are calibrating.

- Check the **Calibrate Temperature Sensor** check box to select the temperature sensor for calibration. This will add the ***Temperature*** to the Calibration order list box.
- Check the **Calibrate Static Pressure Sensor** check box to select the static pressure sensor for calibration. This will add the ***Static Pressure*** to the Calibration order list box.
- Check the **Calibrate Differential Pressure Sensor** check box to select the differential pressure sensor for calibration. This will add the ***Diff. Pressure*** to the Calibration order list box.

The **Calibration Order** list displays the list of sensors to be calibrated. Sensors are calibrated in order from the top of the list.

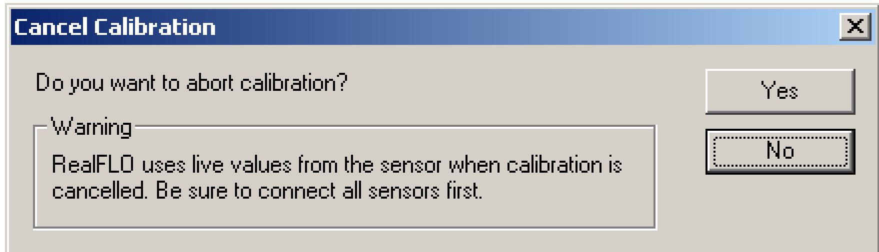
- Select **Move Up** button to move the specified item in the list up. The button is disabled if highlight item is on the top of the list or the list is empty.
- Select **Move Down** button to move the specified item in the list down. The button is disabled if highlight item is on the bottom of the list or the list is empty.

The **<Back** button is not enabled as this is the initial step.

The **Next>** button completes the selections and opens the Step 1: Force Value dialog.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



The live value from each sensor is used as soon as you click **Next.** Connect al sensors first.

WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

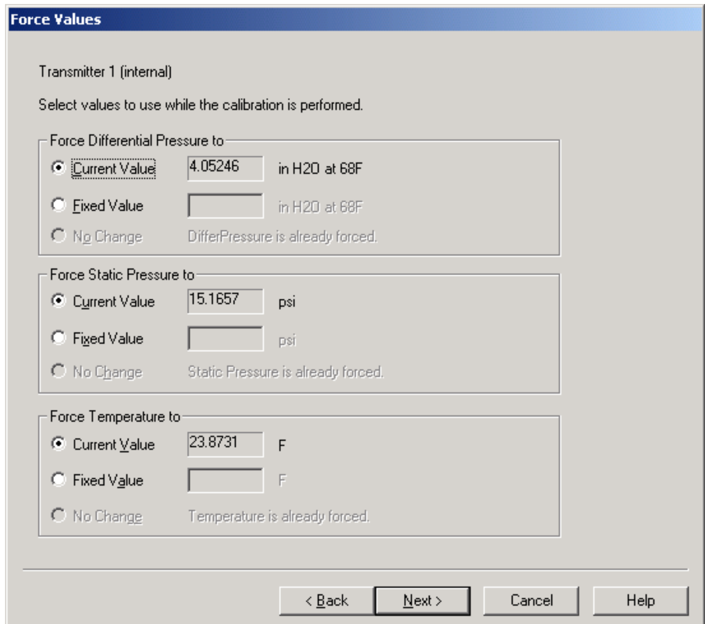
Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 1: Force Value

The flow calculations continue to execute while calibrating sensors. The sensor value needs to be forced to either the current value or a fixed value during calibration. This dialog lets you select the current value of the input or a fixed value of your choice.

When more than one sensor is selected, they need to each be forced to a current or fixed value before any of the other steps are performed.



Select the value you wish to use, for each sensor, by clicking the appropriate radio button for each sensor.

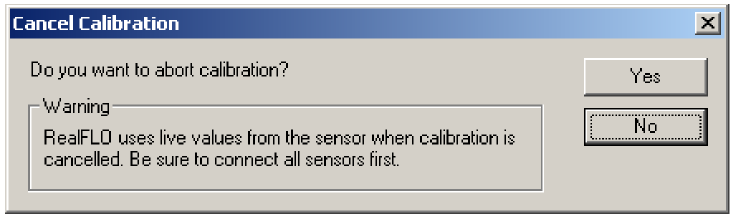
- Check the **Current Value** radio button to use the current value for the sensor.
- Check the **Fixed Value** radio button and enter a value to use for the calibration in the entry box.
- The **No Change** radio button will be selected if the value is currently forced. (You may still select one of the other two radio buttons if desired).

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

When the **Next>** button is pressed Realflo records the start of calibration for the sensor in the event log. The sensor input is forced. The sensor can now be disconnected to the process.

The **Cancel** button closes the dialog and stops the transmitter calibration.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



Realflo uses live values from the sensor when calibration is cancelled. Connect sensors first.

WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

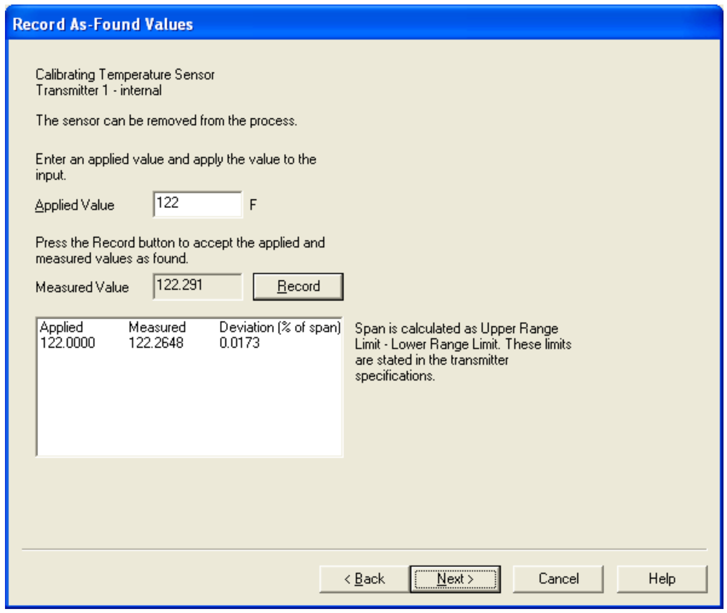
Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 2: Record As-Found Values

As-found readings indicate how the sensor was calibrated before adjustment. These can be used to correct flow measurement errors resulting from an out of calibration sensor. Follow the procedure your company has set for taking as-found readings. You need to record at least one as-found reading.

Realflo will record As-Found values to the unit types selected for the meter run. If the units type for the meter run and the MVT are not the same then the MVT units are scaled to the meter run units.



To take as-found readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.
- The measured value from the process is in the **Measured Value** box. When it has settled, click on the **Record** button to record an as-found reading.

Repeat the process to record additional readings.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For MVT Calibration the **deviation** is calculated as follows. The operating limits are read from the flow computer.

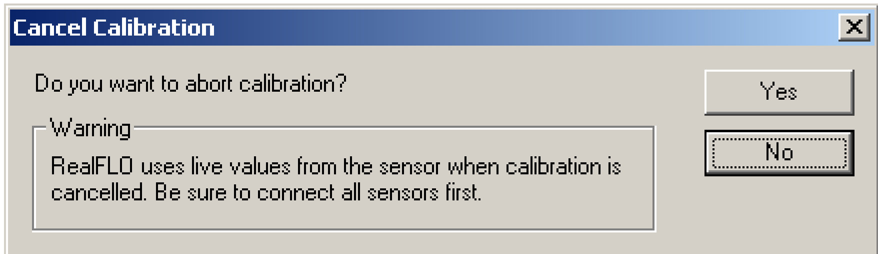
```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The **Next>** button proceeds to the next step.

The **Cancel** button is grayed and an as found reading needs to be recorded.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



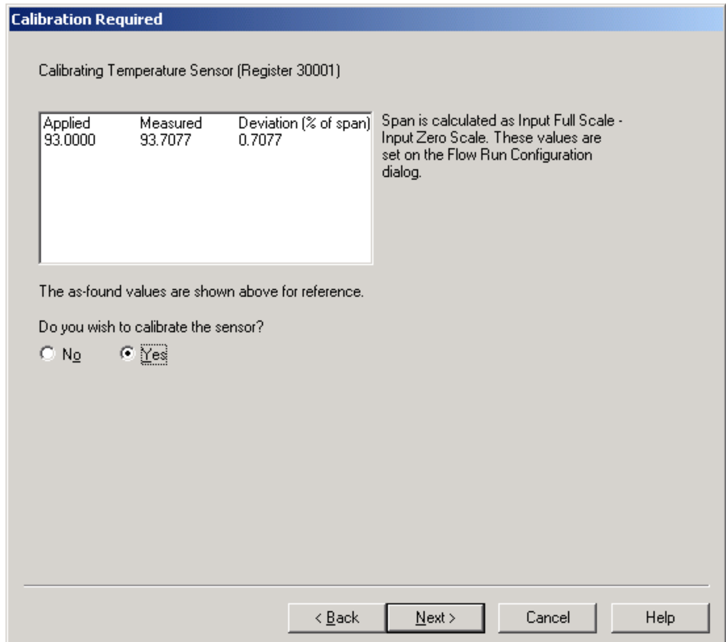
WARNING
Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

Calibration Step 3: Calibration Required

The as-found readings indicate if calibration is required. Examine the list of as-found readings. If the sensor is in need of calibration, select **Yes**. Otherwise select **No**.



As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For Run Calibration the deviation is calculated as follows. The output full scale and zero scale are taken from the input configuration for the run.

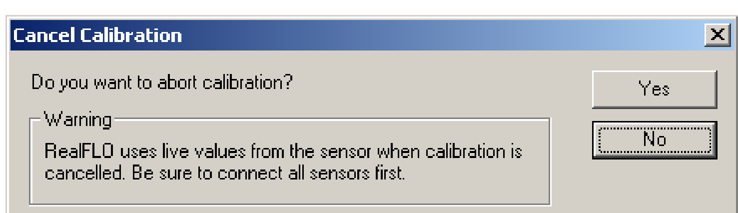
```
span = input full scale – input zero scale
deviation = (measured - applied) / span
```

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log.

The **Next>** button proceeds to the next step.

The **Cancel** button is grayed and an as found reading needs to be recorded.

When you click the **Cancel** button to abort the calibration the following message is displayed. Click **Yes** to abort the calibration. Click **No** to continue with the calibration. The default button is **No.**



WARNING

Realflo uses live values from the sensor when calibration is cancelled. Be sure to connect all sensors first.

Realflo does not erase any calibration events from the flow computer when canceling.

The **Help** button displays the online help file.

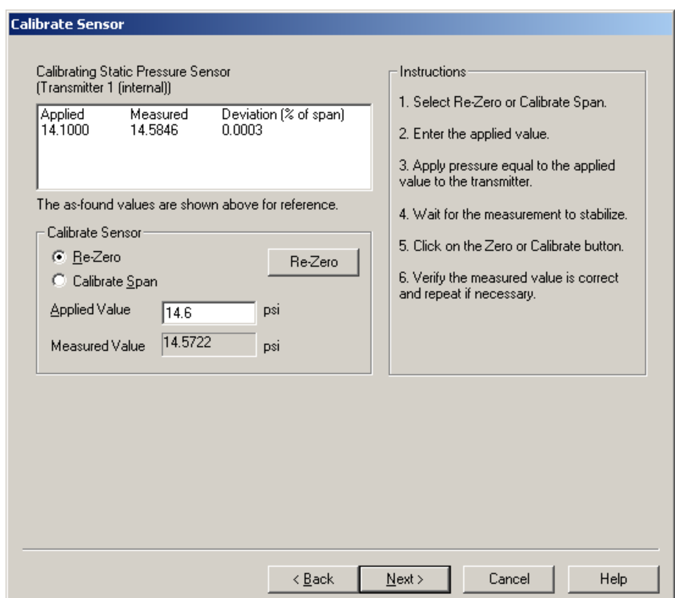
Calibration Step 4: Calibrate SCADAPack 4101, 4202 or 4203

Step four in the calibration procedure varies depending on the type of transmitter being calibrated. Use this section if you are calibrating a SCADAPack 4102 or a SCADAPack 4202 or 4203.

This dialog aids you in calibrating a sensor by displaying the measured value from the sensor and the as-found readings.

Follow the procedure your company or the sensor supplier has set to calibrate the sensor. When the sensor calibration is complete, you may wish to check the as-left measurements that will be recorded in the next step. This confirms that you have calibrated the sensor correctly before placing it back in service.

- The Static Pressure can only have a span calibration performed if at least 5% of the rated pressure is applied.
- The RTD Zero can only be adjusted +/- 1% of the RTD upper limit, typically 8.5 degrees C, relative to the settings used when a reset sensor command was last issued.



The list box displays as-found values listed in the list of ***Record As-Found Values*** dialog.

The **Measured Value** displays the measured value from the sensor.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

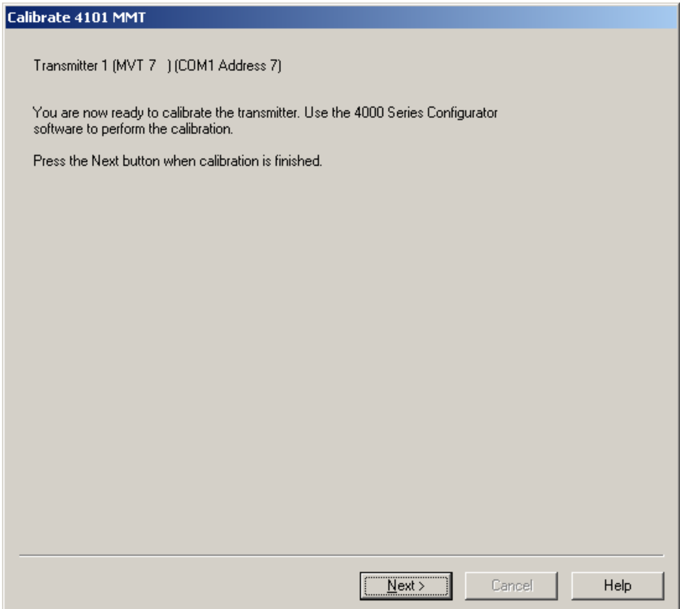
For MVT Calibration the deviation is calculated as follows. The operating limits are read from the flow computer.

```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

Calibration Step 4: Calibrate SCADAPack 4101

Step four in the calibration procedure varies depending on the type of transmitter being calibrated. Use this section if you are calibrating a SCADAPack 4101 transmitter.

The as-found readings, for each sensor, will indicate if calibration is required for the sensor. You are prompted to use the 4000 Configurator application to perform the calibration. The 4000 Configurator software is installed from the Control Microsystems Hardware Documentation CD.



The **Next>** button proceeds to the next step.

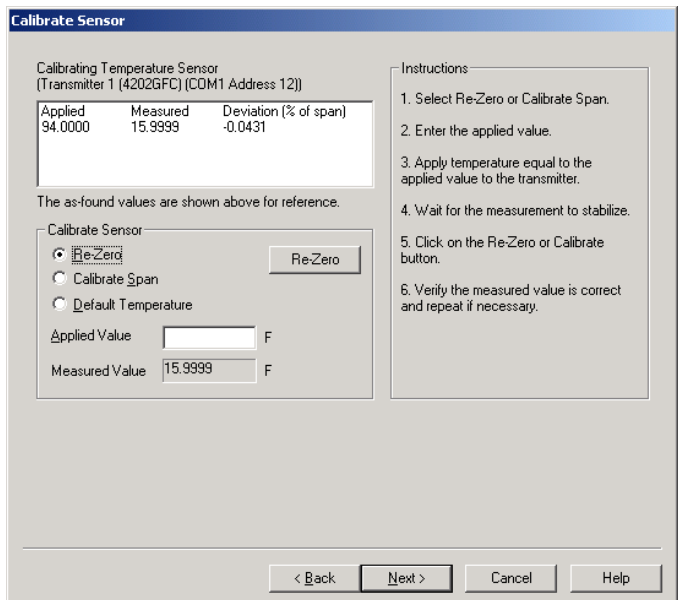
The **Help** button displays the online help file.

Calibration Step 4: Calibrate 3095 MVT

Step four in the calibration procedure varies depending on the type of transmitter being calibrated. Use this section if you are calibrating a 3905 transmitter.

This dialog aids you in calibrating a sensor by displaying the measured value from the sensor and the as-found readings.

Follow the procedure your company or the sensor supplier has set to calibrate the sensor. When the sensor calibration is complete, you may wish to check the as-left measurements that will be recorded in the next step. This confirms that you have calibrated the sensor correctly before placing it back in service.



The list box displays as-found values listed in the list of ***Record As-Found Values*** dialog.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For MVT Calibration the deviation is calculated as follows. The operating limits are read from the flow computer.

```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

The Calibrate Sensor section of the Calibrate Sensor dialog displays the current calibration settings and selectable radio buttons for configuring the sensor calibration.

The Radio buttons enable the changing of the zero and span for the Temperature, Static Pressure and Differential Pressure sensors. For Temperature sensors, an additional radio button allows the user to fix the Temperature value in the event the temperature reading is outside the configured limits.

- Select the **Re-Zero** radio button to enable a new entry in the **Applied Value** field. This field displays the current zero value. The button is labeled **Re-Zero** if the **Re-Zero** radio button is selected. Clicking the **Re-Zero** button writes the zero applied value to the transmitter immediately.

- Select the **Calculate Span** radio button to enable a new entry in the **Applied Value** field. This field displays the current span value. The button is labeled **Calibrate** if the **Calibrate Span** radio button is selected. Clicking the **Calibrate** button writes the span applied value to the transmitter immediately.

When calibrating the temperature sensor you may select the **Default Temperature** radio button to enable a new entry in the **Applied Value** field. The button is labeled **Set** if the **Default Temperature** radio button is selected. The transmitter returns the fixed temperature value if the RTD is not working, or if the RTD is not connected. The valid range is –40 to 1200 °F or –40 to 648.89 °C. The default value is 60 °F or 15.56 °C. The new fixed temperature point is written to the transmitter immediately.

The **Measured Value** displays the measured value from the sensor.

Realflo records the points at which MVT calibration was performed in the event log.

Each time the **Re-Zero** button is clicked the following information is recorded.

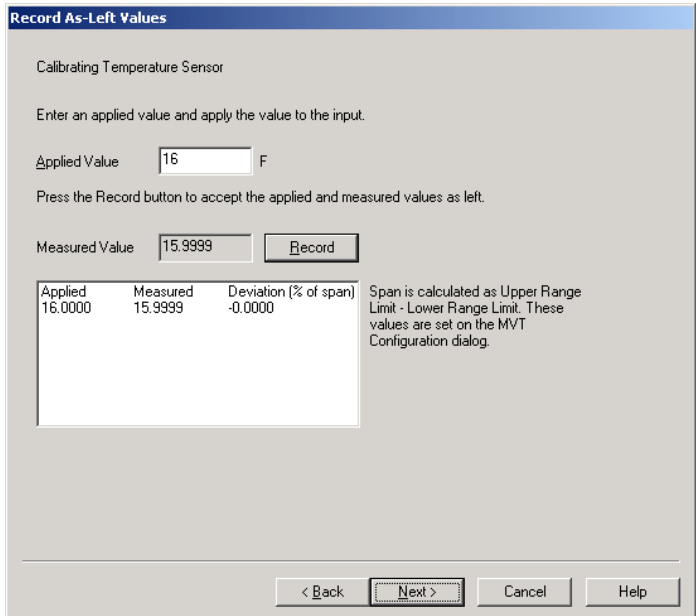
Event Name	MVT Re-zero
Current Value	The applied value entered by the user
Previous Value	The measured value from the controller

Each time the **Calibrate** button is clicked the following information is recorded.

Event Name	MVT Span Calibration
Current Value	The applied value entered by the user
Previous Value	The measured value from the controller

Calibration Step 5: Record As Left Values

As-left readings indicate how the sensor was calibrated. These can be used to verify sensor calibration. Follow the procedure your company has set for taking as-left readings. You need to record at least one as-left reading.



Realflo will record all As Found values to the units type selected for the meter run. If the units type for the meter run and the MVT are not the same then the MVT units are scaled to the meter run units.

To take as-left readings:

- Apply a known signal to the sensor, or measure the signal applied to the sensor with a calibrated instrument.
- Enter the applied value in the **Applied Value** edit box.
- The measured value from the process is displayed. When it has settled, click on the **Record** button to record an as-left reading.

As readings are recorded they are automatically entered in the record window. The applied values are listed under the Applied column. The measured values are listed under the Measured column and the deviation between the readings is listed under the Deviation column.

For MVT Calibration the deviation is calculated as follows. The operating limits are read from the flow computer.

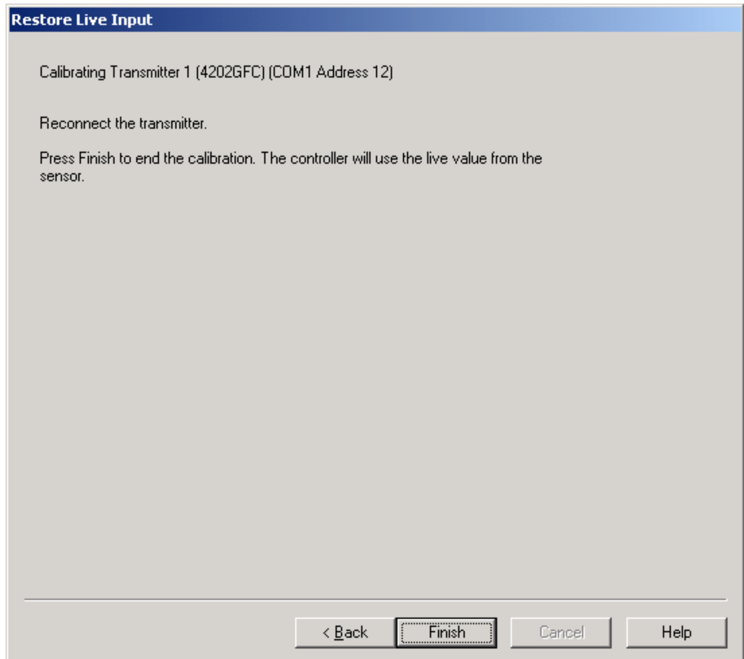
```
span = upper range limit - lower range limit
deviation = (measured - applied) / span
```

Repeat the process to record additional readings.

- When required readings are taken, click on the **Next>** button.

Calibration Step 6: Restore Live Input

The sensors need to be reconnected to the process and the input hardware before calibration is complete. Reconnect sensors and verify connections are correct.



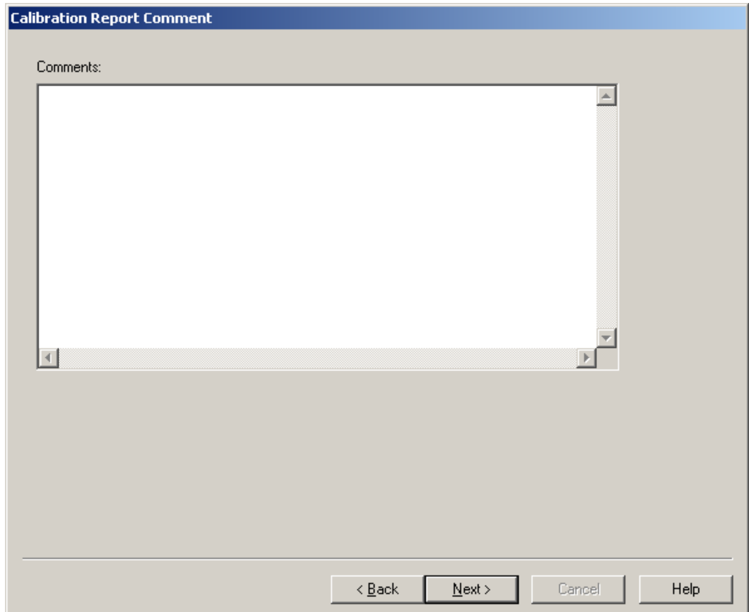
- Click on the **Finish** button when the sensor is connected.

WARNING

The live value from all sensors is used as soon as the **Finish** button is clicked. Be sure to connect all sensors first.

Calibration Step 7: Calibration Report Comment

Realflo creates, stores, and prints calibration reports for each calibration session performed. Comments may be added to the calibration report using the Calibration Report Comment dialog as shown below.

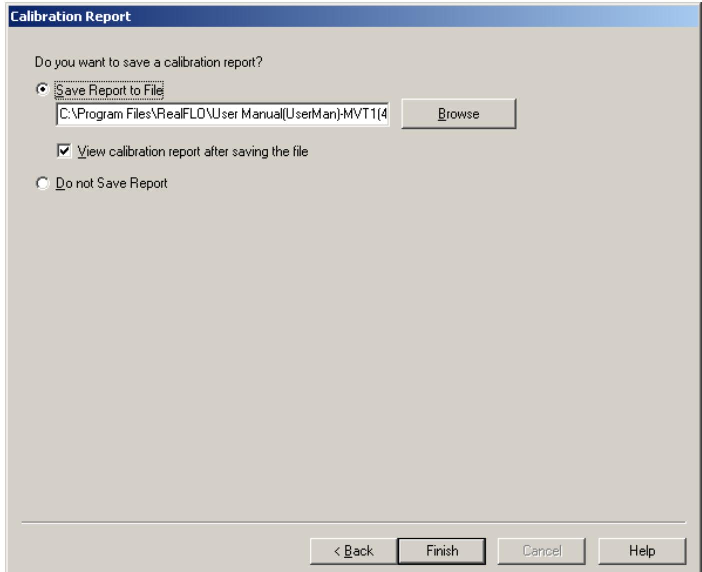


Enter any comments or leave the window blank.

- Click the **Next** button when completed entering comments.

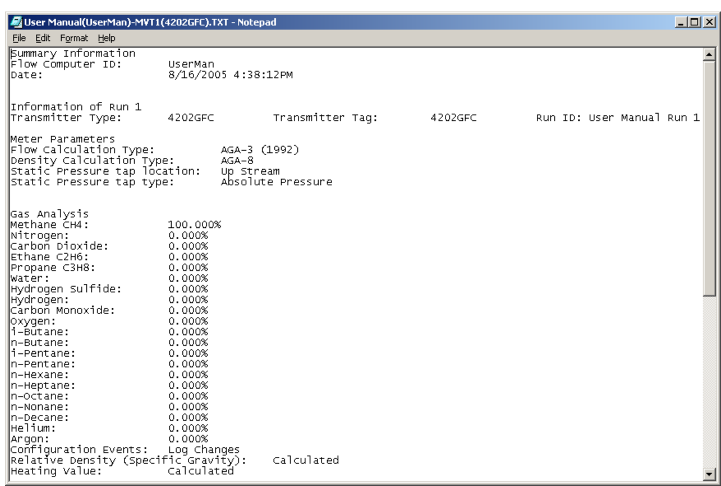
Calibration Step 8: Calibration Report

The Calibration Report dialog allows the saving of the calibration report.



- Select **Save Report to File** to save the report.
  - Type the name of the report in the Save Report to File window. The default location and name are specified on the Calibration Report Options dialog.
  - Select Browse to select a different file name.
- Check **View Calibration Report After Saving the File** to view the saved calibration report file. Default is checked.
- Select **Do not Save Report** to skip saving the calibration report.
- Click the Finis button to complete the calibration process.

If selected the Calibration report will be displayed as shown below.



Change Orifice Plate Wizard

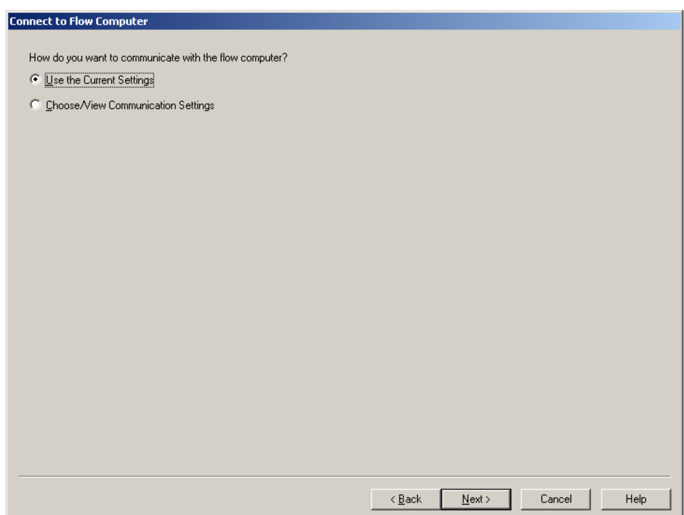
The Change Orifice Plate wizard enables the orifice plate to be changed for AGA-3 meter runs. This wizard supports Dual Chamber Orifice fittings and Singe Chamber Orifice fittings. This wizard will prompt you through the plate change procedure.

For each step in the wizard a dialog is presented to enter the parameters for the step. Each dialog contains four buttons to allow navigation through the wizard.

- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.
- **Cancel** cancels the operation and closes the wizard. Steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.
- **Help** opens the user manual.

Connect to Flow Computer

The connect to flow computer step defines the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two selections.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo. (The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are: COM 1 (serial port on the PC), 9600 baud, no parity, 8 Data bits, and 1 Stop bit. The default Modbus address Realflo will connect to is station 1.

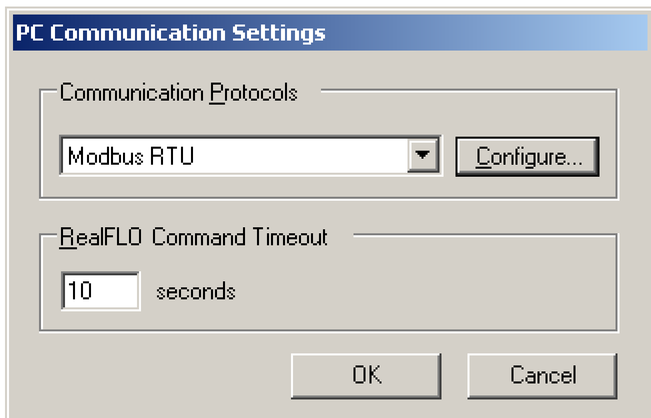
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click the **Next>** button to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

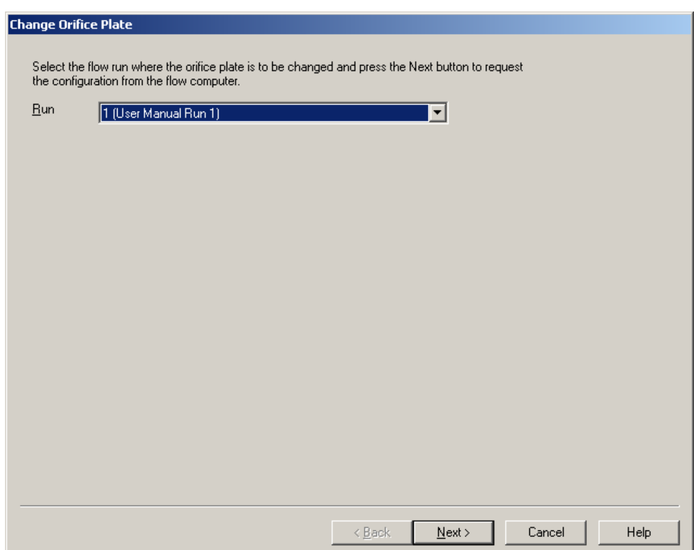
See the section **Communication** >> **PC Communication Settings Command** in the **Realflo Expert Mode Reference** section of this manual for complete details on the parameter settings in this dialog.

You need to know the communication settings for the connection to the flow computer to use this step.



Select Meter Run

This step selects which meter run the orifice plate is to be changed.

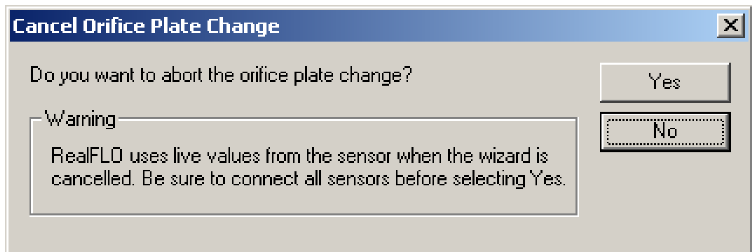


The **Run** dropdown selection displays runs using AGA –3 flow calculations. Select the run to change or inspect the orifice plate.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Next>** button completes the run selection and the wizard moves to the next step. This button is grayed if there are no flow runs configured to use the AGA-3 flow calculation.

The **Cancel** button aborts the plate change and displays the following message.



- Click **Yes** to abort the calibration.
- Click **No** to continue with the plate change. The default button is No.

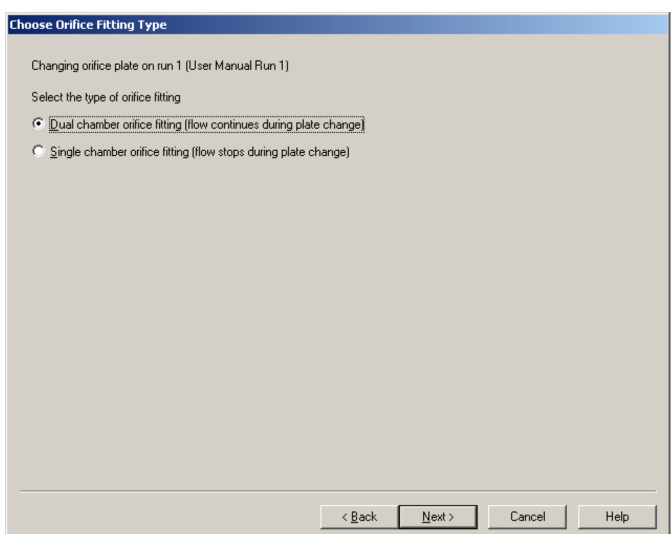
WARNING
Realflo uses live values from the sensor when the plate change is cancelled. Be sure to connect all sensors first.

Realflo does not erase any events from the flow computer when the plate change is cancelled. Realflo restores live values (ends forcing) when Cancel is clicked.

The **Help** button displays the online help file.

Choose Orifice Fitting Type Step

This page allows the user to select the type of orifice fitting.



Select **Dual Chamber Orifice Fitting** if a dual chamber fitting is present. Flow accumulation with estimated values will continue during the plate change.

Select **Singe Chamber Orifice Fitting** if a single chamber fitting is present. Flow accumulation will stop during the plate change.

The **Next** button moves to the next step.

- The next step is described in the section **Dual Chamber Orifice** if a dual chamber fitting is selected.
- The next step is described in the section **Single Chamber Orifice** if a single chamber fitting is selected.

The **Cancel** button closes the dialog and stops the plate change procedure.

The **Help** button displays the online Help file.

Dual Chamber Orifice

A dual chamber orifice allows the user to change, or inspect, the orifice plate without stopping the flow. These are generally large custody transfer sites where the orifice fitting is bypassed during the change or inspection procedure.

The Change Orifice Plate Command forces the Static Pressure, Differential Pressure and Temperature inputs to a fixed value during the orifice plate change or inspection procedure. This command is disabled if the Update Readings command is enabled. The flow is estimated during the procedure using the fixed values.

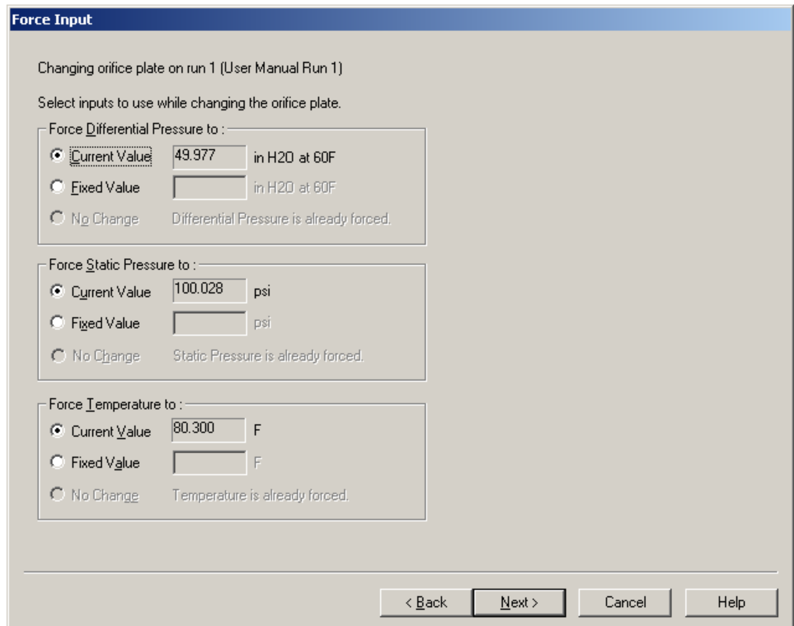
This command allows a user to place a flow run into estimation mode to allow an orifice plate to be changed or inspected. Changing the orifice plate involves the following steps.

- Set the estimated flow to be used during the orifice plate change by forcing inputs to fixed values.
- Change the orifice size.
- Complete the orifice plate change and resume normal flow measurement.

The Flow Computer ID is checked when the Change Orifice Plate command is selected. If the Flow Computer ID does not match the ID Realflo displays the message “ `The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file`.” The command is aborted.

Force Input Step

This step forces the flow run inputs. An estimated flow will be calculated while the plate change is in progress. The current values are updated every second.



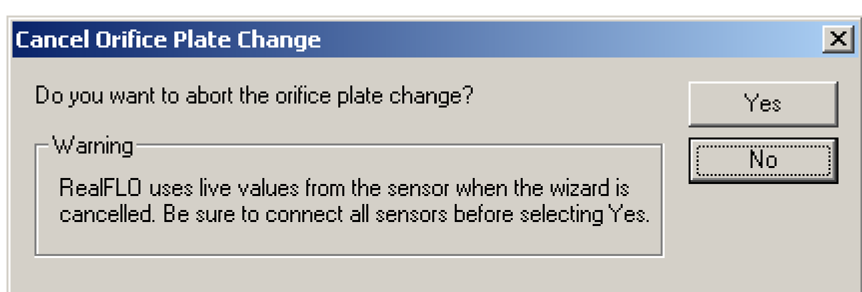
Select the value you wish to use, for each sensor, by clicking the appropriate radio button for each sensor.

- Check the **Current Value** radio button to use the current value for the sensor.
- Check the **Fixed Value** radio button and enter a value to use for the calibration in the entry box.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Next>** button completes the force inputs step and the wizard moves to the next step. Realflo records the start of the plate change procedure in the event log and forces the sensor inputs.

The **Cancel** button aborts the plate change and displays the following message.



- Click **Yes** to abort the calibration.

- Click **No** to continue with the plate change. The default button is No.

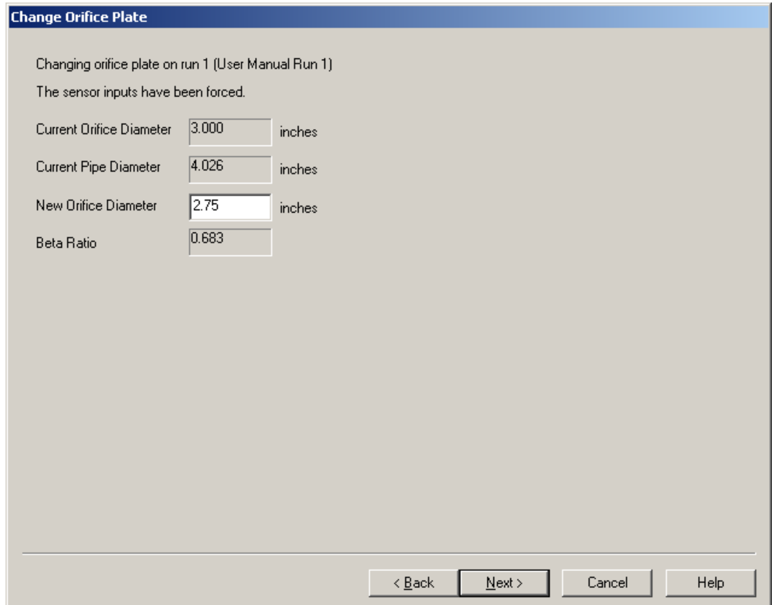
WARNING
Realflo uses live values from the sensor when the plate change is cancelled. Be sure to connect all sensors first.

Realflo does not erase any events from the flow computer when the plate change is cancelled. Realflo restores live values (ends forcing) when Cancel is clicked.

The **Help** button displays the online help file.

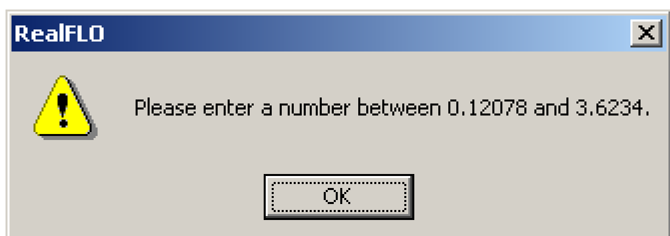
Change Orifice Plate Step

The orifice plate can now be changed. The forced inputs are used while the change is in progress. This dialog allows you to enter the new orifice plate diameter.



The **Current Orifice Diameter** and **Current Pipe Diameter** are displayed for reference.

Enter the new orifice size in the **New Orifice Diameter** entry box. If the diameter is not valid, Realflo displays the following a message box.



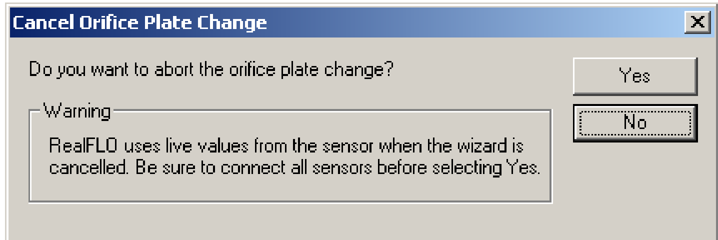
You need to enter a valid orifice diameter. Click the OK button to return to the Change Orifice dialog.

The **Beta Ratio** is calculated and displayed for orifice diameter changes.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Next>** button completes the change orifice step and the wizard moves to the last step.

The **Cancel** button aborts the plate change and displays the following message.



- Click **Yes** to abort the calibration.
- Click **No** to continue with the plate change. The default button is No.

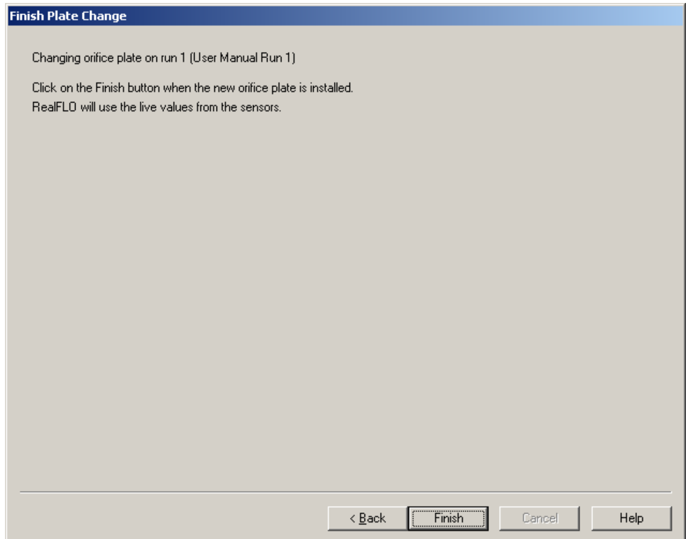
WARNING
Realflo uses live values from the sensor when the plate change is cancelled. Be sure to connect all sensors first.

Realflo does not erase any events from the flow computer when the plate change is cancelled. Realflo restores live values (ends forcing) when Cancel is clicked.

The **Help** button displays the online help file.

Complete Orifice Plate Change

The Finish Plate Change is the last step in the Plate Change wizard.



The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

The **Finish** button completes the orifice plate change wizard and closes the dialog. Realflo restores the sensor live values

The **Help** button displays the online help file.

Single Chamber Orifice

A single chamber orifice requires the flow be stopped while an orifice plate is changed.

The Change Orifice Plate command prompts the user to stop the flow before changing the plate and start the flow after changing the plate.

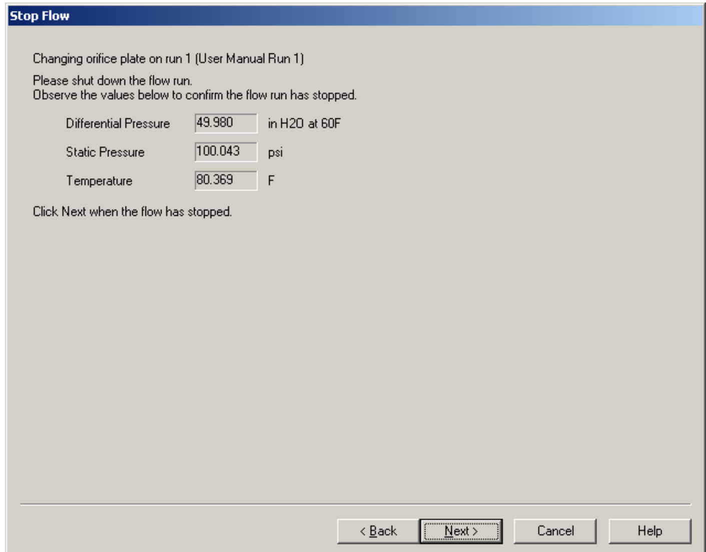
Changing the orifice plate involves the following steps.

- Confirm that flow has stopped.
- Change the orifice size.
- Complete the orifice plate change.

The Flow Computer ID is checked when the Change Orifice Plate command is selected. If the Flow Computer ID does not match the ID Realflo displays the message “ The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file.” The command is aborted.

Stop Flow Step

This step stops the flow run. The current inputs can be monitored while the flow is stopped.



The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up. For example, backing up to the force values step does not restore the live values.

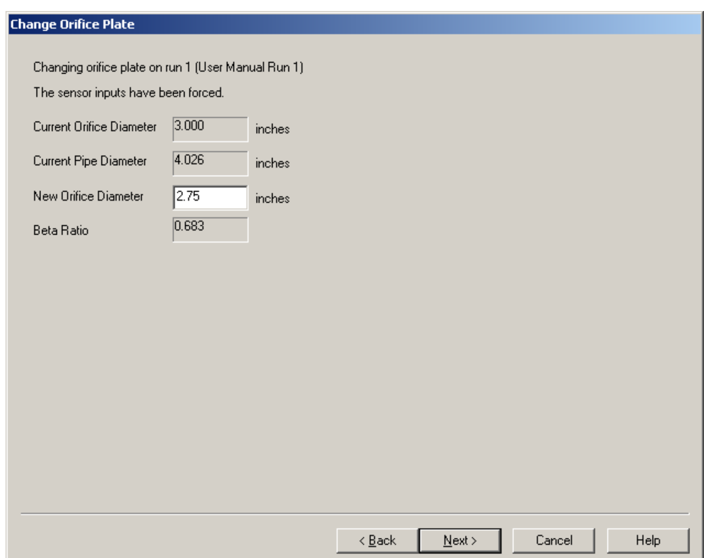
The **Next>** button completes the Stop Flow step and the wizard moves to the next step. Realflo records the start of the plate change procedure in the event log and forces the sensor inputs.

The **Cancel** button aborts the plate change and closes the wizard.

The **Help** button displays the online help file.

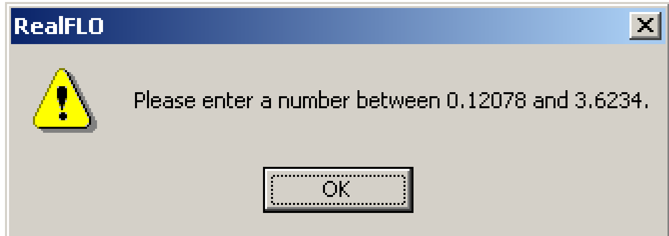
Change Orifice Plate Step

The orifice plate can now be changed. The forced inputs are used while the change is in progress. This dialog allows you to enter the new orifice plate diameter.



The **Current Orifice Diameter** and **Current Pipe Diameter** are displayed for reference.

Enter the new orifice size in the **New Orifice Diameter** entry box. If the diameter is not valid, Realflo displays the following a message box.



You need to enter a valid orifice diameter. Click the OK button to return to the Change Orifice dialog.

The **Beta Ratio** is calculated and displayed for orifice diameter changes.

The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up.

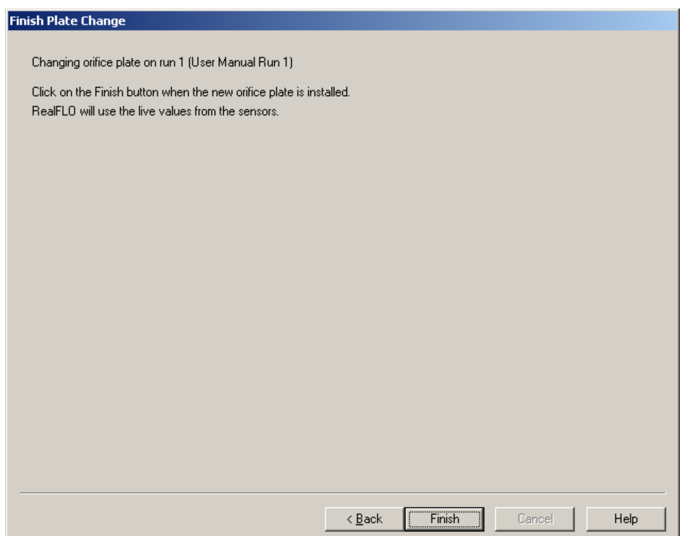
The **Next>** button completes the change orifice step and the wizard moves to the last step.

The **Cancel** button aborts the plate change and closes the wizard.

The **Help** button displays the online help file.

Complete Orifice Plate Change

The Finish Plate Change is the last step in the Plate Change wizard.



The **<Back** button returns to the previous step. Backing up does not erase events from the flow computer event log. Realflo does not attempt to reverse the effect of a previous step when backing up.

The **Finish** button completes the orifice plate change wizard and closes the dialog. Realflo restores the sensor live values

The **Help** button displays the online help file.

Force Inputs Wizard

The Force Sensor wizard allows forcing and unforcing of the value of the temperature sensor, static pressure sensor, differential pressure sensor, or pulse counter input. Flow calculations continue to execute while sensors are forced.

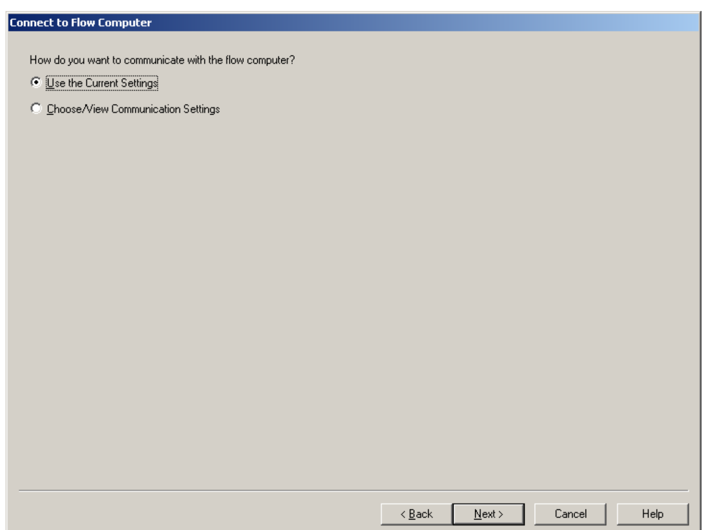
The flow computer ID is checked when the Force Inputs command is selected. If the flow computer ID does not match the ID in the dialog Realflo displays the message " The Flow Computer ID from the flow computer does not match the Flow Computer ID from the file."

For each step in the wizard a dialog is presented to enter the parameters for the step. Each dialog contains four buttons to allow navigation through the wizard.

- **<Back** returns to the previous step in the wizard. This button is disabled on the first step of a wizard.
- **Next>** moves to the next step in the wizard. This button is hidden on the last step of a wizard.
- **Finish** is displayed on the final step of a wizard in place of the Next button. It finishes the operation. This button is hidden on other steps.
- **Cancel** cancels the operation and closes the wizard. Steps performed thus far in the wizard are cancelled. Pressing the ESC key performs the same action as Cancel.
- **Help** opens the user manual.

Connect to Flow Computer

The connect to flow computer step defines the communication settings for the connection between the PC running the Realflo application and the target flow computer.



The **How do you want to communicate with the flow computer?** prompt provides two selections.

The **Use the Current Settings** option sets the default communication settings for Realflo. These settings are for the PC that is running Realflo.

(The communication settings for the PC running Realflo and the communication settings in the flow computer need to match).

The default communication settings are: COM 1 (serial port on the PC), 9600 baud, no parity, 8 Data bits, and 1 Stop bit. The default Modbus address Realflo will connect to is station 1.

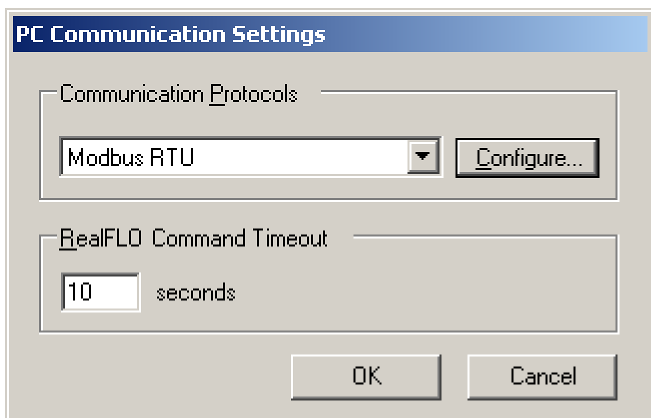
Use this selection if the serial port on your PC is COM 1 and the serial port settings for the serial port on the flow computer are set for default (9600, 8,n,1 and Modbus address 1).

- Click the **Next>** button to begin communication with the flow computer and move to the next step in the wizard.

The **Choose/View Communication Setup** option opens the PC Communication Settings dialog as shown below. This allows you to view the default settings and to change the PC communication setting for the type of connection you are using to communicate with the flow computer.

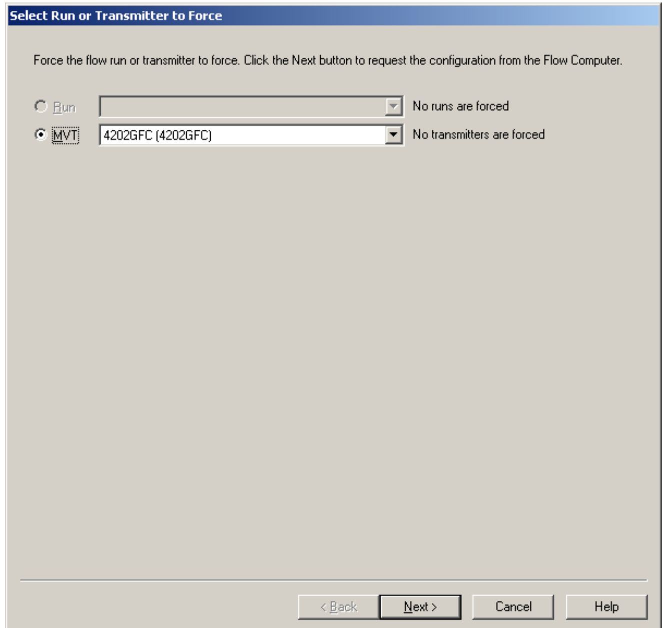
See the section **Communication** >> **PC Communication Settings Command** in the **Realflo Expert Mode Reference** section of this manual for complete details on the parameter settings in this dialog.

You need to know the communication settings for the connection to the flow computer to use this step.



Select Run or Transmitter to Force

This step selects the run or transmitter to force.



Select **Run** to force the sensor inputs for a flow run using analog or pulse sensors. Select the run to be forced from the dropdown list. The Run controls are disabled if there are no runs using analog or pulse sensors.

See the section **Force Run Inputs** below for information on forcing Run inputs.

Select **MVT** to force the inputs from an MVT. Select the MVT to be forced from the dropdown list beside it. The MVT controls are disabled if there are no transmitters configured.

See the section **Force Transmitter Sensor** Inputs below for information on forcing MVT inputs.

The **Back** button is disabled, as this is the first step in the wizard.

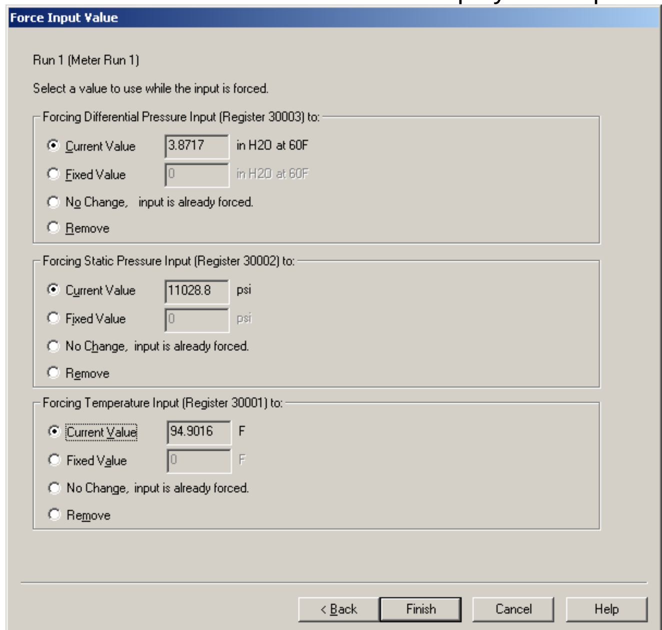
The **Next** starts the force procedure.

The **Cancel** closes the wizard.

The **Help** displays the online help file.

Force Run Inputs

When the Force Run is selected the Force Input Values dialog is displayed as shown below. The Force Input Values step selects the analog inputs of a flow run which will be forced or unforced. It displays the inputs that can be forced.



The Force Input Value dialog contains sections for Force Differential Pressure Input, Force Static Pressure Input and Force Temperature Input. When AGA-7 calculation type is used the dialog contains a section for Force Pulse Counter Input instead of Force Differential Pressure Input.

For each input the following parameters are available:

- Select **Current Value** to use the current value for the sensor. The current value is shown beside the control and updates continuously.
- Select **Fixed Value** to use a fixed value. Type the value in the edit box.
- Select **No Change, input is already forced** to leave the input in its current state. This is selected by default if the value is already forced. This is disabled if the input is not forced.
- Select **Remove** to remove the existing forcing. This button is disabled if the input is not forced.

The **Back** button moves back to the Select Run or Transmitter to Force step.

Backing up does not erase events from the flow computer event log, or remove forcing from inputs previously processed.

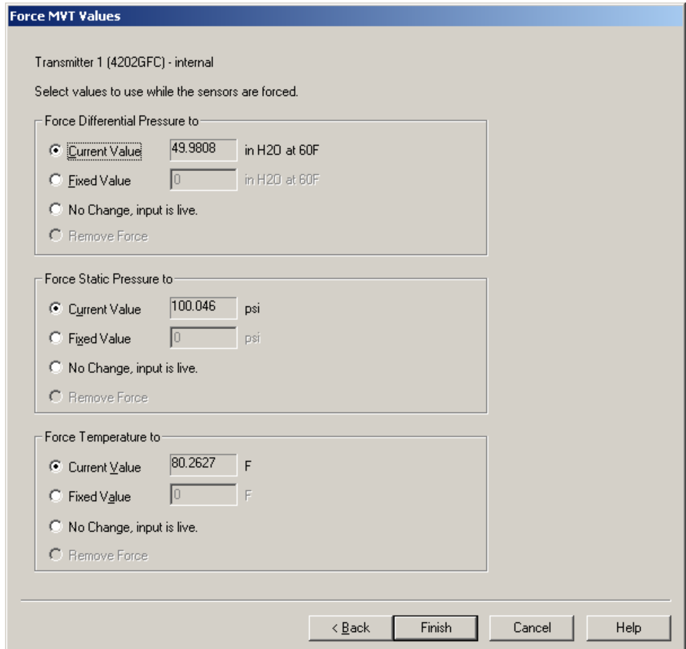
The **Finish** button completes the Force Input Value process and closes the dialog.

The **Cancel** button closes the wizard. This does not undo any changes. Any input that is already forced will remain forced.

The **Help** displays the online help file.

Force MVT Inputs

This step shows the selected MVT inputs. The inputs can be forced to the current value or a fixed value, left as it is, or the forcing can be removed. The transmitter number, transmitter tag name, the communication port and the transmitter address associated with this MVT transmitter are displayed to aid you in determining which input you are forcing.



The MVT Values dialog contains sections for Force Differential Pressure, Force Static Pressure and Force Temperature.

For each input the following parameters are available:

- Select **Current Value** to use the current value for the sensor. The current value is shown beside the control and updates continuously.
- Select **Fixed Value** to use a fixed value. Type the value in the edit box.
- Select **No Change, input is already forced** to leave the input in its current state. This is selected by default if the value is already forced. This is disabled if the input is not forced.
- Select **Remove Force** to remove the existing forcing. This button is disabled if the input is not forced.

The **Back** button moves back to the Select Run or Transmitter to Force step. Backing up does not erase events from the flow computer event log, or remove forcing from inputs previously processed.

The **Finish** button completes the Force Input Value process and closes the dialog.

The **Cancel** button closes the wizard. This does not undo any changes. Any input that is already forced will remain forced.

The **Help** displays the online help file.

The same MVT can be used for more than one flow run. Realflo forces the value for each run.

TeleBUS Protocol Interface

This section describes communication with a SCADA system.

Data interchange, including flow history data, is accomplished using the TeleBUS protocol. TeleBUS is fully compatible with standard Modbus drivers.

Data may be retrieved over any SCADA communications system while taking advantage of the error detection and non-proprietary nature of the Modbus protocol.

Register Addresses

The TeleBUS protocol registers used by the flow calculation routine for configuration, display and data archiving are called holding registers. Holding registers have a five-digit address in the range of 40001 to 49999. The data values in these registers may be read or written to by any software package that supports the Modbus protocol.

TeleBUS Registers Used by the Flow Computer

The flow calculation routine in the flow computer uses holding registers in the ranges shown below. These registers are described in the following sections of this manual. A Telepace Ladder Logic program that may be executing simultaneously on the flow computer cannot use the registers in this range.

Configuration and Control Registers	49500 to 49999
Requested Data Registers	48500 to 49499.
Meter Run 1 Data Registers	47500 to 48499
Meter Run 2 Data Registers	46500 to 47499
Meter Run 3 Data Registers	45500 to 46499
Requested Daily History Registers	44500 to 45499.
Meter Run 4 Data Registers	44400 to 44499
Meter Run 5 Data Registers	44300 to 44399
Meter Run 6 Data Registers	44200 to 44299
Meter Run 7 Data Registers	44100 to 44199
Meter Run 8 Data Registers	44000 to 44099
Meter Run 9 Data Registers	43900 to 43999
Meter Run 10 Data Registers	43800 to 43899
MVT Configuration Registers	43700 to 43799
MVT Data Registers	43600 to 43689
MVT Internal Registers	38000 to 38999
Display Configuration Registers	43470 to 43499

Process I/O Configuration Registers 43400 to 43469

Uncorrected Accumulated Flow, runs 1 to 10 43300 to 43398

SolarPack Configuration/Accumulation 43180 to 43260

In addition to the above registers the SCADAPack 4202 and 4203 controllers use the following registers for transmitter parameters and data. These registers cannot be used if a SCADAPack 4202 or 4203 controller is used.

SCADAPack 4202 and 4203 data and parameters registers 40001 to 40499

Data Formats

The TeleBUS protocol interface allows for data access and configuration locally or remotely, using any software running the Modbus protocol. Data are stored in several formats in registers. Some formats take more than one register for a number. These are described in the table below.

Data Type	Registers Required	Description
sint	1	Signed integer in the range –32767 to 32767.
uint	1	Unsigned integer in the range 0 to 65535.
slong	2	Signed long integer in the range -2,147,483,647 to 2,147,483,647. The lower numbered register contains the higher order word.
ulong	2	Unsigned long integer in the range 0 to 4,294,967,295. The lower numbered register contains the higher order word.
float	2	IEEE single precision floating-point number. The lower numbered register contains the higher order word.
userID	4	8-byte string packed into four registers. The first register contains the first two characters of the string, etc. The first character is in the low order byte, the second in the high order byte. The string is terminated with a NULL (= 0) character if it is less than 8 characters. Set the first register to 0 to indicate a NULL (empty) string.
runID	8	16-byte string packed into eight registers. The first register contains the first two characters of the string, etc. The first character is in the low order byte, the second in the high order byte. The string is terminated with a NULL (= 0) character if it is less than 16 characters. Set the first register to 0 to indicate a NULL (empty) string.

Data Type	Registers Required	Description
RunID2	16	32-byte string packed into 16 registers. The first register contains the first two characters of the string, etc. The first character is in the low order byte, the second in the high order byte. The string is terminated with a NULL (= 0) character if it is less than 32 characters. Set the first register to 0 to indicate a NULL (empty) string.

Register Data Formats

The HMI or SCADA Host Software in use with the flow computer calculations needs to either support these data formats with the Modbus protocol or allow for custom scripting such that numeric data written to, or read from the flow computer, can be interpreted in these formats.

Meter Run 1 Data Registers

This section contains a of tables listing Meter Data Registers utilized by the flow computer (gas flow routines). These registers display data from each meter run. The flow computer continuously updates these registers.

The registers shown in this section are for meter run 1. Data for additional meter runs will start at lower addresses.

Execution State Registers

These registers contain the execution state of the flow calculation.

Actual Register	*Data Type*	*Description*
47500	uint	Meter run = 1
47501	unit	Execution state: 1 = stopped 2 = running

Meter 1 Execution State Registers

Instantaneous and Accumulated Readings Registers

The instantaneous readings registers contain flow data. The values are instantaneous results. The ***Source*** column indicates the calculation that produces the value.

Values produced by the input, flow and accumulation calculations are updated once per second. Values produced by the compressibility calculation are updated each time the compressibility calculation recalculates. This time varies according to the calculation type and the changes in the inputs to the calculation (including configuration parameters). Check the time of the last update registers to determine when the calculation was performed.

Values for the previous contract day are updated at the end of the contract day. Values for the current contact day include flow for the contract day, even if an event causes a separate day record in the hourly history.

Actual Register	*Data Type*	*Description*	*Source*

Actual Register	Data Type	Description	Source
43390	float	Uncorrected flow volume during the current day (AGA-7 only)	Accumulation
43392	float	Uncorrected flow volume during the previous contract day (AGA-7 only)	Accumulation
43394	float	Uncorrected flow volume during the current month (AGA-7 only)	Accumulation
43396	float	Uncorrected flow volume during the previous month (AGA-7 only)	Accumulation
43398	float	Not used	
47502	uint	Calibration flags The calibration flag register indicates whether input values are forced or live. Bit 0 = Get current temperature Bit 1 = Get current static pressure Bit 2 = Get current differential pressure or mass flow Bit 3 = Get current pulse rate Bit 4 = Temperature is forced Bit 5 = Static pressure is forced Bit 6 = Differential pressure is forced Bit 7 = Pulse rate is forced Bit 14 = Generate calibration event Bit 15 = Generate orifice plate change event A bit set indicates input is forced. See also registers 47522 – 47528 and registers 47556, 47558 and 48470.	Input
47504	uint	Compressibility approximated flag 0 = compressibility value is calculated result 1 = compressibility value is approximate	Flow calculation
47505	uint	Input or flow calculation error code	Flow calculation
47506	uint	Compressibility calculation error code	Compressibility calculation
47507	Uint	Temperature Input Alarm	Input
47508	Uint	Static Pressure Input Alarm	Input

Actual Register	*Data Type*	*Description*	*Source*
47509	Uint	Differential Pressure (AGA-3 and V-Cone only) Turbine Pulses (AGA-7 only) input Alarm	Input
47510	ulong	Turbine meter pulses (AGA-7 only)	Input
47512	ulong	Number of flow calculations during the contract day	Accumulation
47514	float	Date of flow update (days since Jan 1, 1970)	Flow calculation
47516	float	Time of flow update (seconds since 00:00:00)	Flow calculation
47518	float	Date of compressibility update (days since Jan 1, 1970)	Compressibility calculation
47520	float	Time of compressibility update (seconds since 00:00:00)	
47522	float	Temperature	Input
47524	float	Static pressure	Input
47526	float	Differential pressure (AGA-3 and V-Cone only) Mass flow rate (AGA-11 only)	Input
47528	float	Flow volume rate	Flow calculation
47530	float	Flow mass rate	Flow calculation
47532	float	Flow energy rate	Flow calculation
47534	float	Flow extension (AGA-3 1990 only) Flow product (AGA-3 1985 only) Uncorrected flow volume (AGA-7 only)	Flow calculation
47536	float	Supercompressibility	Compressibility calculation
47538	float	Real relative gas density	Compressibility calculation
47540	float	Mass density at flow conditions	Compressibility calculation
47542	float	Mass density at base conditions	Compressibility calculation
47544	float	Heating value	Density calculation
47546	float	Duration of flow during the contract day (seconds)	Accumulation
47548	float	Flow volume at base conditions during the contract day	Accumulation

Actual Register	Data Type	Description	Source
47550	float	Flow mass at base conditions during the contract day	Accumulation
47552	float	Flow energy at base conditions during the contract day	Accumulation
47554	float	Total accumulated flow volume at base conditions	Accumulation
47556	float	Forced Temperature	Input
47558	float	Forced Static Pressure	Input
48470	float	Forced Differential Pressure (AGA-3 and V-Cone only)	Input
48472	float	Flow duration in current month.	Accumulation
48474	float	Flow volume in current month	Accumulation
48476	float	Flow duration in previous month	Accumulation
48478	float	Flow volume in previous month	Accumulation
48490	ulong	Forced Pulse Rate (AGA-7 only)	Input
48492	float	Date of last flow configuration change (days since January 1, 1970).	Current readings
48494	float	Time of last flow configuration change (seconds since midnight).	Current readings
48496	float	Date of last density configuration change (days since January 1, 1970).	Current readings
48498	float	Time of last density configuration change (seconds since midnight).	Current readings

Instantaneous and Accumulated Readings Registers

Actual Register	Data Type	Description	Source
48480	float	Duration of flow during the previous contract day (seconds)	Accumulation
48482	float	Flow volume at base conditions during the previous contract day	Accumulation
48484	float	Flow mass at base conditions during the previous contract day	Accumulation
48486	float	Flow energy at base conditions during the previous contract day	Accumulation

Actual Register	*Data Type*	*Description*	*Source*
48488	ulong	Number of flow calculations during the previous contract day	Accumulation

Previous Day Accumulated Readings Registers

Daily Flow History Data Registers

Daily flow data registers are updated automatically at the beginning of each new contract day, and a user querry is not required to be refreshed. There are 35 days consisting of 26 History Registers each. The table **Meter 1 Daily Flow History - Day 1 Registers** shows the registers associated with the recent day of data only. The table **Meter 1 Daily Flow History - Days 2 through 35 Registers** shows the registers used for days 2 through 35. Day 1 is the recent day

Actual Register	*Data Type*	*Description*
47560	float	Date at the end of the period (days since Jan 1, 1970)
47562	float	Time at the end of the period (seconds since 00:00:00)
47564	float	Duration of flow in the period
47566	float	Flow volume at base conditions
47568	float	Flow mass at base conditions
47570	float	Flow energy at base conditions
47572	float	Flow extension (AGA-3 1990 only) Flow product (AGA-3 1985 only) Uncorrected flow volume (AGA-7 only)
47574	float	Average temperature
47576	float	Average static pressure
47578	float	Average differential pressure (AGA-3 and V-Cone only)
47580	float	Average number of rotations per second (AGA-7 only)
47582	float	Average real relative gas density

Actual Register	Data Type	Description
47584	float	Units code = input units code + (contract units code * 32) The units code field indicates the units in use at the time the log entry was made. The codes for the input units and contract units are listed below. Both are combined in a single floating-point value to save space in the log. ***Units*** ***Units Code*** US1 0 US2 1 US3 2 IP 3 Metric1 4 Metric2 5 Metric3 6 SI 7 US4 8 US5 9 US6 10 US7 11 US8 12

Meter 1 Daily Flow History - Day 1 Registers

Actual Register	Data Type	Description
47586 to 47611	See Day 1 Structure	2nd most recent contract day
47612 to 47637	See Day 1 Structure	3rd most recent contract day
47638 to 47663	See Day 1 Structure	4th most recent contract day
47664 to 47689	See Day 1 Structure	5th most recent contract day
47690 to 47715	See Day 1 Structure	6th most recent contract day
47716 to 47741	See Day 1 Structure	7th most recent contract day
47742 to 47767	See Day 1 Structure	8th most recent contract day
47768 to 47793	See Day 1 Structure	9th most recent contract day
47794 to 47819	See Day 1 Structure	10th most recent contract day
47820 to 47845	See Day 1 Structure	11th most recent contract day
47846 to 47871	See Day 1 Structure	12th most recent contract day
47872 to 47897	See Day 1 Structure	13th most recent contract day
47898 to 47923	See Day 1 Structure	14th most recent contract day
47924 to 47949	See Day 1 Structure	15th most recent contract day
47950 to 47975	See Day 1 Structure	16th most recent contract day
47976 to 48001	See Day 1 Structure	17th most recent contract day
48002 to 48027	See Day 1 Structure	18th most recent contract day
48028 to 48053	See Day 1 Structure	19th most recent contract day
48054 to 48079	See Day 1 Structure	20th most recent contract day
48080 to 48105	See Day 1 Structure	21st most recent contract day
48106 to 48131	See Day 1 Structure	22nd most recent contract day
48132 to 48157	See Day 1 Structure	23rd most recent contract day
48158 to 48183	See Day 1 Structure	24th most recent contract day
48184 to 48209	See Day 1 Structure	25th most recent contract day
48210 to 48235	See Day 1 Structure	26th most recent contract day
48236 to 48261	See Day 1 Structure	27th most recent contract day

Actual Register	*Data Type*	*Description*
48262 to 48287	See Day 1 Structure	28th most recent contract day
48288 to 48313	See Day 1 Structure	29th most recent contract day
48314 to 48339	See Day 1 Structure	30th most recent contract day
48340 to 48365	See Day 1 Structure	31st most recent contract day
48366 to 48391	See Day 1 Structure	32nd most recent contract day
48392 to 48417	See Day 1 Structure	33rd most recent contract day
48418 to 48443	See Day 1 Structure	34th most recent contract day
48444 to 48469	See Day 1 Structure	35th most recent contract day

Meter 1 Daily Flow History - Days 2 through 35 Registers

Meter Run 2 Data Registers

The registers for meter 2 are organized in the same manner as meter 1. The registers for each meter start at a different offset. The table below shows the registers used for meter run 2.

Actual Register	*Data Type*	*Description*
46500 to 47489	See meter run 1 Data Structure above	Meter run 2 Data Registers.
43380 to 43389	See Uncorrected Flow Accumulated Readings Registers above	Meter run 2 Uncorrected Flow Registers

Meter Run 3 Data Registers

The registers for meter 3 are organized in the same manner as meter 1. The registers for each meter start at a different offset. The table below shows the registers used for meter run 3.

Actual Register	*Data Type*	*Description*
45500 to 46489	See meter run 1 Data Structure above	Meter run 3 Data Registers.
43370 to 43379	See Uncorrected Flow Accumulated Readings Registers above	Meter run 3 Uncorrected Flow Registers

Meter Run 4 Data Registers

The registers for meter 4 do not contain the daily history that is provided for runs 1 to 3. The data structures for meter runs 4 to 10 do not contain the full daily flow history to conserve register space. See the section **Meter Runs 4 to 10 Daily Flow History Registers** for daily flow history data for these meter runs.

The tables below show the structure. The flow computer continuously updates these registers.

Execution State Registers

These registers contain the execution state of the flow calculation.

Actual Register	*Data Type*	*Description*
44400	uint	Meter run = 4

Actual Register	*Data Type*	*Description*
44401	uint	Execution state: 1 = stopped 2 = running

Meter 4 Execution State Registers

Instantaneous and Accumulated Readings Registers

The instantaneous readings registers contain flow data. The values are instantaneous results. The **Source** column indicates the calculation that produces the value.

Values produced by the input, flow and accumulation calculations are updates once per second. Values produced by the compressibility calculation are updated each time the compressibility calculation recalculates. This time varies according to the calculation type and the changes in the inputs to the calculation (including configuration parameters). Check the time of last update registers to determine when the calculation was performed.

Values for the previous contract day are updated at the end of the contract day. Values for the current contract day include flow for the contract day, even if an event causes a separate day record in the hourly history.

Actual Register	*Data Type*	*Description*	*Source*
43360	float	Uncorrected flow volume during the previous month (AGA-7 only)	Accumulation
43362	float	Uncorrected flow volume during the current month (AGA-7 only)	Accumulation
43364	float	Uncorrected flow volume during the previous contract day (AGA-7 only)	Accumulation
43366	float	Uncorrected flow volume during the contract day (AGA-7 only)	Accumulation
43368	float	Not used	
44402	uint	Calibration flags Bit 0 = Get current temperature Bit 1 = Get current static pressure Bit 2 = Get current differential pressure or mass flow Bit 3 = Get current pulse rate Bit 4 = Temperature is forced Bit 5 = Static pressure is forced Bit 6 = Differential pressure is forced Bit 7 = Pulse rate is forced Bit 14 = Generate calibration event Bit 15 = Generate orifice plate change event. Bit set indicates input is forced.	Input

Actual Register	*Data Type*	*Description*	*Source*
44404	uint	Compressibility approximated flag 0 = compressibility value is calculated result 1 = compressibility value is approximate	Flow calculation
44405	uint	Input or flow calculation error code	Flow calculation
44406	uint	Compressibility calculation error code	Compressibility calculation
44407	uint	Temperature Input Alarm	Input
44408	uint	Static Pressure Input Alarm	Input
44409	uint	Differential Pressure (AGA-3 and V-Cone only) Turbine Pulses (AGA-7 only) input Alarm	Input
44410	slong	Turbine meter pulses (AGA-7 only)	Input
44412	slong	Number of flow calculations during the contract day	Accumulation
44414	float	Date of flow update (days since Jan 1, 1970)	Flow calculation
44416	float	Time of flow update (seconds since 00:00:00)	Flow calculation
44418	float	Date of compressibility update (days since Jan 1, 1970)	Compressibility calculation
44420	float	Time of compressibility update (seconds since 00:00:00)	
44422	float	Temperature	Input
44424	float	Static pressure	Input
44426	float	Differential pressure (AGA-3 and V-Cone only) Mass flow rate (AGA-11 only)	Input
44428	float	Flow volume rate	Flow calculation
44430	float	Flow mass rate	Flow calculation
44432	float	Flow energy rate	Flow calculation
44434	float	Flow extension (AGA-3 1990 only) Flow product (AGA-3 1985 only) Uncorrected flow volume (AGA-7 only)	Flow calculation
44436	float	Supercompressibility	Compressibility calculation
44438	float	Real relative gas density	Compressibility calculation
44440	float	Mass density at flow conditions	Compressibility calculation
44442	float	Mass density at base conditions	Compressibility calculation
44444	float	Heating value	Density calculation

Actual Register	***Data Type***	***Description***	***Source***
44446	float	Duration of flow during the contract day (seconds)	Accumulation
44448	float	Flow volume at base conditions during the contract day	Accumulation
44450	float	Flow mass at base conditions during the contract day	Accumulation
44452	float	Flow energy at base conditions during the contract day	Accumulation
44454	float	Total accumulated flow volume at base conditions	Accumulation
44456	float	Duration of flow during the previous contract day (seconds)	Accumulation
44458	float	Flow volume at base conditions during the previous contract day	Accumulation
44460	float	Flow mass at base conditions during the previous contract day	Accumulation
44462	float	Flow energy at base conditions during the previous contract day	Accumulation
44464	ulong	Number of flow calculations during the previous contract day	Accumulation
44466	float	Forced Temperature	Input
44468	float	Forced Static Pressure	Input
44470	float	Forced Differential Pressure (AGA-3 and V-Cone only) Forced mass flow rate (AGA-11 only)	Input
44472	float	Flow duration in current month.	Accumulation
44474	float	Flow volume in current month	Accumulation
44476	float	Flow duration in previous month	Accumulation
44478	float	Flow volume in previous month	Accumulation
44490	ulong	Forced Pulse Rate (AGA-7 only)	Input
44492	float	Date of last flow configuration change (days since January 1, 1970).	Current readings
44494	float	Time of last flow configuration change (seconds since midnight).	Current readings
44496	float	Date of last density configuration change (days since January 1, 1970).	Current readings
44498	float	Time of last density configuration change (seconds since midnight).	Current readings

Instantaneous and Accumulated Readings Registers

Meter Runs 4 to 10 Daily Flow History Registers

The data structures for meter runs 4 to 10 do not contain the full daily flow history to conserve register space.

For SCADAPack 32 and SCADAPack 330/334, SCADAPack 350 controllers only the following registers can be used to display the daily flow history for any flow run. This includes runs 1 to 3.

Use the **Get Daily History Command** to load the history data into these registers.

There are 35 days consisting of 26 History Registers each. The table **Meter 1 Daily Flow History - Day 1 Registers** shows the registers associated with the recent day of data only. The table **Meter 1 Daily Flow History - Days 2 through 35 Registers** shows the registers used for days 2 through 35. Day 1 is the recent day.

Actual Register	***Data Type***	***Description***
44560	float	Date at the end of the period (days since Jan 1, 1970)
44562	float	Time at the end of the period (seconds since 00:00:00)
44564	float	Duration of flow in the period
44566	float	Flow volume at base conditions
44568	float	Flow mass at base conditions
44570	float	Flow energy at base conditions
44572	float	Flow extension (AGA-3 1990 only) Flow product (AGA-3 1985 only) Uncorrected flow volume (AGA-7 only)
44574	float	Average temperature
44576	float	Average static pressure
44578	float	Average differential pressure (AGA-3 and V-Cone only)
44580	float	Average number of rotations per second (AGA-7 only)
44582	float	Average real relative gas density

Actual Register	Data Type	Description
44584	float	Units code = input units code + (contract units code * 32) The units code field indicates the units in use at the time the log entry was made. The codes for the input units and contract units are listed below. Both are combined in a single floating point value to save space in the log. ***Units*** ***Units Code*** US1 0 US2 1 US3 2 IP 3 Metric1 4 Metric2 5 Metric3 6 SI 7 US4 8 US5 9 US6 10 US7 11 US8 12

Daily Flow History - Day 1 Registers

Actual Register	Data Type	Description
44586 to 44611	See Day 1 Structure	2nd most recent contract day
44612 to 44637	See Day 1 Structure	3rd most recent contract day
44638 to 44663	See Day 1 Structure	4th most recent contract day
44664 to 44689	See Day 1 Structure	5th most recent contract day
44690 to 44715	See Day 1 Structure	6th most recent contract day
44716 to 44741	See Day 1 Structure	7th most recent contract day
44742 to 44767	See Day 1 Structure	8th most recent contract day
44768 to 44793	See Day 1 Structure	9th most recent contract day
44794 to 44819	See Day 1 Structure	10th most recent contract day
44820 to 44845	See Day 1 Structure	11th most recent contract day
44846 to 44871	See Day 1 Structure	12th most recent contract day
44872 to 44897	See Day 1 Structure	13th most recent contract day
44898 to 44923	See Day 1 Structure	14th most recent contract day
44924 to 44949	See Day 1 Structure	15th most recent contract day
44950 to 44975	See Day 1 Structure	16th most recent contract day
44976 to 45001	See Day 1 Structure	17th most recent contract day
45002 to 45027	See Day 1 Structure	18th most recent contract day
45028 to 45053	See Day 1 Structure	19th most recent contract day
45054 to 45079	See Day 1 Structure	20th most recent contract day
45080 to 45105	See Day 1 Structure	21st most recent contract day
45106 to 45131	See Day 1 Structure	22nd most recent contract day
45132 to 45157	See Day 1 Structure	23rd most recent contract day
45158 to 45183	See Day 1 Structure	24th most recent contract day
45184 to 45209	See Day 1 Structure	25th most recent contract day
45210 to 45235	See Day 1 Structure	26th most recent contract day
45236 to 45261	See Day 1 Structure	27th most recent contract day

Actual Register	Data Type	Description
45262 to 45287	See Day 1 Structure	28th most recent contract day
45288 to 45313	See Day 1 Structure	29th most recent contract day
45314 to 45339	See Day 1 Structure	30th most recent contract day
45340 to 45365	See Day 1 Structure	31st most recent contract day
45366 to 45391	See Day 1 Structure	32nd most recent contract day
45392 to 45417	See Day 1 Structure	33rd most recent contract day
45418 to 45443	See Day 1 Structure	34th most recent contract day
45444 to 45469	See Day 1 Structure	35th most recent contract day

Daily Flow History - Days 2 through 35 Registers

Get Daily History Command

The daily history is comprised of 35 days worth of data that is written into a block of registers when the flow computer is queried. This command can read hourly history for any run. The history for runs 1 to 3 is also available in dedicated registers for those runs.

Only the host computer, application program, or Realflo can send commands to the flow computer at one time. Command Reply Registers 49505 and 49506 will indicate an error if more than one host sends a command at one time.

Use the following procedure to execute the command.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 12 (Get Daily History)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the command succeeded.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run if the command was successful.

Read the Data Registers.

Location	Data Type	Description
44560 to 45469	see table	Daily totals are displayed.

Meter Run 5 Data Registers

The registers for meter 5 are organized in the same manner as meter 4. The registers for each meter start at a different offset. The table below shows the registers used for meter run 5.

Actual Register	Data Type	Description
44300 to 44399	See meter run 4 Data Structure above	Meter run 5 Data Registers.

Actual Register	*Data Type*	*Description*
43350 to 43359	See Uncorrected Flow Accumulated Readings Registers above	Meter run 5 Uncorrected Flow Registers

Meter Run 6 Data Registers

The registers for meter 6 are organized in the same manner as meter 4. The registers for each meter start at a different offset. The table below shows the registers used for meter run 6.

Actual Register	*Data Type*	*Description*
44200 to 44299	See meter run 4 Data Structure above	Meter run 6 Data Registers.
43340 to 43349	See Uncorrected Flow Accumulated Readings Registers above	Meter run 6 Uncorrected Flow Registers

Meter Run 7 Data Registers

The registers for meter 7 are organized in the same manner as meter 4. The registers for each meter start at a different offset. The table below shows the registers used for meter run 7.

Actual Register	*Data Type*	*Description*
44100 to 44199	See meter run 4 Data Structure above	Meter run 7 Data Registers.
43330 to 43339	See Uncorrected Flow Accumulated Readings Registers above	Meter run 7 Uncorrected Flow Registers

Meter Run 8 Data Registers

The registers for meter 8 are organized in the same manner as meter 4. The registers for each meter start at a different offset. The table below shows the registers used for meter run 8.

Actual Register	*Data Type*	*Description*
44000 to 44099	See meter run 4 Data Structure above	Meter run 8 Data Registers.
43320 to 43329	See Uncorrected Flow Accumulated Readings Registers above	Meter run 8 Uncorrected Flow Registers

Meter Run 9 Data Registers

The registers for meter 9 are organized in the same manner as meter 4. The registers for each meter start at a different offset. The table below shows the registers used for meter run 9.

Actual Register	Data Type	Description
43900 to 43999	See meter run 4 Data Structure above	Meter run 9 Data Registers.
43310 to 43319	See Uncorrected Flow Accumulated Readings Registers above	Meter run 9 Uncorrected Flow Registers

Meter Run 10 Data Registers

The registers for meter 10 are organized in the same manner as meter 4. The registers for each meter start at a different offset. The table below shows the registers used for meter run 10.

Actual Register	Data Type	Description
43800 to 43899	See meter run 4 data Structure above	Meter run 10 Data Registers.
43300 to 43309	See Uncorrected Flow Accumulated Readings Registers above	Meter run 8 Uncorrected Flow Registers

TeleBUS Configuration Registers

This section of the User Manual describes the configuration of the Gas flow computer using the TeleBUS communication protocol. TeleBUS protocol is fully compatible with standard Modbus drivers.

This method of configuration is typically used in a SCADA system where the host computer is required to modify flow computer operating parameters through the SCADA communication system. Command sequences enable the modification of flow computer parameters by authorized users.

Only the host computer, application program, or Realflo can send commands to the flow computer at one time. Command reply registers 49505 and 49506 will indicate an error if more than one host sends a command at one time.

This section contains a of tables listing configuration registers utilized by the flow computer (gas flow routines). The gas flow data is updated to the tables using the various **Get** commands. The **Set** commands write data in the tables to the flow computer.

The registers labeled, as **Actual Registers** in the tables are the registers containing the values already in use by the flow calculation routines. The registers labeled as **Config. Registers** are the registers used for loading new configuration values to the flow calculation routines.

Configuration changes are not passed to the flow calculation routines until the command has been entered and verification has taken place where applicable. Configuration values already in use may be loaded into separate registers for viewing on command.

Realflo does not allow configuration changes if the Event Log in the flow computer is full. Use the Read Logs/History command to empty the flow computer Event Log.

Configuration Command Execution

Entering a command consists of writing the appropriate command number into the Command Register and the appropriate meter number into the Meter Run Register. To stop unauthorized command entry, and to allow for recording of user commands in the event log, a user number and PIN number needs to be specified before a command is executed.

Only the host computer, application program, or Realflo can send commands to the flow computer at one time. Command reply registers 49505 and 49506 will indicate an error if more than one host sends a command at one time.

Configuration commands are written to registers starting at location 49500.

Write to the registers starting at location 49500 and then read the Command Register (49500) until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command number from 1 to 2203. See **Flow Computer Commands** for a complete list of command numbers.
49501	uint	Meter run number from 1 to 10
49502	uint	User number needs to correspond to the PIN number as entered in the user accounts table. The default value is 1 if no User accounts have been created in Realflo. See the **Accounts** command for more information on user number.
49503	uint	The PIN needs to correspond to the PIN as entered in the user accounts table. The default value is 1 if no user accounts have been created in Realflo. See **Accounts** command for more information on PIN.

Feedback to the user is provided through a Command Reply Register, which will indicate the same command number as was requested, if the command was accepted and executed. In the event that the command could not be carried out, an error code is loaded into the Command Reply Register indicating the reason that the command was not accepted.

The Reply Registers become valid after the Command Register is changed to zero by the flow computer.

Replies to commands are read from the registers starting at location 49505. Successfully accepted commands return the command number in the Reply Register (49505). Error numbers will be returned when the command was not successful.

Read from the registers starting at location 49505.

Location	***Data Type***	***Description***
49505	uint	Echo command number from 1 to 2203 or error reply code.
49506	uint	Specific to error. Usually meter run if the command was successful. See **Flow Computer Error Codes** for a listing of error codes.

Input Configuration

The flow calculation routines require a temperature transmitter input, static pressure transmitter input and a differential pressure transmitter input (AGA-3 or V-Cone), or pulse input (AGA-7).

Input Configuration Registers

The Input Configuration Registers for each transmitter input are set to contain the source register; the minimum and maximum scaled and unscaled values and the level limits and hysteresis. The Input Configuration Registers for the pulse input are set to contain the Source Register, the low flow minimum pulse limit and the time duration for low flow pulse limit check.

The General Input Configuration Registers are set to contain the meter run number, type of units used, and the flow and compressibility calculation types.

The registers in the **Actual Registers** column in these tables are the registers containing the values already in use by the flow calculation routines. The registers in the **Config. Registers** column are the registers used for loading new configuration values to the flow calculation routines.

The registers in these tables are read from the flow computer using the **Get Input Configuration Command**.

The registers in these tables are set in the flow computer using the **Set Input Configuration Command**.

Config. Register	***Actual Register***	***Data Type***	***Description***
49510	49570	uint	Meter run: 1 to 10
49511	49571	uint	Input units type: 0 = US1, 1 = US2, 2 = US3, 3 = Imperial, 4 = Metric1, 5 = Metric2, 6 = Metric3, 7 = SI, 8 = US4, 9 = US5, 10 = US6, 11 = US7 12 = US8
49512	49572	uint	Flow calculation type: 2 = AGA-3 (1985) 3 = AGA-3 (1992), 7 = AGA-7, 12 = AGA-11 22 = V-Cone
49513	49573	uint	Compressibility calculation type: 8 = AGA 8 19 = NX-19
49514	49574	uint	Static pressure tap location: 0 = upstream, 1 = downstream

Config. Register	*Actual Register*	*Data Type*	*Description*
49515	49575	uint	Log out of range events flag 0 = ignore Out Of Range events 1 = log Out Of Range events in event queue
49516	49576	uint	Temperature input register, or MVT transmitter number (1 to 10), or SCADAPack 4202 or 4203 transmitter number (1)
49517	49577	uint	Zero scale temperature input (used with type 0 temperature inputs)
49518	49578	uint	Full scale temperature input (used with type 0 temperature inputs)
49519	49579	uint	Static pressure input register, or MVT transmitter number (1 to 10), or SCADAPack 4202 or 4203 transmitter number (1).
49520	49580	uint	Zero scale static pressure input (used with type 0 static pressure inputs)
49521	49581	uint	Full scale static pressure input (used with type 0 static pressure inputs)
49522	49582	uint	Differential pressure input register, or MVT transmitter number (1 to 10) or SCADAPack 4202 or 4203 transmitter number (1). (AGA-3 and V-Cone only)
49523	49583	uint	Zero scale differential pressure input (AGA-3 and V-Cone only) (used with type 0 differential pressure inputs)
49524	49584	uint	Full scale differential pressure input (AGA-3 and V-Cone only) (used with type 0 differential pressure inputs)
49525	49585	uint	Rotation counter input register (AGA-7 only)
49526	49586	uint	Time duration for low flow pulse limit check (seconds) (AGA-7 only)
49527	49587	slong	Low flow minimum pulse limit (AGA-7 only)
49529	49589	float	Temperature at zero scale (used with type 3 temperature inputs)
49531	49591	float	Temperature at full scale (used with type 3 temperature inputs)
49533	49593	float	Temperature low level cutoff
49535	49595	float	Temperature low level hysteresis
49537	49597	float	Temperature high level hysteresis
49539	49599	float	Temperature high level cutoff
49541	49601	float	Static pressure at zero scale (used with type 3 static pressure inputs)

Config. Register	*Actual Register*	*Data Type*	*Description*
49543	49603	float	Static pressure at full scale (used with type 3 static pressure inputs)
49545	49605	float	Static pressure low level cutoff
49547	49609	float	Static pressure low level hysteresis
49549	49607	float	Static pressure high level hysteresis
49551	49611	float	Static pressure high level cutoff
49553	49613	float	Atmospheric pressure
49555	49615	float	Differential pressure at zero scale (AGA-3 and V-Cone only) (used with type 3 differential pressure inputs)
49557	49617	float	Differential pressure at full scale (AGA-3 and V-Cone only) (used with type 3 differential pressure inputs)
49559	49619	float	Differential pressure low level cutoff (AGA-3 and V-Cone only)
49561	49621	float	Differential pressure low level hysteresis (AGA-3 and V-Cone only)
49563	49623	float	Differential pressure high level hysteresis (AGA-3 and V-Cone only)
49565	49625	float	Differential pressure high level cutoff (AGA-3 and V-Cone only)
49567	49627	uint	Static pressure altitude and latitude compensation 0 = ignore 1 = compensate
49568	49628	uint	Sensor Fail Action 0 = last known value 1 = default value
49569	49629	uint	Gas Quality Sources (PEMEX only) 0 = manual 1 = PEMEX host
49871	49876	uint	Flow Direction Control 0 = forward indicated by value 1 = reverse indicated by value 2 = forward indicated by status 3 = reverse indicated by status
49872	49877	uint	Flow Direction Register 1 to 4096 10001 to 14096 30001 to 39999 40001 to 49999
49873	49878	uint	On Indicates 0 = Reverse 1 = Forward

Config. Register	Actual Register	Data Type	Description
49874	49879	uint	Time stamp for Enron Modbus history logs. 0 = time leads data 1 = time lags data

Input Configuration Registers

The Input Type Registers describe the type of data in the Input Registers for each type of input. For floating point-input registers, floating-point scaling values need to be used.

Config. Register	Actual Register	Data Type	Description
49900	49920	uint	Temperature input register type 0 = Telepace integer requiring scaling 2 = float in engineering units (no scaling required) 3 = float requiring scaling 4 = MVT 5 = ISaGRAF integer 6 = SCADAPack 4202 or 4203
49901	49921	uint	Static pressure input register type 0 = Telepace integer requiring scaling 2 = float in engineering units (no scaling required) 3 = float requiring scaling 4 = MVT 5 = ISaGRAF integer 6 = SCADAPack 4202 or 4203
49902	49922	uint	Differential pressure input register type 0 = Telepace integer requiring scaling 2 = float in engineering units (no scaling required) 3 = float requiring scaling 4 = MVT 5 = ISaGRAF integer 6 = SCADAPack 4202 or 4203
49903	49923	uint	Turbine input register type 1 = Telepace long 5 = ISaGRAF integer or Mass flow input register type (AGA-11 only) 7 = Coriolis source
49904	49924	float slong	Zero scale temperature input (used with type 3 and 5 temperature inputs) float format with type 3 inputs slong format with type 5 inputs
49906	49926	float slong	Full scale temperature input (used with type 3 and 5 temperature inputs) float format with type 3 inputs slong format with type 5 inputs

Config. Register	*Actual Register*	*Data Type*	*Description*
49908	49928	float slong	Zero scale static pressure input (used with type 3 and 5 static pressure inputs) float format with type 3 inputs slong format with type 5 inputs
49910	49930	float slong	Full scale static pressure input (used with type 3 and 5 static pressure inputs) float format with type 3 inputs slong format with type 5 inputs
49912	49932	float slong	Zero scale differential pressure input (AGA-3 and V-Cone only) (used with type 3 and 5 differential pressure inputs) float format with type 3 inputs slong format with type 5 inputs
49914	49934	float slong	Full scale differential pressure input (AGA-3 and V-Cone only) (used with type 3 and 5 differential pressure inputs) float format with type 3 inputs slong format with type 5 inputs
49916	49936	float	Altitude
49918	49938	float	Latitude in decimal degrees

Input Type Configuration Registers

Registers 49904 – 49915 and 49924 – 49935 use the float type for type 3 inputs and the ISaGRAF integer type for type 5 inputs.

Get Input Configuration Command

The **Get Input Configuration** command returns the Input Configuration Registers.

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command = 1 (Get Input Configuration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	*Data Type*	*Description*
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	*Data Type*	*Description*

Location	*Data Type*	*Description*
49570 to 49628	Input configuration structure	See the **Input Configuration** section for details on these registers.
49920 to 49939	Input register type configuration structure	See the **Input Configuration** section for details on these registers.

Set Input Configuration Command

The **Set Input Configuration** command sets the Input Configuration registers.

Write the configuration data into the registers.

Location	*Data Type*	*Description*
49510 to 49568	Input configuration structure	See the **Input Configuration** section for details on these registers.
49900 to 49918	Input type configuration structure	See the **Input Configuration** section for details on these registers.

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command = 3 (Set Input Config)
49501	uint	Meter run = 1 to 3
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	*Data Type*	*Description*
49505	uint	Echo command or error from ***Flow Calculation Engine Command Errors***.
49506	uint	Specific to error. The run number if the command was successful.

MVT Configuration

MVT configuration defines the operation of the MVT transmitter and the polling of the transmitter by the flow computer.

The flow computer polls each configured transmitter in turn. It waits for a response or timeout. If the transmitter does not respond it will take longer to poll it, than if it responded. The timeout is set by the user in the sensor configuration page. The flow computer does not retry the transmitter. It moves on to the next transmitter. The transmitter will be polled again in the regular cycle.

The communication failure alarm is raised if the transmitter does not respond for 3 consecutive polls.

Configuration events for the transmitters are logged in the event logs for all runs that use a sensor from the transmitter. If no runs use the transmitter, then the events are not logged.

MVT Data Registers

The flow computer polls the MVT transmitters and updates the Data Registers.

The sensor status values are the same for each transmitter.

0 = response OK

1 = communication failed

2 = value below operating limit

3 = transmitter configuration invalid

4 = not polled, may be disabled

5 = bad value

6 = value above operating limit

7 = sensor is off line, may be calibrating

8 = RTD open (temperature sensor only)

9 = RTD offset out of range (temperature only)

Register	***Data Type***	***Description***
43600	uint	Transmitter 1: differential pressure sensor status
43601	uint	Transmitter 1: static pressure sensor status
43602	uint	Transmitter 1: temperature pressure sensor status
43603	uint	Transmitter 2: differential pressure sensor status
43604	uint	Transmitter 2: static pressure sensor status
43605	uint	Transmitter 2: temperature pressure sensor status
43606	uint	Transmitter 3: differential pressure sensor status
43607	uint	Transmitter 3: static pressure sensor status
43608	uint	Transmitter 3: temperature pressure sensor status
43609	uint	Transmitter 4: differential pressure sensor status
43610	uint	Transmitter 4: static pressure sensor status
43611	uint	Transmitter 4: temperature pressure sensor status
43612	uint	Transmitter 5: differential pressure sensor status
43613	uint	Transmitter 5: static pressure sensor status
43614	uint	Transmitter 5: temperature pressure sensor status
43615	uint	Transmitter 6: differential pressure sensor status
43616	uint	Transmitter 6: static pressure sensor status
43617	uint	Transmitter 6: temperature pressure sensor status
43618	uint	Transmitter 7: differential pressure sensor status
43619	uint	Transmitter 7: static pressure sensor status
43620	uint	Transmitter 7: temperature pressure sensor status
43621	uint	Transmitter 8: differential pressure sensor status
43622	uint	Transmitter 8: static pressure sensor status
43623	uint	Transmitter 8: temperature pressure sensor status
43624	uint	Transmitter 9: differential pressure sensor status
43625	uint	Transmitter 9: static pressure sensor status
43626	uint	Transmitter 9: temperature pressure sensor status

Register	Data Type	Description
43627	uint	Transmitter 10: differential pressure sensor status
43628	uint	Transmitter 10: static pressure sensor status
43629	uint	Transmitter 10: temperature pressure sensor status
43630	float	Transmitter 1: differential pressure
43632	float	Transmitter 1: static pressure
43634	float	Transmitter 1: temperature
43636	float	Transmitter 2: differential pressure
43638	float	Transmitter 2: static pressure
43640	float	Transmitter 2: temperature
43642	float	Transmitter 3: differential pressure
43644	float	Transmitter 3: static pressure
43646	float	Transmitter 3: temperature
43648	float	Transmitter 4: differential pressure
43650	float	Transmitter 4: static pressure
43652	float	Transmitter 4: temperature
43654	float	Transmitter 5: differential pressure
43656	float	Transmitter 5: static pressure
43658	float	Transmitter 5: temperature
43660	float	Transmitter 6: differential pressure
43662	float	Transmitter 6: static pressure
43664	float	Transmitter 6: temperature
43666	float	Transmitter 7: differential pressure
43668	float	Transmitter 7: static pressure
43670	float	Transmitter 7: temperature
43672	float	Transmitter 8: differential pressure
43674	float	Transmitter 8: static pressure
43676	float	Transmitter 8: temperature
43678	float	Transmitter 9: differential pressure
43680	float	Transmitter 9: static pressure
43682	float	Transmitter 9: temperature
43684	float	Transmitter 10: differential pressure
43686	float	Transmitter 10: static pressure
43688	float	Transmitter 10: temperature

Internal Registers

The flow computer uses the following registers for communication with the MVT transmitter. The contents are of no interest to the user. These registers cannot be used in another program.

Register	Data Type	Description
38000		Internal data
…		
38999		Internal data

MVT Command Parameter Registers

The Command Parameter Registers are used by the **MVT Change Address Command**.

Register	Data Type	Description
43700	uint	Flow Computer serial port 1 = com1 2 = com2 3 = com3 4 = com4
43701	uint	Timeout = 100 ms to 10000 ms
43702	uint	Start or current address = 1 to 65534
43703	uint	End or new address = 1 to 65534

MVT Transmitter Information Registers

The Transmitter Information Registers are used by the **MVT Search Command.**

Register	Data Type	Description
43710	uint	Address of transmitter
43711	uint	Manufacturer code
43712	S	Serial number
43714	userID	Tag
43718	uint	Type code (valid for 3095FB, SCADAPack 4000 and SCADAPack 4202 or 4203) See the table below, **MVT Transmitter Type Codes**, for SCADAPack 4000 transmitter type code.

MVT Transmitter Type Codes

Type Code	Model Number	Description
41020	4102	Multivariable transmitter (Serial interface)
41021	4102	Multivariable transmitter (Serial and LAN interfaces)
40120	4012	Gauge pressure transmitter (Serial interface)
40121	4012	Absolute pressure transmitter (Serial interface)
40122	4012	Gauge pressure transmitter (Serial and LAN interfaces)
40123	4012	Absolute pressure transmitter (Serial and LAN interfaces)
40320	4032	Differential pressure transmitter (Serial interface)
40321	4032	Differential pressure transmitter (Serial and LAN interfaces)
0	Unknown	The transmitter is not functioning correctly

MVT Configuration Registers

The MVT transmitter configuration registers are defined as follows. The registers in the ***Actual Register*** column are the registers containing the values already in use by the flow computer MVT transmitter. The registers in the ***Config.Register*** column are the registers used for loading new configuration values to the flow computer and the MVT transmitter.

The registers in this table are read using the **Get MVT Configuration Command.**

The registers in this table are set using the **Set MVT Configuration Command**.

Config. Register	***Actual Register***	***Data Type***	***Description***
43720	43760	uint	Transmitter polling status: 0 = disabled 1 = enabled
43721	43761	uint	Serial Port: 0 = unused, for internal SCADAPack 4202 or 4203 in slot 1 1 = com1 2 = com2 3 = com3 4 = com4 100 = LAN (4102, 4000 only)
43722	43762	uint	Address of transmitter: 0 = unused, for internal SCADAPack 4202 or 4203 in slot 1 1 to 247 (Rosemount 3095FB, 4101) 1 to 255 (SCADAPack 4000, SCADAPack 4202 or 4203 in standard addressing mode) 1 to 65534 (SCADAPack 4000, SCADAPack 4202 or 4203 in extended addressing mode)
43723	43763	uint	Timeout: 0 = unused, for internal SCADAPack 4202 or 4203 in slot 1 10 to 10000 ms
43724	43764	uint	Manufacturer code
43725	43765	uint	Turnaround delay time: 0 to 200 ms
43726	43766	uint	Differential pressure units: 1 = inches of water at 60 F (3095FB only) 2 = Pascal 3 = kiloPascal 6 = inches of water at 68°F
43727	43767	uint	Static pressure units: 3 = kiloPascal 4 = MegaPascal 5 = psi
43728	43768	uint	Temperature units: 20 = Celsius 21 = Fahrenheit
43729	43769	ulong	Serial number
43731	43771	userID	Tag: 1 to 8 characters
43735	43775	float	Differential pressure damping: 3095FB: 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824, or 27.648 SCADAPack 4000 and SCADAPack

Config. Register	***Actual Register***	***Data Type***	***Description***
			4202 or 4203 : 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, or 32.0 seconds
43737	43777	float	Differential pressure upper operating limit
43739	43779	float	Differential pressure lower operating limit
43741	43781	float	Static pressure damping: 3095FB: 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824, or 27.648 SCADAPack 4000 and SCADAPack 4202 or 4203: 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, or 32.0 seconds
43743	43783	float	Static pressure upper operating limit
43745	43785	float	Static pressure lower operating limit
43747	43787	float	Temperature damping: 3095FB: 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824, or 27.648 SCADAPack 4000 and SCADAPack 4202 or 4203: Not supported
43749	43789	float	Temperature upper operating limit
43751	43791	float	Temperature lower operating limit
43752	43792	uint	Type code (not used with SCADAPack 4101) 31 = 3095FB MVT 4102 = SCADAPack 4102 4202 = SCADAPack 4202 4203 = SCADAPack 4203.
43753	43793	uint	Type Code (not used with SCADAPack 4101) 31 = 3095FB MVT 40120 = 4012 Absolute 40121 = 4012 Gauge 41020 = 4102 Serial 41021 = 4102 Serial and LAN 4202 = 4202 DR 42021 = 4202 DS 42990 = 4203 DR 42991 = 4203 DS
43754	43794	ulong	IP Address (MSB first) (when Port is LAN)
43756	43796	uint	IP Protocol (when Port is LAN) 0 = None 1 = Modbus/TCP 2 = Modbus RTU in UDP
43757	43797	Float	Atmospheric pressure (used by SCADAPack 4102 and SCADAPack 4202 or 4203) 0 = absolute pressure >0 to 30 psia (or equivalent) = gage

Config. Register	***Actual Register***	***Data Type***	***Description***
			pressure

MVT Search Command

The flow computer can search for MVT transmitters connected to its serial ports.

Write the search parameters into the Configuration Registers.

Register	***Data Type***	***Description***
43700	uint	Flow Computer serial port 1 = com1 2 = com2 3 = com3 4 = com4 100 = LAN (4102, 4000 only)
43701	uint	Timeout = 100 ms to 10000 ms
43702	uint	Start address = 1 to 65534 0 for LAN
43703	uint	End address = 1 to 65534
43704	Ulong	IP Address (SCADAPack 4102 only when LAN port is available) MSB first, representing aa.bb.cc.dd format
43706	Uint	IP Protocol (SCADAPack 4102 only when LAN port is available) 0 = None 1 = Modbus/TCP 2 = Modbus RTU in UDP

Write the command and read the Command Register until it is cleared.

Register	***Data Type***	***Description***
49500	uint	Command = 130 (Search for MVT Transmitter)
49501	uint	Meter run = 0
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine if a transmitter was found. An error is returned if the command parameters are invalid.

Register	***Data Type***	***Description***
49505	uint	Command status: 130 = command complete other = Error code from MVT Command Errors.
49506	uint	Command result: 0 = transmitter found 1 = no transmitter found

If a transmitter was found, read the search result registers to get the transmitter information.

Register	***Data Type***	***Description***

43710	uint	Address of transmitter
43711	uint	Manufacturer code
43712	ulong	Serial number
43714	userID	Tag
43718	uint	Type code (valid for 3095FB, SCADAPack 4102, 4202 and 4203

The flow computer will return the first transmitter found. Repeat the command with a different range to find additional transmitters.

MVT Change Address Command

This command changes the address of a MVT transmitter.

Write the command parameters into the Configuration Registers.

Register	***Data Type***	***Description***
43700	uint	Flow Computer serial port: 1 = com1 2 = com2 3 = com3 4 = com4
43701	uint	Timeout = 100 ms to 10000 ms
43702	uint	Current address = 1 to 247
43703	uint	New address = 1 to 247

Write the command and read the Command Register until it is cleared.

Register	***Data Type***	***Description***
49500	uint	Command = 131 (Change MVT Address)
49501	uint	Meter run = 0
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine if the transmitter address was changed. An error is returned if the command parameters are invalid.

Register	***Data Type***	***Description***
49505	uint	Command status: 131 = command complete other = other = Error code from MVT Command Errors.
49506	uint	Command result: 0 = transmitter address changed 1 = no response from transmitter

Get MVT Configuration Command

This command reads a MVT-transmitter configuration from the transmitter and flow computer. The flow computer reads the configuration from the transmitter and returns it. If the transmitter does not respond, the current configuration from the flow computer is returned instead.

If the transmitter is disabled in the flow computer, the current configuration from the flow computer is returned. The flow computer does not attempt to read the transmitter.

Write the command and read the Command Register until it is cleared.

Register	***Data Type***	***Description***
49500	uint	Command = 132 (Get MVT Configuration)
49501	uint	Transmitter number = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the command parameters are invalid.

Register	***Data Type***	***Description***
49505	uint	Command status: 132 = command complete other = other = Error code from MVT Command Errors.
49506	uint	Command result: 0 = error occurred 1 to 10 = transmitter number

If a transmitter was found, read the actual Configuration Registers.

Register	***Data Type***	***Description***
43760 to 43792	MVT Configuration Structure	See the **MVT Transmitter Type Codes** section for details.

Set MVT Configuration Command

The command writes a MVT-transmitter configuration to the flow computer and the transmitter. The flow computer writes the configuration to the transmitter. If the transmitter does not respond, the configuration is still saved in the flow computer memory.

Write data into the Configuration Registers.

Register	***Data Type***	***Description***
43720 to 43752	MVT configuration structure	See the **MVT Transmitter Type Codes** section for details.

Write the command and read the Command Register until it is cleared.

Register	***Data Type***	***Description***
49500	uint	Command = 133 (Set MVT Configuration)
49501	uint	Transmitter number = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the configuration data are invalid.

Register	***Data***	***Description***

	Type	
49505	uint	Command status: 133 = command complete other = other = Error code from MVT Command Errors.
49506	uint	Command result: 0 = error occurred 1 to 10 = transmitter number

Read MVT Configuration Command

This command reads a MVT-transmitter configuration from the transmitter and flow computer. The flow computer reads the configuration from the transmitter and returns it. If the transmitter does not respond, the current configuration from the flow computer is returned instead.

If the transmitter is disabled in the flow computer, the search parameters will be used to try to read the transmitter.

Write the search parameters into the Configuration Registers.

Register	***Data Type***	***Description***
43700	uint	Flow Computer serial port: 1 = com1 2 = com2 3 = com3 4 = com4 100 = LAN (SCADAPack 4000 only)
43701	uint	Timeout = 100 ms to 10000 ms
43702	uint	Station address = 1 to 247 0 for LAN
43703	uint	End address = 1 to 65534 Not used for LAN
43704	Ulong	IP Address (SCADAPack 4000 only when LAN port is available) MSB first, representing aa.bb.cc.dd format
43706	Uint	IP Protocol (SCADAPack 4000 only when LAN port is available) 0 = None 1 = Modbus/TCP 2 = Modbus RTU in UDP

Write the command and read the Command Register until it is cleared.

Register	***Data Type***	***Description***
49500	uint	Command = 136 (Read MVT Configuration)
49501	uint	Transmitter number = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the command parameters are invalid.

Register	***Data Type***	***Description***
49505	uint	Command status:

Register	***Data Type***	***Description***
		136 = command complete other = other = Error code from MVT Command Errors.
49506	uint	Command result: 0 = error occurred 1 to 10 = transmitter number

If a transmitter was found, read the actual Configuration Registers.

Register	***Data Type***	***Description***
43760 to 43792	MVT configuration structure	See the **MVT Transmitter Type Codes** section for details.

Set MVT Sensor Mode

This command writes the sensor mode to the flow computer and the transmitter.

The calibrate mode allows operation to the bottom end of the MVT. The flow computer allows writing to the MVT registers when calibrate mode is set and disallows writing when on-line mode is set. This keeps the MVT from being accessed by other sources.

Write the mode into the Configuration Registers.

Register	**Data Type**	**Description**
49990	uint	Sensor Mode 0 = On-line 255 = Calibrate

Write the command and read the Command Register until it is cleared.

Register	**Data Type**	**Description**
49500	uint	Command = 139 (Set Sensor Mode)
49501	uint	Transmitter number (1 to 10)
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine if the mode was accepted. An error is returned if the command parameters were invalid.

Register	**Data Type**	**Description**
49505	uint	Command Status 139 = command complete other = Error code from MVT Command Errors.
49506	uint	Command Result 0 = error 1 to 10 = Transmitter number

MVT Calibration

MVT calibration changes the calibration of a transmitter. A transmitter may be calibrated while it is in use by flow runs. To do this the inputs to the flow runs needs to be forced. The procedure is as follows.

- Select the MVT to calibrate.
- Determine which runs take one or more inputs from this transmitter. It is possible that no runs take inputs from the transmitter. It is still possible to calibrate the transmitter, however no inputs need to be forced and no information needs to be logged in the steps that follow.
- Force each input point using sensors from this transmitter to its current value or a fixed value. The value needs to be in the input units for the run, not in the transmitter units. Use the **Force Inputs** command appropriate for the sensor (commands 30, 31, 33, 34, 36, and 37).
- Remove the transmitter from the process.
- For each sensor on the transmitter that is to be calibrated.
- Measure as-found readings for the sensor. Record the as-found readings in the event logs for each run that use the sensor. The values need to be in the input units for the run, not in the transmitter units. Use the **Log User Defined Event** command to log the appropriate events.
- Read the transmitter sensor information to determine the applicable range for the transmitter calibration parameters. Use the **Get MVT Sensor Information** command.
- Determine the new calibration parameters.
- Write the calibration parameters to the transmitter. Use the **Calibrate MVT Sensor** command.
- Measure as-left readings for the sensor. Record the as-left readings in the event logs for each run that use the sensor. The values need to be in the input units for the run, not in the transmitter units. Use the **Log User Defined Event** command to log the appropriate events.
- Reinstall the transmitter into the process.
- Restore each input point using sensors from this transmitter to live values. Use the **End Calibration** command appropriate for the sensor (commands 32, 35, and 38).

MVT Sensor Information Registers

The Sensor Information Registers show information about. These registers are read using the Get MVT Sensor Information command.

Register	***Data Type***	***Description***
49980	uint	Sensor type: 1 = differential pressure 2 = static pressure 3 = flow temperature
49981	float	Zero value
49983	float	Span value (not available for sensor type 3 on SCADAPack 4000 and SCADAPack 4202 or 4203.
49985	float	Upper range limit

49987	float	Lower range limit

MVT Sensor Calibration Registers

The Sensor Calibration Registers contain calibration data for MVT sensors. These registers are written using the **Calibrate MVT Sensor** command.

Register	***Data Type***	***Description***
49990	uint	Sensor type: 1 = differential pressure 2 = static pressure 3 = flow temperature
49991	uint	Type of value 0 = calibration zero 1 = calibration span (not available for sensor type 3 on SCADAPack 4000 and SCADAPack 4202 or 4203). 2 = fixed temperature (for 3095FB only; for sensor type 3 only)
49992	float	Value to set (depends on type of value)

Get MVT Sensor Information Command

This command reads sensor information from a MVT transmitter. The flow computer reads this information from the transmitter and returns it.

Select the type of sensor for which information is needed.

Register	***Data Type***	***Description***
49990	uint	Sensor type: 1 = differential pressure 2 = static pressure 3 = flow temperature

Write the command and read the Command Register until it is cleared.

Register	***Data Type***	***Description***
49500	uint	Command = 134 (Get MVT Sensor Information)
49501	uint	Transmitter number = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the sensor parameters are invalid.

Register	***Data Type***	***Description***
49505	uint	Command status: 134 = command complete other = other = Error code from MVT Command Errors.
49506	uint	Command result: 0 = error occurred 1 to 10 = transmitter number

If a transmitter responded, read the Transmitter Information Registers.

Register	***Data Type***	***Description***
49980	uint	Sensor type: 1 = differential pressure 2 = static pressure 3 = flow temperature
49981	float	Zero value
49983	float	Span value
49985	float	Upper range limit
49987	float	Lower range limit

Calibrate MVT Sensor Command

This command writes sensor calibration data to a MVT transmitter. The flow computer writes the data to the sensor. This command needs to be repeated for each sensor on the transmitter.

The command will not work if span calibration or fixed temperature is selected for the SCADAPack 4000, 4200 or 4300 transmitters.

Write data into the Sensor Calibration Registers.

Register	***Data Type***	***Description***
49990	uint	Sensor type: 1 = differential pressure 2 = static pressure 3 = flow temperature
49991	uint	Type of value 0 = calibration zero 1 = calibration span 2 = fixed temperature (when sensor type is 3)
49992	float	Value to set (depends on type of value)

Write the command and read the Command Register until it is cleared.

Register	***Data Type***	***Description***
49500	uint	Command = 135 (Calibrate MVT Sensor)
49501	uint	Transmitter number = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the command parameters are invalid.

Register	***Data Type***	***Description***
49505	uint	Command status: 135 = command complete other = Error code from MVT Command Errors.
49506	uint	Command result: 0 = error occurred 1 to 10 = transmitter number

Contract Configuration

The flow calculation routines require valid entries for the Contract Configuration Registers. This is called Contract Configuration because these parameters are often defined by a contract for selling gas.

Contract Configuration Registers

The Contract Configuration Registers define parameters for the gas measurement contract.

Changes to the Contract Configuration Registers are not allowed while the flow calculation is running, except as noted below.

The registers in the **Actual Registers** column in these tables are the registers containing the values already in use by the flow calculation routines. The registers in the **Config. Registers** column are the registers used for loading new configuration values to the flow calculation routines.

The registers in this table are read from the flow computer using the ***Get Contract Configuration*** command.

The registers in this table are set in the flow computer using the ***Set Contract Configuration*** command.

Config. Register	***Actual Register***	***Data Type***	***Description***
49630	49640	uint	Meter run number: 1 to 10
49631	49641	uint	Output and log units type: 0 = US1, 1 = US2, 2 = US3, 3 = Imperial, 4 = Metric1, 5 = Metric2, 6 = Metric3, 7 = SI, 8 = US4, 9 = US5, 10 = US6, 11 = US7 12 = US8
49632	49642	uint	Contract hour, 0 to 23
49633	49643	float	Base temperature
49635	49645	float	Base static pressure
49637	49647	uint	**For Flow Computer 6.70 and later** Input weighting average 0 = flow-dependent time-weighted linear average 2 = flow-weighted linear average
			For Flow Computer 5.28 and earlier Input error action 0 = do not accumulate flow when inputs in error 1 = accumulate flow when inputs in error

Config. Register	Actual Register	Data Type	Description
49638	49648	Float	Wet gas meter factor. Version 6.10 or greater. Default value is 1.0. The value 0.0 indicates that the parameter is not supported and that 1.0 should be substituted for it. For version 6.21 or greater, this parameter can be changed while flow calculations are running and without starting a new contract day.
49831	49841	Float	Pemex Base Temperature
49833	49843	Float	Pemex Base Static Pressure

Contract Configuration Registers

Get Contract Configuration Command

The **Get Contract Configuration** command returns the Contract Configuration Registers.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 13 (Get Contract Configuration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	Data Type	Description
49640 to 49646	Contract Configuration Structure	See the ***Contract Configuration Registers*** section for details on these registers.

Set Contract Configuration Command

The **Set Contract Configuration** command sets the Contract Configuration Registers.

Write the configuration data into the registers.

Location	Data Type	Description
49630 to 49636	Contract configuration structure	See the **Contract Configuration Registers** section for details on these registers.

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command = 15 (Set Contract Configuration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

AGA-3 Configuration

AGA-3 Configuration defines parameters unique to the AGA-3 calculation. Configuration of the AGA-3 flow calculation parameters is accomplished by setting the required values into the AGA-3 Configuration Registers.

AGA-3 Configuration Registers

The registers in the **Actual Registers** column in these tables are the registers containing the values already in use by the flow calculation routines. The registers in the **Config. Registers** column are the registers used for loading new configuration values to the flow calculation routines.

The registers in these tables are read from the flow computer using the ***Get AGA-3 Configuration Command***.

The registers in these tables are set in the flow computer using the ***Set AGA-3 Configuration Command***.

Config. Register	***Actual Register***	***Data Type***	***Description***
49650	49680	uint	Meter run: 1 to 10
49651	49681	uint	Orifice material 0 = stainless, 1 = Monel, 2 = carbon steel
49652	49682	uint	Pipe material 0 = stainless, 1 = Monel, 2 = carbon steel
49653	49683	float	Orifice diameter
49655	49685	float	Reference temperature for orifice measurement
49657	49687	float	Pipe diameter
49659	49689	float	Reference temperature for pipe diameter measurement
49661	49691	float	Isentropic exponent
49663	49693	float	Viscosity
49665	49695	float	Temperature dead band

Config. Register	Actual Register	Data Type	Description
49667	49697	float	Static pressure dead band
49669	49699	float	Differential pressure dead band

AGA-3 Configuration Registers

Get AGA-3 Configuration Command

The **Get AGA-3 Configuration** command returns the AGA-3 Configuration Registers.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 301 (get AGA-3 (1992) configuration) Command = 351 (get AGA-3 (1985) configuration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Register to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error code from ***AGA-3 (1985) Calculation Errors***, ***AGA-3 (1992) Calculation Errors*** or ***AGA-3 Command Errors***.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	Data Type	Description
49680 to 49700	AGA-3 Configuration Structure	See the **AGA-3 Configuration Registers** section for details on these registers.

Set AGA-3 Configuration Command

The **Set AGA-3 Configuration** command sets the AGA-3 Configuration Registers.

Write the configuration data into the registers.

Location	Data Type	Description
49650 to 49670	AGA-3 configuration structure	See the **AGA-3 Configuration Registers** section for details on these registers.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 303 (set AGA-3 (1992) configuration) Command = 353 (set AGA-3 (1985) configuration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	***Data Type***	***Description***
49505	uint	Echo command or error code from ***AGA-3 (1985) Calculation Errors***, ***AGA-3 (1992) Calculation Errors*** or ***AGA-3 Command Errors***.
49506	uint	Specific to error. The run number if the command was successful.

AGA-7 Configuration

AGA-7 configuration defines parameters unique to the AGA-7 calculation. Configuration of the AGA-7 flow calculation parameters is accomplished by setting the required values into the AGA-7 Configuration Registers.

AGA-7 Configuration Registers

The registers in the **Actual Registers** column in these tables are the registers containing the values already in use by the flow calculation routines. The registers in the **Config. Registers** column are the registers used for loading new configuration values to the flow calculation routines.

The registers in these tables are read from the flow computer using the ***Get AGA-7 Configuration Command***.

The registers in these tables are set in the flow computer using the ***Set AGA-7 Configuration Command***.

Config. Register	***Actual Register***	***Data Type***	***Description***
49710	49720	uint	Meter run = 1 to 10
49711	49721	float	K factor
49713	49723	float	M factor
49719	49729	unit	Uncorrected Flow Volume 0 = include M factor in calculation (default). 1 = exclude M factor from calculation.

AGA-7 Configuration Registers

Get AGA-7 Configuration Command

The **Get AGA-7 Configuration** command returns the AGA-7 Configuration Registers.

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command = 701 (Get AGA-7 configuration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	***Data Type***	***Description***

Location	Data Type	Description
49505	uint	Command = 701 or error code from ***AGA-7 Calculation Errors*** or ***AGA-7 Command Errors***.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	Data Type	Description
49720 to 49729	AGA-7 Configuration Structure	See the **AGA-7 Configuration Registers** section for details on these registers.

Set AGA-7 Configuration Command

The **Set AGA-7 Configuratio**n command sets the AGA-7 Configuration Registers.

Write the configuration data into the registers.

Location	Data Type	Description
49710 to 49714, 49719	AGA-7 Configuration Structure	See the **AGA-7 Configuration Registers** section for details on these registers.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 703 (Set AGA-7 Configuration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	Data Type	Description
49505	uint	Command = 701 or error code from ***AGA-7 Calculation Errors*** or ***AGA-7 Command Errors***.
49506	uint	Specific to error. The run number if the command was successful.

Coriolis Meter Configuration

Coriolis meter configuration defines parameters unique to the Coriolis meter used for AGA-11 calculations. Configuration of the Coriolis parameters is accomplished by setting the required values into the Coriolis Meter Configuration Registers.

Coriolis Meter Configuration Registers

The registers in the **Actual Registers** column in these tables are the registers containing the values already in use by the flow calculation routines. The registers in the **Config. Registers** column are the registers used for loading new configuration values to the flow calculation routines.

The registers in these tables are read from the flow computer using the ***Get Coriolis Meter Configuration Command***.

The registers in these tables are set in the flow computer using the ***Set Coriolis Meter Configuration Command***.

Config. Register	***Actual Register***	***Data Type***	***Description***
49650	49680	uint	Coriolis Meter: 1 to 10 (Meter number is linked to Meter Run number)
49651	49681	float	Address: 1 to 247
49652	49682	float	Serial port: 0 = Com1, 1 = Com2, 2 = Com3, 3 = Com4
49653	49683	unit	Timeout: 1 to 1000
49654	49684	uint	Device code 0 = E&H Promass 83

Coriolis Meter Configuration Registers

Get Coriolis Meter Configuration Command

The **Get Coriolis Meter Configuration** command returns the Coriolis Meter Configuration Registers.

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command = 112 (get Coriolis Meter configuration)
49501	uint	Coriolis Meter number = 1 to 10 (Meter number is linked to Meter Run number)
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	***Data Type***	***Description***
49505	uint	Command = 112 or error code from ***AGA-11 Calculation Errors*** or ***AGA-11 Command Errors***.
49506	uint	Specific to error. Coriolis meter number if the command was successful. (Meter number is linked to Meter Run number)

Read the Data Registers.

Location	***Data Type***	***Description***
49680 to 49684	Coriolis Meter Configuration Structure	See the ***Coriolis Meter Configuration Registers*** section for details on these registers.

Set Coriolis Meter Configuration Command

The **Set Coriolis Meter Configuratio**n command sets the Coriolis Meter Configuration Registers.

Write the configuration data into the registers.

Location	Data Type	Description
49650 to 49654	Coriolis Meter Configuration Structure	See the ***Coriolis Meter Configuration Registers*** section for details on these registers.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 113 (set Coriolis Meter configuration)
49501	uint	Coriolis Meter number = 1 to 10 (Meter number is linked to Meter Run number)
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	Data Type	Description
49505	uint	Command = 113 or error code from ***AGA-11 Calculation Errors*** or ***AGA-11 Command Errors***.
49506	uint	Specific to error. Coriolis meter number if the command was successful. (Meter number is linked to Meter Run number)

V-Cone Configuration

V-Cone configuration defines parameters unique to the V-Cone calculation. Configuration of the V-Cone flow calculation parameters is accomplished by setting the required values into the V-Cone Configuration Registers.

In the original McCrometer V-Cone Application Sizing sheet that is included with V-Cone meters uses the terminology **Cd** (discharge coefficient) rather than **Cf** (flow coefficient). You will need to use the **Re** and **Cd** values from the V-Cone Application Sizing sheet for the **Re** and **Cf** entries. If the **Re** value is the same for all entries in the table only the first pair is used.

McCrometer now supplies one value of **Cd** in the sizing document. You need to enter one **Re/Cd** pair only. See the McCrometer Application Sizing sheet for the **Re/Cd** pair for your meter.

V-Cone Configuration Registers

The registers in the **Actual Registers** column in these tables are the registers containing the values already in use by the flow calculation routines. The registers in the **Config. Registers** column are the registers used for loading new configuration values to the flow calculation routines.

The registers in these tables are read from the flow computer using the ***Get V-Cone Configuration*** command.

The registers in these tables are set in the flow computer using the ***Set V-Cone Configuration*** command.

Config. Register	Actual Register	Data Type	Description

Config. Register	*Actual Register*	*Data Type*	*Description*
49650	49680	uint	Meter run = 1 to 10
49651	49681	uint	V-Cone material 2 = carbon steel, 3 = stainless 304, 4 = stainless 316
49652	49682	uint	Pipe material 2 = carbon steel, 3 = stainless 304, 4 = stainless 316
49653	49683	float	Cone diameter
49655	49685	float	Reference temperature for cone diameter measurement.
49657	49687	float	Inside meter diameter
49659	49689	float	Reference temperature for inside meter diameter measurement
49661	49691	float	Isentropic exponent
49663	49693	float	Viscosity
49665	49695	float	Number of points: 1 to 10
49667	49697	float	Point 1 Reynold's number
49669	49699	float	Point 1 Coefficient
49671	49701	float	Point 2 Reynold's number
49673	49703	float	Point 2 Coefficient
49675	49705	float	Point 3 Reynold's number
49677	49707	float	Point 3 Coefficient
49679	49709	uint	Adiabatic Expansion Factor Method 0 = Legacy 1 = V-Cone 2 = Wafer Cone
49711	49721	float	Point 4 Reynold's number
49713	49723	float	Point 4 Coefficient
49715	49725	float	Point 5 Reynold's number
49717	49727	float	Point 5 Coefficient
49830	49840	uint	Wet Gas Correction Factor Method 0 = Legacy Method 1 = V-Cone or Wafer Cone
49831	49841	float	Mass flow rate of liquid at flow
49833	49843	float	Density of liquid at flow conditions
49940	49960	float	Point 6 Reynold's number
49942	49962	float	Point 6 Coefficient
49944	49964	float	Point 7 Reynold's number
49946	49966	float	Point 7 Coefficient
49948	49968	float	Point 8 Reynold's number
49950	49970	float	Point 8 Coefficient
49952	49972	float	Point 9 Reynold's number
49954	49974	float	Point 9 Coefficient
49956	49976	float	Point 10 Reynold's number
49958	49978	float	Point 10 Coefficient

V-Cone Configuration Registers

Get V-Cone Configuration

The **Get V-Cone Configuration** command returns the V-Cone Configuration Registers.

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command = 2201 (get V-Cone configuration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	*Data Type*	*Description*
49505	uint	Echo command or error code from **V-Cone Calculation Errors** or ***V-Cone Command Errors***.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	*Data Type*	*Description*
49680 to 49708, 49721 to 49728, 49840 to 49844 49960 to 49979	V-Cone Configuration Structure	See the **V-Cone Configuration Registers** section for details on these registers.

Set V-Cone Configuration

The **Set V-Cone Configuration** command sets the V-Cone Configuration Registers.

Write the configuration data into the registers.

Location	*Data Type*	*Description*
49650 to 49678, 49711 to 49718, 49830 to 79834, 49940 to 49959	V-Cone Configuration Structure	See the **V-Cone Configuration Registers** section for details on these registers.

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command = 2203 (Set V-Cone Configuration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	*Data Type*	*Description*
49505	uint	Echo command or error code from ***V-Cone Calculation Errors*** or ***V-Cone Command Errors***.

49506	uint	Specific to error. The run number if the command was successful.

AGA-8 Configuration

Configuration of the AGA-8 calculation parameters is accomplished by setting the required values into the AGA-8 Configuration Registers. AGA-8 configuration defines parameters unique to the AGA-8 calculation.

The AGA-8 Configuration Registers define the composition of the gas being measured. The gas composition can be made up of a number of components. These components are usually represented as either a percentage of the gas being measured i.e. 0 to 100% or as a fraction of the gas being measured i.e. 0 to 1.0000. The flow computer uses fractional values for gas composition components, 0 to 1.0000.

The range of the fractional values of the components cannot be predetermined. The valid gas components are shown below. There are two ranges shown for each gas component. Realflo accepts any value in the Expanded Range. Only values in the Normal Range will work in every circumstances.

Component	***Normal Range***	***Expanded Range***
Methane CH_4	.4500 to 1.0000	0 to 1.0000
Nitrogen	0 to 0.5000	0 to 1.0000
Carbon Dioxide	0 to 0.3000	0 to 1.0000
Ethane C_2H_6	0 to 0.1000	0 to 1.0000
Propane C_3H_8	0 to 0.0400	0 to 0.1200
Water	0 to 0.0005	0 to 0.0300
Hydrogen Sulfide	0 to 0.0002	0 to 1.0000
Hydrogen	0 to 0.1000	0 to 1.0000
Carbon Monoxide	0 to 0.0300	0 to 0.0300
Oxygen	0	0 to 0.2100
Total Butanes • iButane • nButane	0 to 0.0100	0 to 0.0600
Total Pentanes • iPentane • nPentane	0 to 0.0300	0 to 0.0400
Total Hexane Plus • nHexane • nHeptane • nOctane • nNonane • nDecane	0 to 0.0200	0 to 0.0400
Helium	0 to 0.0200	0 to 0.0300
Argon	0	0 to 0.0100

AGA-8 Configuration Registers

The registers in the **Actual Registers** column in these tables are the registers containing the values already in use by the flow calculation routines. The registers in the **Config. Registers'** column are the registers used for loading new configuration values to the flow calculation routines.

The AGA-8 gas composition can be changed while the flow calculation is running. This allows an on-line gas chromatograph to provide updates to the gas composition. Frequent changes to the composition will result in the event log filling with gas composition events. When the log is full, further changes cannot be made until Realflo reads the log. Use the Composition Logging Control register to not log changes if this occurs.

Realflo checks the validity of the entered components using the following limits:

- Individual components are in the ranges listed in the table above.
- The Total of all Components field displays the sum of components. The total of components needs to be 1.0000 (+/- 0.00001) if Composition Units is set to Mole Fractions or 100% (+/- 0.00001%) if Composition Units is set to Percent.

The registers in these tables are read from the flow computer using the ***Get AGA-8 Gas Ratios Command***

The registers in these tables are set in the flow computer using the ***Set AGA-8 Gas Ratios Command***.

Config. Register	***Actual Register***	***Data Type***	***Description***	
49730	49780	uint	Meter run = 1 to 10	
49731	49781	float	Methane	
49733	49783	float	Nitrogen	
49735	49785	float	Carbon Dioxide	
49737	49787	float	Ethane	
49739	49789	float	Propane	
49741	49791	float	Water	
49743	49793	float	Hydrogen Sulfide	
49745	49795	float	Hydrogen	
49747	49797	float	Carbon Monoxide	
49749	49799	float	Oxygen	
49751	49801	float	iButane	
49753	49803	float	nButane	
49755	49805	float	iPentane	
49757	49807	float	nPentane	
49759	49809	float	n-Hexane (when individual components selected)	Hexanes+ (when combined component s selected)
49761	49811	float	n-Heptane	N/A
49763	49813	float	n-Octane	N/A
49765	49815	float	n-Nonane	N/A
49767	49817	float	n-Decane	N/A
49769	49819	float	Helium	
49771	49821	float	Argon	
49773	49823	uint	Composition logging control 0 = log composition changes 1 = do not log composition changes	
49774	49824	float	Real Relative Gas Density 0 = calculate live value	
49776	49826	float	Heating Value (for dry gas) 0 = calculate live value	

AGA-8 Configuration Registers

Get AGA-8 Gas Ratios Command

The **Get AGA-8 Gas Ratios** command returns the AGA-8 Configuration Registers.

In Flow Computer versions 6.73 and older, when gas ratios are written to the flow computer using the Set AGA-8 Gas Ratios the new gas ratios are updated in the Configuration Config registers. The Configuration Actual registers are not updated until a new Density calculation is started with the new values. The new gas ratios are not available to SCADA host software reading the Configuration Actual registers until a new Density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when gas ratios are written to the flow computer using the Set AGA-8 Gas Ratios the new gas ratios are updated in the Configuration Config registers and in the Configuration Actual registers. This allows a SCADA host to immediately confirm the new ratios were written to the flow computer. The new gas ratios are not used by the flow computer until a new density calculation is started.

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command = 801 (Get AGA-8 gas ratios)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	*Data Type*	*Description*
49505	uint	Command = 801 or error code from ***AGA-8 Calculation Errors*** or ***AGA-8 Command Errors***.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	*Data Type*	*Description*
49780 to 49827	Get AGA-8 Gas Fractions Configuration Structure	See the **AGA-8 Configuration Registers** section for details on these registers.

Set AGA-8 Gas Ratios Command

The **Set AGA-8 Gas Ratios** command sets the AGA-8 Configuration Registers.

Write the configuration data into the registers.

Location	*Data Type*	*Description*

49730 to 49777	AGA-8 Gas Fractions Configuration Structure	See the **AGA-8 Configuration Registers** section for details on these registers.

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command = 803 (Set AGA-8 Gas Ratios)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	*Data Type*	*Description*
49505	uint	Command = 801 or error code from ***AGA-8 Calculation Errors*** or ***AGA-8 Command Errors***.
49506	uint	Specific to error. The run number if the command was successful.

AGA-8 Hexanes+ Configuration Registers

The registers in the **Actual Registers** column in these tables are the registers containing the values already in use by the flow calculation routines. The registers in the **Proposed Registers'** column are the registers used for loading new configuration values to the flow calculation routines.

The AGA-8 Hexanes+ gas portions can be changed while the flow calculation is running. This allows an on-line gas chromatograph to provide updates to the gas composition. Frequent changes to the composition will result in the event log filling with gas composition events. When the log is full, further changes cannot be made until Realflo reads the log.

The AGA-8 Hexanes+ configuration allows a single value to be used for the heavy gas components (n-Hexane through n-Decane). These ratios are applied to the Hexanes+ ratio to determine the true ratio for those components.

The registers in these tables are read from the flow computer using the **Get AGA-8 Hexanes+ Ratios Command.**

The registers in these tables are set in the flow computer using the **Set AGA-8 Hexanes+ Ratios Command.**

If individual gas components are selected, the values of portions will be 0.

If combined value for hexane and higher components is selected, the values of portions from n-Hexane to n-Decane needs to sum to 100.000.

Proposed Registers	*Actual Registers*	*Data Type*	*Description*
49730	49780	Uint	Meter run = 1 to 10
49759	49809	Float	n-Hexane portion
49761	49811	Float	n-Heptane portion
49763	49813	float	n-Octane portion
49765	49815	float	n-Nonane portion

49767	49817	float	n-Decane portion
49773	49823	uint	0 = Use individual gas components (default) 1 = Use combined value for hexane and higher components.

AGA-8 Hexanes+ Configuration Registers

Get AGA-8 Hexanes+ Gas Ratios

The **Get AGA-8 Hexanes+ Gas Ratios** command returns the AGA-8 Hexanes+ Configuration Registers.

In Flow Computer versions 6.73 and older, when AGA-8 Hexanes+ gas ratios are written to the flow computer using the Set AGA-8 Hexanes+ Gas Ratios the new gas ratios are updated in the Proposed Registers. The Actual Registers are not updated until a new Density calculation is started with the new values. The new gas ratios are not available to SCADA host software reading the Actual Registers until a until a new Density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when AGA-8 Hexanes+ gas ratios are written to the flow computer using the Set AGA-8 Hexanes+ Gas Ratios the new gas ratios are updated in the Proposed Registers and in the Actual Registers. This allows a SCADA host to immediately confirm the new ratios were written to the flow computer. The new gas ratios are not used by the flow computer until a new density calculation is started.

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command = 802 (Get AGA-8 Hexanes+ gas ratios)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	***Data Type***	***Description***
49505	uint	Command = 802 or error code from ***AGA-8 Calculation Errors*** or ***AGA-8 Command Errors***.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	***Data Type***	***Description***
49780, 49809 to 49818, 49823	Get AGA-8 Hexanes+ Gas Fractions Configuration Structure	See the AGA-8 Hexanes+ Configuration Registers section for details on these registers.

Set AGA-8 Hexanes+ Gas Ratios

The **Set AGA-8 Hexanes+ Gas Ratios** command sets the AGA-8 Hexanes+ Configuration Registers.

Write the configuration data into the registers.

Location	Data Type	Description
49730, 49759 to 49768, 49773	AGA-8 Hexanes+ Gas Fractions Configuration Structure	See the AGA-8 Hexanes+ Configuration Registers section for details on these registers.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 804 (Set AGA-8 Hexanes+ Gas Ratios)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	Data Type	Description
49505	uint	Command = 802 or error code from ***AGA-8 Calculation Errors*** or ***AGA-8 Command Errors***.
49506	uint	Specific to error. The run number if the command was successful.

NX-19 Configuration

Configuration of the NX-19 flow calculation parameters is accomplished by setting the required values into the NX-19 Configuration Registers. This is not supported for PEMEX flow computers.

NX-19 Configuration Registers

The registers in the **Actual Registers** column in these tables are the registers containing the values already in use by the flow calculation routines. The registers in the **Config. Registers** column are the registers used for loading new configuration values to the flow calculation routines.

The NX-19 gas composition can be changed while the flow calculation is running. This allows an on-line gas chromatograph to provide updates to the gas composition. Frequent changes to the composition will result in the event log filling with gas composition events. When the log is full, further changes cannot be made until Realflo reads the log.

The registers in these tables are read from the flow computer using the ***Set NX-19 Gas Ratios Command***.

The registers in these tables are set in the flow computer using the ***Set NX-19 Gas Ratios Command***.

Config. Register	Actual Register	Data Type	Description
49830	49840	uint	Meter run = 1 to 10
49831	49841	float	Specific gravity
49833	49843	float	Fraction of carbon dioxide
49835	49845	float	Fraction of nitrogen
49837	49847	float	Heating value (valid range: 0.07 to 1.52)

Config. Register	*Actual Register*	*Data Type*	*Description*
49839	49849	uint	Composition logging control 0 = log composition changes 1 = do not log composition changes

NX-19 Configuration Registers

Get NX-19 Gas Ratios Command

The **Get NX-19 Gas Ratios** command returns the NX-19 Configuration Registers.

In Flow Computer versions 6.73 and older, when gas ratios are written to the flow computer using the Set NX-19 Gas Ratios command the new gas ratios are updated in the Configuration Config registers. The Configuration Actual registers are not updated until a new Density calculation is started with the new values. The new gas ratios are not available to SCADA host software reading the Configuration Actual registers until a until a new Density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when gas ratios are written to the flow computer using the Set NX-19 Gas Ratios command the new gas ratios are updated in the Configuration Config registers and in the Configuration Actual registers. This allows a SCADA host to immediately confirm the new ratios were written to the flow computer. The new gas ratios are not used by the flow computer until a new density calculation is started.

Write the **Get NX-19 Gas Ratios** command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	integer	Command = 1901 (Get NX19 Gas Ratios)
49501	integer	Meter run = 1 to 10
49502	integer	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	*Data Type*	*Description*
49505	integer	Command = 1901 or error code from ***NX-19 Calculation Errors*** or ***NX-19 Command Errors***.
49506	integer	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	*Data Type*	*Description*
49840 to 49848	NX-19 Gas Fractions Configuration Structure	See the **NX-19 Configuration Registers** section for details on these registers.

Set NX-19 Gas Ratios Command

The **Set NX-19 Gas Ratios** command sets the NX-19 Configuration Registers.

Write the configuration data into the registers.

Location	***Data Type***	***Description***
49830 to 49838	NX-19 gas fractions configuration structure	See the **NX-19 Configuration Registers** section for details on these registers.

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command = 1903 (Set NX-19 Gas Ratios)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

	Data Type	***Description***
49505	uint	Command = 1901 or error code from ***NX-19 Calculation Errors*** or ***NX-19 Command Errors***.
49506	uint	Specific to error. The run number if the command was successful.

Orifice Plate Change

Changing the orifice plate requires forcing inputs and changing the AGA-3 configuration. Use the following commands to force the inputs before making a change to the AGA-3 configuration. Refer to the AGA-3 Configuration section for commands to change the orifice plate.

Start Plate Change: Temperature Input Commands

A plate change requires that the temperature, static pressure, and differential pressure inputs to a run be forced. These commands affect the temperature input. These commands need to be used with the **Start Plate Change: Static Pressure Input** commands and the **Start Plate Change: Differential Pressure Input** commands.

These commands force the temperature input to either the current temperature or to a fixed value. The flow computer will use the forced value during the plate change process.

Write the information required for the request.

Location	***Data Type***	***Description***
48690	integer	Meter run to calibrate: 1 to 10
48691	float	Forced manual value for temperature. This register is required only if calibration is done using a forced manual value. This register is not used if a forced recent value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 40 = (Start plate change: force current temp.) 41 = (Start plate change: force fixed temp.)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the temperature value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48695	float	Value for temperature while calibrating.

End Plate Change: Temperature Input Command

Ending a plate change requires that the temperature, static pressure, and differential pressure input to a run be returned to live values. This command needs to be used with the **End Plate Change: Static Pressure** command and the **End Plate Change: Differential Pressure** command.

This command ends a plate change by restoring the live input for temperature.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 42 = (End plate change: temperature)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Start Plate Change: Static Pressure Input Commands

A plate change requires that the temperature, static pressure, and differential pressure inputs to a run be forced. These commands affect the static pressure input. These commands needs to be used with the **Start Plate Change: Temperature Input** commands and the **Start Plate Change: Differential Pressure Input** commands.

These commands force the static pressure input to either the current static pressure or to a fixed value. The flow computer will use the forced value during the plate change process.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48691	float	Forced manual value for static pressure. This register is required only if calibration is done using a forced manual value. This register is not used if a forced recent value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 43 = (Start plate change: force current pressure) 44 = (Start plate change: force fixed pressure)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the static pressure value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48695	float	Value for static pressure while calibrating.

End Plate Change: Static Pressure Input Command

Ending a plate change requires that the temperature, static pressure, and differential pressure input to a run be returned to live values. This command needs to be used with the **End Plate Change: Temperature** command and the **End Plate Change: Differential Pressure** command.

This command ends a plate change by restoring the live input for static pressure.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 45 = (End plate change: static pressure)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Start Plate Change: Differential Pressure Input Commands

A plate change requires that the temperature, static pressure, and differential pressure inputs to a run be forced. These commands affect the differential pressure input. These commands need to be used with the **Start Plate Change: Temperature Input** commands and the **Start Plate Change: Static Pressure Input** commands.

These commands force the differential pressure input to either the current differential pressure or to a fixed value. The flow computer will use the forced value during the plate change process.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48691	float	Forced manual value for differential pressure. This register is required only if calibration is done using a forced manual value. This register is not used if a forced recent value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 46 = (Start plate change: force current DP) 47 = (Start plate change: force fixed DP)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the differential pressure value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48695	float	Value for differential pressure while calibrating.

End Plate Change: Differential Pressure Input Command

Ending a plate change requires that the temperature, static pressure, and differential pressure input to a run be returned to live values. This command needs to be used with the **End Plate Change: Temperature** command and the **End Plate Change: Static Pressure** command.

This command ends a plate change by restoring the live input for differential pressure.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 48 = (End plate change: differential pressure)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

User Account Configuration

User Accounts are manipulated using the commands **Lookup User Number, Lookup userID, Read Next Account, Delete Account** and **Update Account.**

User Account Configuration Registers

Data for these commands is written into the Configuration Registers shown below. Not all commands use all of the registers. Any value may be entered in the Unused Registers.

Config. Register	Actual Register	Data Type	Description
49850	49860	uint	User number
49851	49861	uint	Personal Identification Number (PIN)
49852	49862	uint	Authorization level
49853	49863	userID	userID string

User Account Configuration Registers

Lookup User Number Command

The **Lookup User Number** command returns the user number corresponding to a userID. First, write the userID into the user account Configuration Registers. Only the registers shown are used.

Location	Data Type	Description
49853	userID	userID string (8 byte string packed into four registers, null terminated if less that 8 characters).

Write the **Lookup User Number** command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 100 (Lookup User Number)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the user account Reply Registers to determine the user number.

Location	Data Type	Description
49860	uint	User number

Lookup User ID Command

The **Lookup userID** command returns the userID corresponding to a user number. First, write the user number into the user account configuration registers. Only the registers shown are used.

Location	Data Type	Description
49850	uint	User number

Write the **Lookup userID** command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 101 (Lookup userID)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Reply Register to determine the user number.

Location	Data Type	Description
49863	userID	userID string (8 byte string packed into four registers, null terminated if less that 8 characters).

Delete Account Command

The **Delete Account** command removes an account from the flow computer. First, write the userID into the user account Configuration Registers. Only the registers shown are used.

Location	Data Type	Description
49853	userID	userID string (8 byte string packed into four registers, null terminated if less that 8 characters).

Write the **Delete Account** command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 102 (Delete Account)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine if the account was deleted.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Update Account Command

The **Update Account** command creates or updates an account. First, write the userID, PIN and authorization level into the user account configuration registers. Only the registers shown are used.

Location	Data Type	Description
49851	uint	PIN
49852	uint	Authorization level
49853	userID	userID string (8 byte string packed into four registers, null terminated if less that 8 characters).

Write the **Update Account** command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 103 (Update Account)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the user account Reply Registers to determine the user number (if needed).

Location	Data Type	Description
49860	uint	User number

Read Next Account Command

The **Read Next Account** command is used to read account information from the flow computer. The command is repeated until the user accounts have been read.

First, write zero into the user number Configuration Register. User number zero is reserved for the flow computer. Retrieving the next user returns the first valid user account.

Location	Data Type	Description
49850	uint	User number

Write the **Read Next Account** command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 104 (Read Next Account)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	0

Read the user account Reply Registers to determine account information.

Location	Data Type	Description

49860	uint	User number
49861	uint	PIN
49862	uint	Authorization level
49863	userID	userID string

If the user number is non-zero, this is a valid account. If the user number is zero, this indicates that no more accounts can be found.

Repeat the process above, using the user number returned as the starting point. Repeat until the user number returned is zero.

Meter Runs Configuration

Meter Runs Configuration Registers

The Run Configuration Registers determine how many meter runs are active. The value is written into the Configuration Register.

Config. Register	***Actual Register***	***Data Type***	***Description***
49870	49875	uint	Number of meter runs in use.

Set Number of Meter Runs Command

This command sets the number of active runs. The number of active runs determines the flow calculation period.

Write the configuration data into the register.

Location	***Type***	***Description***
49870	uint	Number of runs to use: 1 to 10

Write the command 16 (Set Number of Runs) and read the Command Register until it is cleared.

Location	***Type***	***Description***
49500	uint	Command = 16 (Set Number of Runs)
49501	uint	Unused
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	***Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Unused

Flow Run Identification

The Run Identifier (runID) aids in identifying each flow run. The runID is a 16-character string. The runID string is stored in registers in the runID format.

For older flow computers the Run ID is a 16-character string. The Run ID string is stored in registers in the runID format. See the **Run ID Configuration Registers** section.

For version 6 or greater, the Run ID is a 32-character string. The Run ID string is stored in registers in the runID2 format. See the **Long Run ID Configuration Registers** section.

Run ID Configuration Registers

The runID is set using the command **Set runID**. Data for the command is written into the ID Configuration Registers.

These registers overlap the Flow Computer ID registers, but use a different layout.

Config. Register	*Actual Register*	*Data Type*	*Description*
49880	49890	runID	runID string.

Set Run ID Command

Write the configuration data into the registers.

Location	*Data Type*	*Description*
49880	runID	runID string.

Write the command 19 (Set runID) and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command = 19 (Set runID)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	*Data Type*	*Description*
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

The flow computer will log a Set runID event, in the event log, for the run when the ID is set.

The command will not work if there is not enough room in the log for an event. If this occurs the flow runID will not be changed.

Get Run ID Command

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command = 20 (Get Run ID)
49501	uint	Meter run = 1 to 10
49502	uint	User number

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	Data Type	Description
49890	runID	runID string

Long Run ID Configuration Registers

The runID is set using the command **Set Long Run ID**. Data for the command is written into the ID Configuration Registers.

These registers overlap the Flow Computer ID registers and the Run ID registers, but use a different layout.

Proposed Register	Actual Register	Data Type	Description
49880	49880	RunID2	RunID string.

Set Long Run ID Command

Write the configuration data into the registers.

Location	Data Type	Description
49880	runID2	runID string.

Write the command 21 (Set Long Run ID) and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command = 21 (Set Long Run ID)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

The flow computer will log a Set Run ID event, in the event log, for the run when the ID is set.

The command will not work if there is not enough room in the log for an event. If this occurs the flow runID will not be changed.

Get Long Run ID Command

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command = 22 (Get Long Run ID)
49501	uint	Meter run = 1 to 10
49502	uint	User number

Read the Reply Registers to determine whether the data is available.

Location	*Data Type*	*Description*
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	*Data Type*	*Description*
49880	RunID2	runID string

Flow Computer Execution Control

The execution Control Registers control the state of the flow routine execution for the selected meter run. The state of the flow routine execution is selected as either run or stop. Some commands, such as **Contract Configuration Commands**, are not allowed when the flow calculation is running.

Execution Control Registers

Config. Register	*Data Type*	*Description*
48500	uint	Meter run = 1 to 10
48501	uint	Execution state: 1: stop, 2: run
48502	uint	Flow calculation interval (reserved but not used)

Execution Control Registers

Set Execution State Command

Write the desired execution state into the registers.

Location	*Data Type*	*Description*
48500	uint	Meter run = 1 to 10
48501	uint	Execution state: 1 for stopped state 2 for running state

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 8 (Set Execute)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the execution state was accepted.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run if the command was successful.

Read the current execution state from the registers shown in the following table. These registers always show the current execution status for the meter run.

Location	Data Type	Description
47501	uint	Meter run 1 execution state: 1 when stopped 2 when running
46501	uint	Meter run 2 execution state: 1 when stopped 2 when running
45601	uint	Meter run 3 execution state: 1 when stopped 2 when running

Flow Computer ID Configuration

The Flow Computer Identifier allows Realflo to keep from mixing data from different flow computers. The ID is an eight-character string. The ID string is stored in registers using the same format as the existing userID data type.

Flow Computer Identifier Configuration Registers

The Flow Computer ID is set using the command **Set Flow Computer ID**. Data for the command is written into the ID Configuration Registers.

Config. Register	Actual Register	Data Type	Description
49880	49885	userID	Flow Computer ID string.

Set Flow Computer ID Command

The Flow Computer ID provides for a unique identification of each gas flow computer. This unique ID stops accidental mixing of data from different flow computers.

Write the configuration data into the registers.

Location	Data Type	Description
49880	userID	Flow Computer ID string.

Write the command 17 (Set Flow Computer ID) and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command = 17 (Set Flow Computer ID)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the configuration was accepted.

Location	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Get Flow Computer ID Command

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command = 18 (Get Flow Computer ID)
49501	uint	Meter run = 1 to 10
49502	uint	User number

Read the Reply Registers to determine whether the data is available.

Location	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	***Data Type***	***Description***
49885	userID	Flow Computer ID string

Enron Modbus Time Stamp Configuration

The **Enron Timestamp** selects the type of timestamp for Enron flow history logs. Realflo and flow computer versions 6.77 and higher support the selection of **time leads data** or **time lags data** for the timestamp.

- Time leads data selection time stamps the data for the period at the beginning of the period.
- Time lags data selection time stamps the data for the period at the end of the period.

The configuration is valid for each run of the flow computer and is applied on the Enron Modbus enabled ports only. This control is hidden in PEMEX or GOST application modes.

Following registers determine how the Enron Modbus time stamp is defined. The value is written into the Configuration Register.

Config. Register	Actual Register	Type	Description
49874	49879	uint	Time stamp in Enron Modbus 0 = time leads data 1 = time lags data

Set Enron Modbus Time Stamp Command

This command sets the definition of the Enron Modbus time stamp.

Write the configuration data into the register.

Register	Type	Description
49874	uint	Time stamp in Enron Modbus 0 = time leads data 1 = time lags data

Write the command 23 (Set Enron Modbus Time Stamp Command) and read the Command Register until it is zero.

Register	Type	Description
49500	uint	Command = 23 (Set Enron Modbus Time Stamp)
49501	uint	Unused
49502	uint	User number
49503	uint	Pass code for user

Read the Reply Registers to determine whether the configuration was accepted.

Register	Type	Description
49505	Uint	Command status: 23 = command complete Other = error code
49506	uint	Command result: meter run if successful

Real Time Clock Configuration

The Real Time Clock is fully adjustable using the configuration registers. The RTC is configured using the **Set Real Time Clock** or the **Adjust Real Time Clock** commands.

The following methods cannot be used to set the real time clock when using the flow computer.

- The CNFG Real Time Clock and Alarm register assignment in Telepace.

- The setclock function in ISaGRAF.
- The Real Time Clock dialog in Telepace or ISaGRAF.

Using any of these methods to set the Real Time Clock may result in the flow computer logging data incorrectly.

Real Time Clock Configuration Registers

The registers in these tables are read from the flow computer using the command.

Config. Register	*Data Type*	*Description*
48503	uint	Years, 1997 to 2096
48504	uint	Months, 1 to 12
48505	uint	Days, 1 to 31, with exceptions
48506	uint	Hours, 0 to 23
48507	uint	Minutes, 0 to 59
48508	uint	Seconds, 0 to 59

Real Time Clock Settings Registers

Config. Register	*Data Type*	*Description*
48509	sint	Seconds, -32000 to 32000, Increment / Decrement number of seconds

Real Time Clock Adjustment Registers

The actual registers in the table below are updated on each execution of the gas flow engine.

Actual Register	*Data Type*	*Description*
48510	uint	Real Time Clock Hour, 0 to 23
48511	uint	Real Time Clock Minute, 0 to 59
48512	uint	Real Time Clock Second, 0 to 59
48513	uint	Real Time Clock Year, 0 to 99
48514	uint	Real Time Clock Month, 1 to 12
48515	uint	Real Time Clock Day, 1 to 31
48516	uint	Reserved but unused
48517	uint	Reserved but unused
48518	uint	Reserved but unused
48519	uint	Reserved but unused
48520	uint	Reserved but unused

Real Time Clock Actual Value Registers

Read Real Time Clock

One Real Time Clock is configured for the flow computer.

Location	*Data Type*	*Description*
48510	uint	Hour: 0 to 23
48511	uint	Minute: 0 to 59
48512	uint	Second: 0 to 59

Location	Data Type	Description
48513	uint	Year: (19)97 to 99, (20)00 to 96. This register contains one or two digits only, not the entire four digit year.
48514	uint	Month: 1 to 12
48515	uint	Day: 1 to 31
48516 to 48520		Other RTC Configuration data

Set Real Time Clock Command

Write the new time into the registers.

Location	Data Type	Description
48503	uint	Year: (19) 97 to 99, (20) 00 to 96. The complete four digit year needs to be entered.
48504	uint	Month : 1 to 12
48505	uint	Day : 1 to 31
48506	uint	Hour : 0 to 23
48507	uint	Minute : 0 to 59
48508	uint	Second : 0 to 59

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 6 (Set Real Time Clock)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the time was accepted.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. 0 if the command was successful.

Adjust Real Time Clock Command

Write the time adjustment into the registers.

Location	Data Type	Description
48509	integer	Seconds, -32000 to 32000

Write the command 9 (Adjust Real Time Clock) and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 9 (Adjust Real Time Clock)
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the time adjustment was accepted.

Location	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. 0 if the command was successful.

SolarPack 410 Power Management Configuration

The SolarPack 410 Power Management configuration is fully adjustable using the configuration registers. The SolarPack 410 Power Management is configured using the **Set Power Management** or the **Get Power Management** commands.

SolarPack 410 Power Management Configuration Registers

Power management is configured using the following registers.

The Power Management Configuration Registers are defined as follows. The registers in the **Register** column are the registers containing the values already in use by the flow computer or are the registers used for loading new configuration values to the flow computer.

The registers in this table are read using the ***Get Power Management Command.***

The registers in this table are set using the ***Set Power Management Command***.

Register	***Data Type***	***Description***
43180	uint	Enable Input: Time in minutes until power off (1 to 240)
43181	uint	Enable Input: Radio power 0=off, 1=on
43182	uint	Enable Input: *Bluetooth* power 0=off, 1=on
43183	uint	Enable Input: Display backlight 0=off, 1=on
43184	uint	Enable input: Display 0=off, 1=on
43185	uint	Continuous wake: enable 0=off, 1=on
43186	uint	Continuous wake: Radio power 0=off, 1=on
43187	uint	Continuous wake: *Bluetooth* power 0=off, 1=on
43188	uint	Continuous wake: Display backlight 0=off, 1=on
43189	uint	Continuous wake: Display 0=off, 1=on
43190	uint	Scheduled Wake: Time in minutes until power off (1 to 240)
43191	uint	Scheduled Wake: Radio power 0=off, 1=on
43192	uint	Scheduled Wake: *Bluetooth* power 0=off, 1=on
43193	uint	Scheduled Wake: Display backlight 0=off, 1=on
43194	uint	Scheduled Wake: Display 0=off, 1=on
43195	uint	Scheduled Wake: Number of times to wake (0 to 24)
43196	uint	Scheduled Wake: Time 1 to wake (minutes since 00:00)
43197	uint	Scheduled Wake: Time 2 to wake (minutes since 00:00)
43198	uint	Scheduled Wake: Time 3 to wake (minutes since 00:00)

Register	*Data Type*	*Description*
43199	uint	Scheduled Wake: Time 4 to wake (minutes since 00:00)
43200	uint	Scheduled Wake: Time 5 to wake (minutes since 00:00)
43201	uint	Scheduled Wake: Time 6 to wake (minutes since 00:00)
43202	uint	Scheduled Wake: Time 7 to wake (minutes since 00:00)
43203	uint	Scheduled Wake: Time 8 to wake (minutes since 00:00)
43204	uint	Scheduled Wake: Time 9 to wake (minutes since 00:00)
43205	uint	Scheduled Wake: Time 10 to wake (minutes since 00:00)
43206	uint	Scheduled Wake: Time 11 to wake (minutes since 00:00)
43207	uint	Scheduled Wake: Time 12 to wake (minutes since 00:00)
43208	uint	Scheduled Wake: Time 13 to wake (minutes since 00:00)
43209	uint	Scheduled Wake: Time 14 to wake (minutes since 00:00)
43210	uint	Scheduled Wake: Time 15 to wake (minutes since 00:00)
43211	uint	Scheduled Wake: Time 16 to wake (minutes since 00:00)
43212	uint	Scheduled Wake: Time 17 to wake (minutes since 00:00)
43213	uint	Scheduled Wake: Time 18 to wake (minutes since 00:00)
43214	uint	Scheduled Wake: Time 19 to wake (minutes since 00:00)
43215	uint	Scheduled Wake: Time 20 to wake (minutes since 00:00)
43216	uint	Scheduled Wake: Time 21 to wake (minutes since 00:00)
43217	uint	Scheduled Wake: Time 22 to wake (minutes since 00:00)
43218	uint	Scheduled Wake: Time 23 to wake (minutes since 00:00)
43219	uint	Scheduled Wake: Time 24 to wake (minutes since 00:00)

Set Power Management Command

This command writes the power management settings.

Write the configuration to the configuration registers.

Register	*Data Type*	*Description*
43180 to 43219		See above.

Write the command and read the Command Register until it is cleared.

Register	Data Type	Description
49500	uint	Command = 152 (Set Power Management)
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the configuration data are invalid.

Register	Data Type	Description
49505	uint	Command status 152 = command complete
49506	uint	Command result: 0 = OK 1 = invalid parameters

Get Power Management Command

This command reads the power management settings.

Write the command and read the Command Register until it is cleared.

Register	Data Type	Description
49500	uint	Command = 153 (Get Power Management)
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the configuration data are invalid.

Register	Data Type	Description
49505	uint	Command status 153 = command complete other = error code
49506	uint	Command result: 0 = OK 1 = invalid parameters

Read the configuration from the configuration registers if successful.

Register	Data Type	Description
43180 to 43219		See above.

If the configuration is incorrect, the following error code will be returned.

Number	Description
30140	Invalid power management configuration

SolarPack 410 Gas Sampler Output

The gas sampler output is pulsed based on the current flow. The pulse rate is configurable with a factor based on the current volume. The typical interval is once per 15 seconds to once per 2 hours. The pulse width is user adjustable from 0.1 seconds to 5.0 seconds.

Gas Sampler Configuration

The gas sampler is configured using these registers.

Register	Data Type	Description
43230-43231	Float	Volume/pulse using contract units for run 1.
43232	uint	Pulse width in multiples of 0.1 seconds (1 to 50)

Set Gas Sampler Configuration Command

This command writes the gas sampler settings.

Write the configuration to the configuration registers.

Register	Data Type	Description
43230 to 43232		See above.

Write the command and read the Command Register until it is cleared.

Register	Data Type	Description
49500	uint	Command = 154 (Set Gas Sampler Configuration)
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the configuration data are invalid.

Register	Data Type	Description
49505	uint	Command status 154 = command
49506	uint	Command result: 0 = OK 1 = invalid parameters

Get Gas Sampler Configuration Command

This command reads the gas sampler settings.

Write the command and read the Command Register until it is cleared.

Register	Data Type	Description
49500	uint	Command = 155 (Get Gas Sampler Configuration)
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the configuration data are invalid.

Register	Data Type	Description

Register	Data Type	Description
49505	uint	Command status 155 = command complete
49506	uint	Command result: 0 = OK 1 = invalid parameters

Read the configuration from the configuration registers if successful.

Register	Data Type	Description
43230 to 43232		See above.

If the configuration is incorrect, the following error code will be returned.

Number	Description
30139	Invalid gas sampler output configuration

SolarPack 410 Pulse Input Accumulation

The SolarPack 410 flow computer can accumulate a pulse input. The flow computer counts the number of pulses, divides by a K factor and accumulates the results. Total volume, today’s volume, yesterday’s volume, this month’s volume, and last month’s volume accumulators are provided.

Pulse Input Accumulation Configuration

The pulse input accumulation is configured using these registers.

Register	Data Type	Description
43240	uint	Counter register (30001 to 39999, 40001 to 49999) Specifies two registers containing the count value. These registers need to contain a 32-bit unsigned value. The value needs to increase or remain the same (i.e. it cannot decrease) except when it rolls over from the maximum 32-bit unsigned value to zero.
43241-43242	float	K factor (any value > 0) in pulses/volume
43243	Uint	Volume Units 0 = ft^3 (cubic feet) 1 = m^3 (cubic metres) 2 = litres 3 = barrels (42 US gallons) 4 = US gallons

Pulse Input Accumulation Registers

The pulse accumulation is reported in these registers. The registers are available.

Register	Data Type	Description
43248-43249	ulong	Pulse accumulator raw total (total number of pulses)
43250-43251	float	Pulse accumulator total volume in configured units

Register	Data Type	Description
43252-43253	float	Pulse accumulator today's volume in configured units
43254-43255	float	Pulse accumulator yesterday's volume in configured units
43256-43257	float	Pulse accumulator this month's volume in configured units
43258-43259	float	Pulse accumulator last month's volume in configured units
43260	Uint	Volume Units 0 = ft^3 (cubic feet) 1 = m^3 (cubic metres) 2 = litres 3 = barrels (42 US gallons) 4 = US gallons

Set Pulse Input Configuration Command

This command writes the pulse input settings.

Write the configuration to the configuration registers.

Register	Data Type	Description
43240 to 43243		See above.

Write the command and read the Command Register until it is cleared.

Register	Data Type	Description
49500	uint	Command = 156 (Set Pulse Input Configuration)
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the configuration data are invalid. The command does not work if there isn't sufficient room in the run 1 event log to log changes.

Register	Data Type	Description
49505	uint	Command status 156 = command complete
49506	uint	Command result: 0 = OK 1 = invalid parameters

Get Pulse Input Configuration Command

This command reads the pulse input settings.

Write the command and read the Command Register until it is cleared.

Register	Data Type	Description
49500	uint	Command = 157 (Get Pulse Input Configuration)

Register	Data Type	Description
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the configuration data are invalid.

Register	Data Type	Description
49505	uint	Command status 157 = command complete
49506	uint	Command result: 0 = OK 1 = invalid parameters

Read the configuration from the configuration registers if successful.

Register	Data Type	Description
43240 to 43243		See above.

If the configuration is incorrect, the following error code will be returned.

Number	Description
30138	Invalid pulse configuration

Display Control Configuration

Users may select the data that is displayed on the optional display module. The data to display and the interval between the displayed items is user defined. Data items that may be displayed are shown in the **Display Item Identifiers** section below.

Display Control Configuration Registers

The Display Control Configuration Registers are defined as follows. The registers in the **Register** column are the registers containing the values already in use by the flow computer MVT transmitter or are the registers used for loading new configuration values to the flow computer and the transmitter.

The registers in this table are read using the **Get Display Control Configuration Command.**

The registers in this table are set using the **Set Display Control Configuration Command**.

Register	***Data Type***	***Description***
43470	uint	Display interval (2 to 60 seconds)
43471	uint	Display custom item 1 (Use one identifier from the list in **Display Item Identifiers**)
43472	uint	Display custom item 2 (Use one identifier from the list in **Display Item Identifiers**)

Register	***Data Type***	***Description***
43473	uint	Display custom item 3 (Use one identifier from the list in **Display Item Identifiers**)
43474	uint	Display custom item 4 (Use one identifier from the list in **Display Item Identifiers**)
43475	uint	Display custom item 5 (Use one identifier from the list in **Display Item Identifiers**)
43476	uint	Display custom item 6 (Use one identifier from the list in **Display Item Identifiers**)
43477	uint	Display custom item 7 (Use one identifier from the list in **Display Item Identifiers**)
43478	uint	Display custom item 8 (Use one identifier from the list in **Display Item Identifiers**)
43479	uint	Display custom item 9 (Use one identifier from the list in **Display Item Identifiers**)
43480	uint	Display custom item 10 (Use one identifier from the list in **Display Item Identifiers**)
43481	uint	Display custom item 11 (Use one identifier from the list in **Display Item Identifiers**)
43482	uint	Display custom item 12 (Use one identifier from the list in **Display Item Identifiers**)

Display Item Identifiers

Use these values when programming the display controller.

Display Item	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**
DP (input units)	1001	2001	3001	4001	5001
SP (input units)	1002	2002	3002	4002	5002
PT (input units)	1003	2003	3003	4003	5003
Current Time	1004	2004	3004	4004	5004
runID	1005	2005	3005	4005	5005
Orifice plate size (input units)	1006	2006	3006	4006	5006
Calculation state (contract units)	1007	2007	3007	4007	5007
Flow volume rate (contract units)	1008	2008	3008	4008	5008
Flow mass rate (contract units)	1009	2009	3009	4009	5009
Flow energy rate (contract units)	1010	2010	3010	4010	5010
Flow Time	1011	2011	3011	4011	5011
Today’s flow volume (contract units)	1012	2012	3012	4012	5012
Yesterday’s flow volume (contract units)	1013	2013	3013	4013	5013

Display Item	Run 1	Run 2	Run 3	Run 4	Run 5
Pulses	1014	2014	3014	4014	5014
Relative Density	1015	2015	3015	4015	5015
Pipe diameter	1016	2016	3016	4016	5016
Atmospheric pressure	1017	2017	3017	4017	5017
Battery Voltage (SolarPack 410 only)	1018	2018	3018	4018	5018
Custom Item 1	1101	2101	3101	4101	5101
Custom Item 2	1102	2102	3102	4102	5102
Custom Item 3	1103	2103	3103	4103	5103
Custom Item 4	1104	2104	3104	4104	5104
Custom Item 5	1105	2105	3105	4105	5105

Display Item	Run 6	Run 7	Run 8	Run 9	Run 10
DP (input units)	6001	7001	8001	9001	10001
SP (input units)	6002	7002	8002	9002	10002
PT (input units)	6003	7003	8003	9003	10003
Current Time	6004	7004	8004	9004	10004
runID	6005	7005	8005	9005	10005
Orifice plate size (input units)	6006	7006	8006	9006	10006
Calculation state (contract units)	6007	7007	8007	9007	10007
Flow volume rate (contract units)	6008	7008	8008	9008	10008
Flow mass rate (contract units)	6009	7009	8009	9009	10009
Flow energy rate (contract units)	6010	7010	8010	9010	10010
Flow time	6011	7011	8011	9011	10011
Today’s flow volume (contract units)	6012	7012	8012	9012	10012
Yesterday’s flow volume (contract units)	6013	7013	8013	9013	10013
Pulses	6014	7014	8014	9014	10014
Relative Density	6015	7015	8015	9015	10015
Pipe diameter	6016	7016	8016	9016	10016
Atmospheric pressure	6017	7017	8017	9017	10017
Battery Voltage	6018	7018	8018	9018	10018
Custom Item 1	6101	7101	8101	9101	10101
Custom Item 2	6102	7102	8102	9102	10102
Custom Item 3	6103	7103	8103	9103	10103
Custom Item 4	6104	7104	8104	9104	10104
Custom Item 5	6105	7105	8105	9105	10105

Get Display Control Configuration Command

This command reads a display control configuration from the flow computer.

Write the command and read the Command Register until it is cleared.

Register	***Data***	***Description***

	Type	
49500	uint	Command = 137 (Get Display Control Configuration)
49501	uint	Transmitter number = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the command parameters are invalid.

Register	***Data Type***	***Description***
49505	uint	Command status: 137 = command complete Other = error code
49506	uint	Command result: 0 = error occurred 1 to 10 = transmitter number

If a transmitter was found, read the actual Configuration Registers.

Register	***Data Type***	***Description***
43470 to 43482	Display Control Configuration Structure	See the **Display Control Configuration Registers** section for details.

Set Display Control Configuration Command

The command writes a display control configuration to the flow computer. The flow computer writes the configuration and data to the transmitter. If the transmitter does not respond, the configuration is still saved in the flow computer memory.

Write data into the Configuration Registers.

Register	***Data Type***	***Description***
43470 to 43482	Display control configuration structure	See the **Display Control Configuration Registers** section for details.

Write the command and read the Command Register until it is cleared.

Register	***Data Type***	***Description***
49500	uint	Command = 138 (Set Display Control Configuration)
49501	uint	Transmitter number = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the configuration data are invalid.

Register	***Data Type***	***Description***
49505	uint	Command status: 138 = command complete

Register	Data Type	Description
		Other = error code
49506	uint	Command result: 0 = error occurred 1 to 10 = transmitter number

Get Display Control Custom Configuration Command

This command reads a display control custom configuration from the flow computer.

Write the index number of the custom configuration to get from the flow computer.

Register	Data Type	Configuration
43483	uint	Number of the custom configuration for the flow run. 1 to 5.

Write the command and read the command register until it is cleared.

Register	Data Type	Configuration
49500	uint	Command = 150 (Get Display Controller Custom Configuration)
49501	Uint	Transmitter number = 1 to 10
49502	Uint	User number
49503	Uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the configuration data are invalid.

Register	Data Type	Configuration
49505	uint	Command status 150 = command complete Other = error code
49506	Uint	Command result: 0 = error occurred 1 to 10 = Transmitter number

If a transmitter was found, read the actual Custom Configuration record.

Register	Data Type	Configuration
43483	uint	Index number of the custom configuration for the flow run. 1 to 5
43484	Uint	Register to display: 00001 to 09999, 10001 to 19999, 30001 to 39999, 40001 to 49999. 0 = not used
43485	Uint	Display type 1 = Boolean 2 = Signed integer 3 = Unsigned integer 4 = Signed double

Register	Data Type	Configuration
		5 = Unsigned double 6 = ISaGRAF integer 7 = Floating point
43486 to 43489	Chars	Item description string. Seven character string packed into four registers. The first character is in the low order byte. The second character is in the high order byte.
43490 to 43493	Chars	Units string. Seven character string packed into four registers. The first character is in the low order byte. The second character is in the high order byte.

Set Display Control Custom Configuration Command

This command reads a display control custom configuration from the flow computer.

Write the data for one custom configuration index number to the flow computer.

Register	Data Type	Configuration
43483	uint	Index number of the custom configuration for the flow run. 1 to 5
43484	Uint	Register to display: 00001 to 09999, 10001 to 19999, 30001 to 39999, 40001 to 49999. 0 = not used
43485	Uint	Display type 1 = Boolean 2 = Signed integer 3 = Unsigned integer 4 = Signed double 5 = Unsigned double 6 = ISaGRAF integer 7 = Floating point
43486 to 43489	Chars	Item description string. Seven character string packed into four registers. The first character is in the low order byte. The second character is in the high order byte.
43490 to 43493	Chars	Units string. Seven character string packed into four registers. The first character is in the low order byte. The second character is in the high order byte.

Write the command and read the command register until it is cleared.

Register	Data Type	Configuration
49500	uint	Command = 151 (Set Display Controller Custom Configuration)
49501	Uint	Transmitter number = 1 to 10
49502	Uint	User number
49503	Uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the configuration data are invalid.

Register	***Data Type***	***Configuration***
49505	uint	Command status 151 = command complete Other = error code
49506	Uint	Command result: 0 = error occurred 1 to 10 = Transmitter number

Process Input / Output Configuration

Process I/O defines scaling and alarms for input and output points used by your process. Input points convert integer values read from input modules into floating-point values. Output points convert floating-point values into integer values for output modules.

Process I/O is normally used with I/O points that are not related to the flow runs. Use the run configuration to scale inputs to flow runs.

Process I/O is not available on SCADAPack Flow Computers with ISaGRAF firmware. Use an ISaGRAF program to scale I/O values.

The Process I/O configuration registers are defined as follows. The registers in the **Actual Register** column are the registers containing the values already in use by the flow computer. The registers in the **Config. Register** column are the registers used for loading new configuration values to the flow computer.

Process I/Os Configuration Registers

Config. Register	***Actual Register***	***Data Type***	***Description***
43400	43405	uint	Number of process inputs On SCADAPack Flow Computers the maximum number of inputs is 10. On SCADAPack 32, SCADAPack 314/330/334 and SCADAPack 350 Flow Computers the maximum number of inputs 30.
43401	43406	uint	Number of process outputs The maximum number of outputs is 10.

Process Input Configuration Registers

The Process Input configuration are used with the process I/O commands.

Config. Register	***Actual Register***	***Data Type***	***Description***
43410	43440	uint	Process input status 0 = disabled 1 = enabled
43411	43441	uint	Source format 0 = Telepace Integer 5 = ISaGRAF Integer
43412	43442	uint	Source register:

Config. Register	Actual Register	Data Type	Description
			30001 to 39999, 40001 to 49999
43413	43443	uint	Low alarm point: 0 = disabled 00001 to 09999 = address of coil
43414	43444	uint	High alarm point: 0 = disabled 00001 to 09999 = address of coil
43415	43445	uint	Destination format 0 = Most Significant Word First (MSW First) 1 = Least Significant Word First (LSW First)
43416	43446	uint	Destination register: 40001 to 49999
43417	43447	long	Source range zero scale: Source format 0: –32768 to 32767 Source format 5: –2,147,483,648 to 2,147,483,647
43419	43449	long	Source range full scale: Source format 0: –32768 to 32767 Source format 5: –2,147,483,648 to 2,147,483,647
43421	43451	float	Destination range zero scale
43423	43453	float	Destination range full scale
43425	43455	float	Low alarm setpoint
43427	43457	float	Low alarm hysteresis
43429	43459	float	High alarm setpoint
43431	43461	float	High alarm hysteresis

Process Output Configuration Registers

The Process Output Configuration Registers are used with the process I/O commands.

Config. Register	Actual Register	Data Type	Description
43410	43440	uint	Process output status 0 = disabled 1 = enabled
43411	43441	uint	Source format 0 = Most Significant Word First (MSW First) 1 = Least Significant Word First (LSW First)
43412	43442	uint	Source register: 40001 to 49999
43413	43443	uint	Low alarm point: 0 = disabled 00001 to 09999 = address of coil
43414	43444	uint	High alarm point: 0 = disabled 00001 to 09999 = address of coil
43415	43445	uint	Destination format 0 = Telepace Integer

Config. Register	**Actual Register**	**Data Type**	**Description**
			5 = ISaGRAF Integer
43416	43446	uint	Destination register: 40001 to 49999
43417	43447	long	Destination range zero scale: Destination format 0: –32768 to 32767 Destination format 5: –2,147,483,648 to 2,147,483,647
43419	43449	long	Destination range full scale: Destination format 0: –32768 to 32767 Destination format 5: –2,147,483,648 to 2,147,483,647
43421	43451	float	Source range zero scale
43423	43453	float	Source range full scale
43425	43455	float	Low alarm setpoint
43427	43457	float	Low alarm hysteresis
43429	43459	float	High alarm setpoint
43431	43461	float	High alarm hysteresis

Get Number of Process Inputs Command

This command reads the maximum number of process inputs from the flow computer.

Write the command and read the Command Register until it is cleared.

Register	**Data Type**	**Description**
49500	uint	Command = 140 (Get Number of Process Inputs)
49501	uint	0
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the command parameters are invalid.

Register	**Data Type**	**Description**
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. 0 if the command was successful.

Read the Actual Configuration Registers.

Register	**Data Type**	**Description**
43405	uint	See the **Process I/Os Configuration Registers** section for details.

Get Process Input Command

This command reads one Process Input configuration from the flow computer.

Write the command and read the Command Register until it is cleared.

Register	**Data Type**	**Description**

49500	uint	Command = 142 (Get Process Input)
49501	uint	Process Input Number 1 to 10 for SCADAPack Flow Computers 1 to 30 for SCADAPack 32, SCADAPack 314/330/334 and SCADAPack 350 Flow Computers
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the command parameters are invalid.

Register	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Process Input Number. 0 if the command was unsuccessful.

Read the Actual Configuration Registers.

Register	***Data Type***	***Description***
43440 to 43462	mixed	See the **Process Input Configuration Registers** section for details.

Set Process Input Command

This command writes one Process Input configuration to the flow computer.

Write the Configuration Registers.

Register	***Data Type***	***Description***
43410 to 43432	mixed	See the **Process Input Configuration Registers** section for details.

Write the command and read the Command Register until it is cleared.

Register	***Data Type***	***Description***
49500	uint	Command = 143 (Set Process Input)
49501	uint	Process Input Number 1 to 10 for SCADAPack Flow Computers 1 to 30 for SCADAPack 32, SCADAPack 314/330/334 and SCADAPack 350 Flow Computers
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the command parameters are invalid.

Register	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Process Input Number. 0 if the command was

		unsuccessful.

Get Number of Process Outputs Command

This command reads the maximum number of Process Outputs from the flow computer.

Write the command and read the Command Register until it is cleared.

Register	***Data Type***	***Description***
49500	uint	Command = 144 (Get Number of Process Outputs)
49501	uint	0
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the command parameters are invalid.

Register	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. 0 if the command was successful.

Read the Actual Configuration Registers.

Register	***Data Type***	***Description***
43406	uint	See the **Process Output Configuration Registers** section for details.

Get Process Output Command

This command reads one Process Output configuration from the flow computer.

Write the command and read the Command Register until it is cleared.

Register	***Data Type***	***Description***
49500	uint	Command = 146 (Get Process Output)
49501	uint	Process Output Number 1 to 10 for SCADAPack Flow Computers 1 to 10 for SCADAPack 32, SCADAPack 314/330/334 and SCADAPack 350 Flow Computers
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the command parameters are invalid.

Register	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Process Output Number. 0 if the command was unsuccessful.

Read the Actual Configuration Registers.

Register	Data Type	Description
43440 to 43462	mixed	See the **Process Output Configuration Registers** section for details.

Set Process Output Command

This command writes one Process Output configuration to the flow computer.

Write the Configuration Registers.

Register	Data Type	Description
43410 to 43432	mixed	See the **Process Output Configuration Registers** section for details.

Write the command and read the Command Register until it is cleared.

Register	Data Type	Description
49500	uint	Command = 147 (Set Process Output)
49501	uint	Process Output Number 1 to 10 for SCADAPack Flow Computers 1 to 10 for SCADAPack 32, SCADAPack 314/330/334 and SCADAPack 350 Flow Computers
49502	uint	User number
49503	uint	PIN

Read the Reply Registers when the command is complete. An error is returned if the command parameters are invalid.

Register	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Process Output Number. 0 if the command was unsuccessful.

Calibration Registers

The flow calculations continue to execute while sensors are being calibrated. The sensor value needs to be forced to a fixed value during calibration. The current value of the input or a fixed value of your choice may be used.

Calibration Registers

The Calibration Settings registers hold the forced value for the device currently being calibrated. These registers are used when the calibration commands are sent to the flow computer.

Actual Register	Data Type	Description
48690	uint	Meter run = 1 to 10
48691	float	Forced temperature, static pressure or differential pressure.

Actual Register	Data Type	Description
48693	ulong	Forced change in pulse counts

Calibration Settings Registers

The Calibration Data registers hold the live measured values from the device being calibrated. Data in these registers is updated while calibration is in process.

Actual Register	Data Type	Description
48695	float	Temperature, static pressure or differential pressure during calibration.
48697	ulong	Change in pulse counts during calibration (AGA-7 only).

Calibration Data Registers

Force Temperature Input Commands

Start temperature input calibration by forcing either the recent temperature input or a manual forced value. The flow computer will use the forced value during the calibration process.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48691	float	Forced manual value for temperature. This register is required only if calibration is done using a forced manual value. This register is not used if a forced recent value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 30 = (Force Recent Temperature) 31 = (Force Manual Temperature)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Temperature value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10

Location	Data Type	Description
48695	float	Value for temperature while calibrating.

End Temperature Calibration Command

End temperature input calibration by restoring the live input for temperature.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 32 = (End Temperature Calibration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Force Static Pressure Input Commands

Start static pressure input calibration by forcing either the recent pressure input or a manual forced value. The flow computer will use the forced value during the calibration process.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48691	float	Forced manual value for static pressure. This register is required only if calibration is done using a forced manual value. This register is not used if a forced recent value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 33 = (Force Recent Pressure) 34 = (Force Manual Pressure)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Static Pressure value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48695	float	Value for static pressure while calibrating.

End Static Pressure Calibration Command

End Static Pressure input calibration by restoring the live input for pressure.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 35 = (End Pressure Calibration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Force Differential Pressure Input Commands

Start differential pressure input calibration by forcing either the recent differential pressure input or a manual forced value. The flow computer will use the forced value during the calibration process.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48691	float	Forced manual value for differential pressure. This register is required only if calibration is done using a forced manual value. This register is not used if a forced recent value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 36 = (Force Recent DP) 37 = (Force Manual DP)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Differential Pressure value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48695	float	Value for differential pressure while calibrating.

End Differential Pressure Calibration Command

End Differential Pressure input calibration by restoring the live input for differential pressure.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 38 = (End DP Calibration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Force Turbine Counts Commands

Start turbine input calibration by forcing either the recent turbine counts or a manual forced value. The flow computer will use the forced value during the calibration process.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48693	ulong	Forced manual value for turbine counts. This register is required only if calibration is done using a forced manual value. This register is not used if a forced recent value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 75 = (Force Recent Turbine Counts) 76 = (Force Manual Turbine Counts)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Differential Pressure value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48697	ulong	Value for turbine counts while calibrating.

End Turbine Counts Calibration Command

End Differential Pressure input calibration by restoring the live input for differential pressure.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description

49500	uint	Command: 77 = (End Turbine Counts Calibration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Force Mass Flow Rate Calibration Commands

Start Mass Flow Rate calibration by forcing either the current Mass Flow Rate or a manual forced value. The flow computer will use the forced value during the calibration process.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48693	ulong	Forced manual value for Mass Flow Rate. This register is required only if calibration is done using a forced manual value. This register is not used if a forced recent value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 93 = (Force Current Mass Flow Rate) 94 = (Force Manual Mass Flow Rate)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Mass Flow Rate being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48697	ulong	Value for mass flow rate while calibrating.

End Mass Flow Rate Calibration Command

End Mass Flow Rate calibration by restoring the live input for differential pressure.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command:95 = (End Mass Flow Rate Calibration)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Force Inputs Registers

The flow calculations continue to execute while sensors are being forced to either the recent value or a fixed value.

Force Inputs Registers

The Force Inputs registers hold the forced value for the inputs being forced. These registers are used when the force commands are sent to the flow computer.

Actual Register	Data Type	Description
48690	uint	Meter run = 1 to 10
48691	float	Forced temperature, static pressure or differential pressure.
48693	ulong	Forced change in pulse counts

The Force Inputs Data registers hold the live measured values from the input being forced. Data in these registers is updated while the inputs are forced.

Actual Register	Data Type	Description
48695	float	Temperature, static pressure or differential pressure during forcing.
48697	ulong	Change in pulse counts during forcing (AGA-7 only).

Force Current Temperature Command

The force current temperature command forces the temperature input to the current value. The flow computer uses the forced value when the input is forced.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48691	float	Forced fixed value for temperature. This register is required only if forcing is done using a forced fixed value. This register is not used if a forced current value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 78 = (Force Current Temperature)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Temperature value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48695	float	Value for temperature while forcing.

Force Fixed Temperature Command

The force fixed temperature command forces the temperature input to a user entered fixed value. The flow computer uses the forced value when the input is forced.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48691	float	Forced fixed value for temperature. This register is required only if forcing is done using a forced fixed value. This register is not used if a forced current value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 79 = (Force Fixed Temperature)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Temperature value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48691	float	Value for temperature while forcing.

Restore Live Temperature Command

This command restores the live input for temperature.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 80 = (Restore Live Temperature Input)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Force Current Static Pressure Input Command

The force current static pressure command forces the static pressure input to the current value. The flow computer uses the forced value when the input is forced.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48691	float	Forced fixed value for static pressure. This register is required only if forcing is done using a forced fixed value. This register is not used if a forced current value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 81 = (Force Current Static Pressure)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Static Pressure value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48695	float	Value for static pressure while forcing.

Force Fixed Static Pressure Input Command

The force fixed static pressure command forces the static pressure input to a user entered fixed value. The flow computer uses the forced value when the input is forced.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48691	float	Forced fixed value for static pressure. This register is required only if forcing is done using a forced fixed value. This register is not used if a forced current value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	Uint	Command: 82 = (Force Fixed Static Pressure)
49501	Uint	Meter run = 1 to 10

49502	Uint	User number
49503	Uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	*Data Type*	*Description*
49505	Uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	Uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Static Pressure value being used by the flow computer.

Location	*Data Type*	*Description*
48690	Uint	Meter run = 1 to 10
48695	float	Value for static pressure while forcing.

Restore Live Static Pressure Command

This command restores the live input for Static Pressure input.

Write the information required for the request.

Location	*Data Type*	*Description*
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command: 83 = (Restore Live Static Pressure)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	*Data Type*	*Description*
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Force Current Differential Pressure Input Command

The force current differential pressure command forces the differential pressure input to the current value. The flow computer uses the forced value when the input is forced.

Write the information required for the request.

Location	*Data Type*	*Description*
48690	integer	Meter run to calibrate: 1 to 10

48691	float	Forced fixed value for differential pressure. This register is required only if forcing is done using a forced manual value. This register is not used if a forced current value is used.

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command: 84 = (Force Current DP)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Current Forced Data Registers for the Differential Pressure value being used by the flow computer.

Location	***Data Type***	***Description***
48690	uint	Meter run = 1 to 10
48695	float	Value for differential pressure while forcing.

Force Fixed Differential Pressure Input Command

The force fixed differential pressure command forces the differential pressure input to a user entered fixed value. The flow computer uses the forced value when the input is forced.

Write the information required for the request.

Location	***Data Type***	***Description***
48690	integer	Meter run to calibrate: 1 to 10
48691	Float	Forced fixed value for differential pressure. This register is required only if forcing is done using a forced manual value. This register is not used if a forced current value is used.

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	Uint	Command: 85 = (Force Fixed DP)
49501	Uint	Meter run = 1 to 10
49502	Uint	User number
49503	Uint	PIN

Read the Reply Registers to determine whether the action was performed.

	Data	

Location	Type	Description
49505	Uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	Uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Differential Pressure value being used by the flow computer.

Location	Data Type	Description
48690	Uint	Meter run = 1 to 10
48695	Float	Value for differential pressure while forcing.

Restore Live Differential Pressure Input Command

This command restores the live input for Differential Pressure input.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 86 = (Restore Live DP Input)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run number if the command was successful.

Force Current Turbine Pulse Rate Command

The force current turbine pulse rate command forces the turbine pulse rate input to the current value. The flow computer uses the forced value when the input is forced.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48693	ulong	Forced fixed value for turbine pulses. This register is required only if forcing is done using a forced manual value. This register is not used if a forced current value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 87 = (Force Current Turbine Pulse Rate)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from ***Flow Calculation Engine Command Errors***.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Differential Pressure value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48697	ulong	Value for turbine counts while forcing.

Force Fixed Turbine Pulse Rate Command

The force current turbine pulse rate command forces the turbine pulse rate input to the user selected value. The flow computer uses the forced value when the input is forced.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48693	ulong	Forced fixed value for turbine pulses. This register is required only if forcing is done using a forced manual value. This register is not used if a forced current value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 88 = (Force Fixed Turbine Pulse Rate)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from ***Flow Calculation Engine Command Errors***.

49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Differential Pressure value being used by the flow computer.

Location	***Data Type***	***Description***
48690	uint	Meter run = 1 to 10
48697	ulong	Value for turbine counts while forcing.

Restore Live Turbine Pulse Rate Command

This command restores the live input for the turbine pulse rate.

Write the information required for the request.

Location	***Data Type***	***Description***
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command: 89 = (Restore Live Turbine Pulse Rate)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	***Data Type***	***Description***
49505	uint	Echo command or error from ***Flow Calculation Engine Command Errors***.
49506	uint	Specific to error. Meter run number if the command was successful.

Force Current Mass Flow Rate Command

The force current mass flow rate command forces the mass flow rate input to the current value. The flow computer uses the forced value when the input is forced.

Write the information required for the request.

Location	***Data Type***	***Description***
48690	integer	Meter run to calibrate: 1 to 10
48691	ulong	Forced fixed value for mass flow rate. This register is required only if forcing is done using a forced manual value. This register is not used if a forced current value is used.

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***

49500	uint	Command: 90 = (Force Current Mass Flow Rate)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from ***Flow Calculation Engine Command Errors***.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Mass Flow Rate value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48697	ulong	Value for Mass Flow Rate while forcing.

Force Fixed Mass Flow Rate Command

The force current mass flow rate command forces the mass flow rate input to the user selected value. The flow computer uses the forced value when the input is forced.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run to calibrate: 1 to 10
48693	ulong	Forced fixed value for mass flow rate. This register is required only if forcing is done using a forced manual value. This register is not used if a forced current value is used.

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 91 = (Force Fixed Mass Flow Rate)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from ***Flow Calculation Engine Command Errors***.
49506	uint	Specific to error. Meter run number if the command was successful.

Read the Calibration Data Registers for the Differential Pressure value being used by the flow computer.

Location	Data Type	Description
48690	uint	Meter run = 1 to 10
48697	ulong	Value for Mass Flow Rate while forcing.

Restore Live Mass Flow Rate Command

This command restores the live input for the mass flow rate.

Write the information required for the request.

Location	Data Type	Description
48690	integer	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 92 = (Restore Live Mass Flow Rate)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from ***Flow Calculation Engine Command Errors***.
49506	uint	Specific to error. Meter run number if the command was successful.

Event and Alarm Log Data

The flow computer stores up to 700 events and 300 alarms in the Alarm and Event logs. This data is made available for retrieval and viewing on the basis of data for maximum of 10 events or alarms at a time.

The same Command Registers and Data Registers are used to read the event and alarm logs. Only the commands used to read the events differ.

If the events in the log are not acknowledged and the event log fills, the oldest events are lost and the lost event counter is incremented. Events are numbered sequentially from 1 to 700, with automatic rollover allowing for verification that events have been duly recorded when reviewing event history. The flow computer will not allow the execution of a command that would cause the event log to fill, so this should not occur.

If the alarms in the log are not acknowledged and the alarm log fills, the oldest alarms are lost and the lost alarm counter is incremented. Alarms are numbered sequentially from 1 to 300, with automatic rollover allowing for verification that alarms have been duly recorded when reviewing alarm history.

Alarm and event numbers are independent. Therefore it is possible to have an alarm and an event with the same number.

Event and Alarm Log Data Registers

Actual Register	*Data Type*	*Description*
48530	uint	Meter run number: 1 to 10
48531	uint	First event to display 1 – 700 or, First alarm to display 1 - 300
48532	uint	No of events or alarms to load in display registers: 1 – 10
48533	uint	Number of events or alarms to delete starting at oldest: Alarms 1 – 300 Events 1 – 700

Log Query Registers

The Header Registers describe the alarm and event data in the Data Set Register groups.

Actual Register	*Data Type*	*Description*
48535	uint	Meter run: 1 to 10
48536	uint	Number of events or alarms shown
48537	uint	First event or alarm number shown
48538	uint	Number of events or alarms in the log
48539	uint	Number of events or alarms lost

Log Header Registers

A total of 10 sets of event or Alarm Data Display Registers are provided. Each event or alarm consists of 11 registers.

Actual Register	*Data Type*	*Description*
48540	uint	Event ID
48541	uint	Sequential event (1 to 700) or alarm (1 to 300) number.
48542	uint	User number
48543	float	Date of event or alarm (days since January 1, 1970)
48545	float	Time of event or alarm (seconds since 00:00:00)
48547	float	New data associated with the event or alarm, if any
48549	float	Previous data associated with the event or alarm, if any

Log Data Set 1 Registers

Actual Register	*Data Type*	*Description*
48551 to 48561	See above	Event or alarm log display set 2
48562 to 48572	See above	Event or alarm log display set 3
48573 to 48583	See above	Event or alarm log display set 4
48584 to 48594	See above	Event or alarm log display set 5
48595 to 48605	See above	Event or alarm log display set 6
48606 to 48616	See above	Event or alarm log display set 7
48617 to 48627	See above	Event or alarm log display set 8
48628 to 48638	See above	Event or alarm log display set 9
48639 to 48649	See above	Event or alarm log display set 10

Log Data Sets 2 through 10 Registers

Get Number of New Events Command

To query the number of new events in the log execute the *Get Number of New Events* command.

Write the information required for the request.

Location	*Data Type*	*Description*
48530	uint	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command: 50 (Get Number Of New Events)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	*Data Type*	*Description*
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	*Data Type*	*Description*
48535	uint	Meter run = 1 to 10
48538	uint	Number of new events in the log
48539	uint	The number of events that were lost because the queue was full.

Get Requested New Events Command

To query specific new event data for loading into the Display Registers, the meter run number, the number of the first new event to display and the number of new events need to be placed in the Event Query Registers before executing the **Get Requested New Events** command.

Write the information required for the request.

Location	*Data Type*	*Description*
48530	uint	Meter run number: 1 to 10
48531	uint	First new event to display: 1 – 700
48532	uint	Number of new events to load in display registers: 1 – 10

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*

49500	uint	Command: 51 (Get Requested New Events)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers to determine which parts of the log are available.

Location	***Data Type***	***Description***
48535	uint	Meter run = 1 to 10
48536	uint	Number of new events shown
48537	uint	First new event number shown
48538	uint	Number of new events in the event log
48539	uint	Number of new events lost

Read the events.

Location	***Data Type***	***Description***
48540 to 48548	Event Structure	First new event in the group.
48549 to 48629	Event Structures	The rest of the new events in the group.

Get Number of All Events Command

To query the total number of events in the log, execute the **Get Number of All Events** command.

Write the information required for the request.

Location	***Data Type***	***Description***
48530	uint	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command: 55 (Get Number Of All Events)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command

		was successful.

Read the Data Registers.

Location	Data Type	Description
48535	uint	Meter run = 1 to 10
48538	uint	Number of events in the log
48539	uint	The number of events that were lost because the queue was full.

Get Requested All Events Command

To query specific event data for loading into the Display Registers, the meter run number, the number of the first event to display and the number of events need to be placed in the Event Query Registers before executing the **Get Requested All Events** command.

Write the information required for the request.

Location	Data Type	Description
48530	uint	Meter run number: 1 to 10
48531	uint	First event to display: 1 – 700
48532	uint	Number of events to load in display registers: 1 – 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 56 (Get Requested All Events)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers to determine which parts of the log are available.

Location	Data Type	Description
48535	uint	Meter run = 1 to 10
48536	uint	Number of events shown
48537	uint	Oldest event number shown
48538	uint	Number of events in the event log
48539	uint	Number of events lost

Read the events.

Location	Data Type	Description
48540 to 48548	Event Structure	First event in the group.

48549 to 48629	Event Structures	The rest of the events in the group.

Get Recent Events Command

To query the recent event data execute the **Get Recent Events** command. The ‘first event to display’ register is ignored when this command is used. Command 50, *Get Number of New Events,* needs to first be run immediately before each instance of this command.

Write the information required for the request.

Location	***Data Type***	***Description***
48530	uint	Meter run number: 1 to 10
48532	uint	No of events/alarms to load in display registers: 1 – 10

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command: 52 (Get Recent Events)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers to determine which parts of the log are available.

Location	***Data Type***	***Description***
48535	uint	Meter run = 1 to 10
48536	uint	Number of events/alarms shown
48537	uint	First event/alarm number shown
48538	uint	Number of events/alarms in the log
48539	uint	Number of events/alarms lost

Read the events.

Location	***Data Type***	***Description***
48540 to 48548	Event Structure	First event in the group.
48549 to 48629	Event Structures	The rest of the events in the group.

Acknowledge Events Command

To acknowledge the oldest events in the log the number of events to Acknowledge Register needs to be specified before executing the

Acknowledge Events command. If there were any lost events then a Lost Events event is generated and stored in the log.

Write the information required for the request.

Location	Data Type	Description
48530	uint	Meter run number: 1 to 10
48533	uint	Number of events to acknowledge starting at oldest: 1 – 700

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 53 (Acknowledge Events)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the action was performed.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Get Number of New Alarms Command

To query the number of new alarms in the alarm log execute the **Get Number of New Alarms** command.

Write the information required for the request.

Location	Data Type	Description
48530	uint	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 60 (Get Number Of New Alarms)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	Data Type	Description
48535	uint	Meter run = 1 to 10
48538	uint	Number of new alarms in the log
48539	uint	The number of new alarms that were lost because the queue was full.

Get Requested New Alarms Command

To query specific alarm data for loading into the Display Registers, the meter run number, the number of the first new alarm to display and the number of new alarms need to be placed in the Alarm Query Registers before executing the **Get Requested New Alarms** command.

Write the information required for the request.

Location	Data Type	Description
48530	uint	Meter run number: 1 to 10
48531	uint	First new alarm to display: 1 – 300
48532	uint	Number of new alarms to load in display registers: 1 – 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 61 (Get Requested New Alarms)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers to determine which parts of the log are available.

Location	Data Type	Description
48535	uint	Meter run = 1 to 10
48536	uint	Number of new alarms shown
48537	uint	First alarm number shown
48538	uint	Number of alarms in the log
48539	uint	Number of alarms lost

Read the alarms.

Location	Data Type	Description
48540 to 48548	Event Structure	First new alarm in the request.
48549 to 48629	Event Structures	The rest of the new alarms in the request.

Get Number of All Alarms Command

To query the total number of alarms in the alarm log, execute the **Get Number of All Alarms** command.

Write the information required for the request.

Location	Data Type	Description
48530	uint	Meter run number: 1 to 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 64 (Get Number Of All Alarms)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers.

Location	Data Type	Description
48535	uint	Meter run = 1 to 10
48538	uint	Number of alarms in the log
48539	uint	The number of alarms that were lost because the queue was full.

Get Requested All Alarms Command

To query specific alarm data for loading into the Display Registers, the meter run number, the number of the first alarm to display and the number of alarms need to be placed in the Alarm Query registers before executing the **Get Requested All Alarms** command.

Write the information required for the request.

Location	Data Type	Description
48530	uint	Meter run number: 1 to 10
48531	uint	First new alarm to display: 1 – 300
48532	uint	Number of new alarms to load in display registers: 1 – 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 65 (Get Requested All Alarms)
49501	uint	Meter run = 1 to 10

49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Read the Data Registers to determine which parts of the log are available.

Location	Data Type	Description
48535	uint	Meter run = 1 to 10
48536	uint	Number of alarms shown
48537	uint	First number shown
48538	uint	Number of alarms in the log
48539	uint	Number of alarms lost

Read the alarms.

Location	Data Type	Description
48540 to 48548	Event Structure	First new alarm in the request.
48549 to 48629	Event Structures	The rest of the new alarms in the request.

Get Recent Alarms Command

To query the recent alarm data execute the **Get Recent Alarms** command. The first alarm to Display Register is ignored when this command is used.

Write the information required for the request.

Location	Data Type	Description
48530	uint	Meter run number: 1 to 10
48532	uint	No of events/alarms to load in Display Registers: 1 – 10

Write the command and read the Command Register until it is cleared.

Location	Data Type	Description
49500	uint	Command: 62 (Get Recent Alarms)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command

		was successful.

Read the Data Registers to determine which parts of the log are available.

Location	***Data Type***	***Description***
48535	uint	Meter run = 1 to 10
48536	uint	Number of alarms shown
48537	uint	First alarm number shown
48538	uint	Number of alarms in the log
48539	uint	Number of alarms lost

Read the alarms.

Location	***Data Type***	***Description***
48540 to 48548	Event Structure	First alarm in the group.
48549 to 48629	Event Structures	The rest of the alarms in the group.

Acknowledge Alarms Command

To acknowledge the oldest alarms in the log the number of alarms, Acknowledge Register needs to be specified before executing the **Acknowledge Alarms** command. If there were any lost alarms then a Lost Alarms alarm is generated and stored in the log.

Write the information required for the request.

Location	***Data Type***	***Description***
48530	uint	Meter run number: 1 to 10
48533	uint	Number of alarms to acknowledge starting at oldest: 1 – 300

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command: 63 (Acknowledge Alarms)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the action was performed.

Location	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Log User Defined Events

Additional events, defined by the user, may be recorded in the event log. Executing the **Log User Event** command (command 54) will store the event and values defined in the following table.

Actual Register	***Data Type***	***Description***
48680	uint	Event ID to be recorded (19000 to 19999)
48681	float	Value to be recorded as the previous value
48683	float	Value to be recorded as the new value

Log Event Registers

The event is stored in the event log for the meter that is defined in the Command Registers.

The event is time stamped by the flow computer when it is recorded.

The event ID needs to be in the range 19000 to 19999. An event ID out of this range will result in the command not working and an event being logged indicating an out of range event ID was specified. This feature keeps users from faking real events.

The previous value and new value are recorded in the event log. The user defines the use of these values.

Log User Event Command

Additional events, defined by the user, may be recorded in the event log. Executing the ***Log User Event*** command will store the event and values.

Write the information required for the request.

Location	***Data Type***	***Description***
48680	uint	Event ID to be recorded (19000 to 19999)
48681	float	Value to be recorded as the previous value
48683	float	Value to be recorded as the new value

Write the command and read the Command Register until it is cleared.

Location	***Data Type***	***Description***
49500	uint	Command: 54 (Log User Event)
49501	uint	Meter run = 1 to 10
49502	uint	User number
49503	uint	PIN for user

Read the Reply Registers to determine whether the action was performed.

Location	***Data Type***	***Description***
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. The run number if the command was successful.

Hourly History Data

There are a total of 30 periods of hourly History Data Registers. Each period is nominally an hour long, but may be shorter. Each period consists of 26 registers. The registers for the first (recent) period of history are shown in the **Hourly History Data - Period 1 Registers** table. The registers for hours 2 through 30 are shown in the **Hourly History Data - Periods 2 to 30 Registers** table.

Hourly History Query and Data Registers

The units code field indicates the units in use at the time the log entry was made.

Actual Register	*Data Type*	*Description*
48704	float	Date at the end of the period (days since Jan 1, 1970)
48706	float	Time at the end of the period (seconds since 00:00:00)
48708	float	Duration of flow in the period in seconds
48710	float	Flow volume at base conditions
48712	float	Flow mass at base conditions
48714	float	Flow energy at base conditions
48716	float	Flow extension (AGA-3 1990 only) Flow product (AGA-3 1985 only) Uncorrected flow volume (AGA-7 only)
48718	float	Average temperature
48720	float	Average static pressure
48722	float	Average differential pressure (AGA-3 only)
48724	float	Average number of rotations per second (AGA-7 only)
48726	float	Average real relative gas density
48728	float	Units code = input units code + (contract units code * 32) The units code field indicates the units in use at the time the log entry was made. The codes for the input units and contract units are listed below. Both are combined in a single floating point value to save space in the log. ***Units*** ***Units Code*** US1 0 US2 1 US3 2 IP 3 Metric1 4 Metric2 5 Metric3 6 SI 7 US4 8 US5 9 US6 10 US7 11 US8 12

Hourly History Data - Period 1 Registers

Actual Register	*Data Type*	*Description*
48730 to 48755	see above	2nd most recent period
48756 to 48781	see above	3rd most recent period
48782 to 48807	see above	4th most recent period
48808 to 48833	see above	5th most recent period
48834 to 48859	see above	6th most recent period

Actual Register	*Data Type*	*Description*
48860 to 48885	see above	7th most recent period
48886 to 48911	see above	8th most recent period
48912 to 48937	see above	9th most recent period
48938 to 48963	see above	10th most recent period
48964 to 48989	see above	11th most recent period
48990 to 49015	see above	12th most recent period
49016 to 49041	see above	13th most recent period
49042 to 49067	see above	14th most recent period
49068 to 49093	see above	15th most recent period
49094 to 49119	see above	16th most recent period
49120 to 49145	see above	17th most recent period
49146 to 49171	see above	18th most recent period
49172 to 49197	see above	19th most recent period
49198 to 49223	see above	20th most recent period
49224 to 49249	see above	21st most recent period
49250 to 49275	see above	22nd most recent period
49276 to 49301	see above	23rd most recent period
49302 to 49327	see above	24th most recent period
49328 to 49353	see above	25th most recent period
49354 to 49379	see above	26th most recent period
49380 to 49405	see above	27th most recent period
49406 to 49431	see above	28th most recent period
49432 to 49457	see above	29th most recent period
49458 to 49483	see above	30th most recent period

Hourly History Data - Periods 2 to 30 Registers

Get Hourly History Command

The hourly history is comprised of 30 days worth of data that is written into a block of registers one-day at a time when the flow computer is queried.

The meter and day are written starting at location 48702. The data is made up of 780 registers starting at 48704. The internal arrangement is 30-hour segments by 26 registers.

In order to specify which day of data is to be loaded into the Display Registers, the meter run number and day requested need to be placed in the Query registers prior to executing the ***Get* Hourly History** command (11).

Write the day request:

Actual Register	*Data Type*	*Description*
48700	uint	Meter run = 1 to 10
48701	uint	Day to query: 0 for today, 1 to 35 for previous days

Write the command and read the Command Register until it is cleared.

Location	*Data Type*	*Description*
49500	uint	Command: 11 (Get Hourly History)
49501	uint	Meter run = 1 to 10
49502	uint	User number

Location	Data Type	Description
49503	uint	PIN for user

Read the Reply Registers to determine whether the data is available.

Location	Data Type	Description
49505	uint	Echo command or error from Flow Calculation Engine Command Errors.
49506	uint	Specific to error. Meter run if the command was successful.

Read the Data Register to determine which day is available.

Actual Register	Data Type	Description
48702	uint	Meter run = 1 to 10
48703	uint	Day to query: 0 for today, 1 to 35 for previous days

Read the Data Registers.

Location	Data Type	Description
48704 to 48728	Hourly History Log	Most recent hour totals are displayed.
48730 to 49483	Hourly History Log	The rest of the hours in the day are displayed.

Program Information Registers

The Program Information Registers describe the flow computer program in the flow computer

Actual Register	Data Type	Description
48525	uint	**Firmware version** The value of register 48525 divided by 100 is the version information, for example a value of 147 indicates major version 1, minor version 47
48526	uint	**Controller type** The Controller type value is stored in the lower 8-bits of the register. 0 = unknown type 2 = Micro16 5 = SCADAPack 6 = SCADAPack Light 7 = SCADAPack Plus 8 = Boot Loader 9 = SCADAPack 32P 10 = SCADAPack 32 11 = Boot Loader 32 12 = SCADAPack LP 13 = SCADAPack 100 (small memory) 14 = SCADAPack 4202 15 = SCADAPack 4102 16 = SCADAPack 4012 Absolute

Actual Register	***Data Type***	***Description***
		17 = SCADAPack 4012 Gauge 18 = SCADAPack 4022 Absolute 19 = SCADAPack 4022 Gauge 20 = SCADAPack 4032 21 = SCADAPack 4052 22 = SCADAPack 4062 23 = SCADAPack Boot Loader 24 = IMV25-M 25 = SCADAPack 100 (large memory) 26 = SCADAPack 4202 DS 27 = SCADAPack 350 28 = Neptune Boot Loader 29 = SCADAPack 4203 DR 30 = SCADAPack 4203 DS 31 = SCADAPack 4203 Boot Loader 32 = SolarPack 410 33 = SCADAPack 330 34 = SCADAPack 334 35 = Pump Controller 36 = SCADAPack 314 255 = 4000 with unsupported sensor
48527	uint	Gas Flow Application Version
48528	uint	Gas Flow Application Build Number
48529	uint	Number of flow runs available (not the number currently in use).

Program Information Registers

Flow Computer Events and Alarms

This section contains tables of the event and alarm codes that are created by the flow computer.

Up to 700 events and 300 alarms are stored in the event log by the flow computation routines. This event log is made available for retrieval and viewing using the Event Log Data and Query registers. Refer to the event log documentation for further information on the Event Log.

Global Events and Alarms

The gas flow computation engine creates these events and alarms.

Number	***Description***	***Event***	***Alarm***
10001	Power On - Cold Boot		√
10002	Power On – Warm Boot		√
10003	Lost Events	√	
10004	Recovered from Input Error	√	
10005	Set Input: Units Type	√	
10006	Set Input: Flow Calculation Type	√	
10007	Set Input: Compressibility Calculation Type	√	
10008	Set Input: Temperature Register	√	
10009	Set Input: Temperature Input at Zero Scale	√	
10010	Set Input: Temperature Input at Full Scale	√	
10011	Set Input: Temperature at Zero Scale	√	
10012	Set Input: Temperature at Full Scale	√	
10013	Set Input: Pressure Register	√	
10014	Set Input: Pressure Input at Zero Scale	√	
10015	Set Input: Pressure Input at Full Scale	√	
10016	Set Input: Pressure at Zero Scale	√	
10017	Set Input: Pressure at Full Scale	√	
10018	Set Input: DP Register	√	
10019	Set Input: DP Input at Zero Scale	√	
10020	Set Input: DP Input at Full Scale	√	
10021	Set Input: DP at Zero Scale	√	
10022	Set Input: DP at Full Scale	√	
10023	Set Contract: Units Type	√	
10024	Set Contract: Base Temperature	√	
10025	Set Contract: Base Pressure	√	
10026	Set Contract: Atmospheric Pressure	√	
10027	Set Input: Static Pressure Tap Location	√	
10028	Set Contract: Contract Hour	√	
10029	Change Execution State	√	
10030	Set RTC Year	√	
10031	Set RTC Month	√	
10032	Set RTC Day	√	
10033	Set RTC Hour	√	
10034	Set RTC Minute	√	
10035	Set RTC Second	√	
10036	Set Input: Temperature Low Level Cutoff	√	
10037	Set Input: Temperature Low Level	√	

Number	Description	Event	Alarm
	Hysteresis		
10038	Set Input: Temperature High Level Cutoff	√	
10039	Set Input: Temperature High Level Hysteresis	√	
10040	Set Input: Pressure Low Level Cutoff	√	
10041	Set Input: Pressure Low Level Hysteresis	√	
10042	Set Input: Pressure High Level Cutoff	√	
10043	Set Input: Pressure High Level Hysteresis	√	
10044	Set Input: Save Low/High Flow Events	√	
10046	Invalid User Event	√	
10047	Starting Calibration: Forced temperature input	√	
10048	Ending Calibration: Restored live temperature input	√	
10049	Starting Calibration: Forced SP input	√	
10050	Ending Calibration: Restored live SP input	√	
10051	Starting Calibration: Forced DP input	√	
10052	Ending Calibration: Restored live DP input	√	
10053	Starting Calibration: Forced pulse count rate	√	
10054	Ending Calibration: Restored live pulse count rate	√	
10055	Set User Number	√	
10056	Set User Security Level	√	
10057	Set Input: Temperature Register Type	√	
10058	Set Input: Pressure Register Type	√	
10059	Set Input: DP Register Type	√	
10060	Set Input: Temperature Input at Zero Scale	√	
10061	Set Input: Temperature Input at Full Scale	√	
10062	Set Input: Pressure Input at Zero Scale	√	
10063	Set Input: Pressure Input at Full Scale	√	
10064	Set Input: DP Input at Zero Scale	√	
10065	Set Input: DP Input at Full Scale	√	
10066	Set Input: Pulse Counter Register	√	
10067	Set Input: Pulse Counter Register Type	√	
10068	Set Active Runs	√	
10069	Lost Alarms	√	
10071	Firmware Version	√	
10072	Application Version	√	
10073	Set Flow Computer ID	√	
10074	Contract In Err Action	√	
10075	Set runID	√	
10076	Power Off		√
10077	Start Plate Change: Forced temperature input	√	
10078	End Plate Change: Restored live	√	

Number	Description	Event	Alarm
	temperature input		
10079	Start Plate Change: Forced static pressure input	√	
10080	End Plate Change: Restored live static pressure input	√	
10081	Start Plate Change: Forced differential pressure input	√	
10082	End Plate Change: Restored live differential pressure input	√	
10083	Set Input: Altitude and Latitude Compensation	√	
10084	Set Input: Altitude	√	
10085	Set Input: Latitude	√	
10086	Forced temperature input	√	
10087	Restored live temperature input	√	
10088	Forced static pressure input	√	
10089	Restored live static pressure input	√	
10090	Forced differential pressure input	√	
10091	Restored live differential pressure input	√	
10092	Forced pulse count rate	√	
10093	Restored live pulse count rate	√	
10094	Set Contract: Wet Gas Meter Factor	√	
10095	Set pulse input counter register	√	
10096	Set pulse input K factor	√	
10097	Set pulse input units	√	
10099	Set Contract: Input averaging	√	
10100	Set input: sensor fail action	√	
10101	Set input: default temperature	√	
10102	Set input: default static pressure	√	
10103	Set input: default differential pressure	√	
10104	Set gas quality source (Pemex only)	√	
10105	Set Input: Flow Direction Control	√	
10106	Set Input: Flow Direction Register	√	
10107	Forced mass flow input	√	
10108	Restored live mass flow input	√	
10109	Starting Calibration: Forced mass flow rate input	√	
10110	Ending Calibration: Restored live mass flow rate input	√	
10111	Set Input: Mass Flow Rate Register Type	√	

Global Alarms and Events Description

AGA-3 (1985) Events and Alarms

These events and alarms are specific to the AGA-3 (1985) calculation.

Number	Description	Event	Alarm
10201	Failed To Create AGA-3 (1985) Data Structure		√
10202	Created AGA-3 (1985) with Execution Stopped	√	
10203	Created AGA-3 (1985) with Execution Running		√

Number	Description	Event	Alarm
10204	Destroyed AGA-3 (1985) Data Structure	√	
10205	Recovered from AGA-3 (1985) error		√
10206	Set AGA-3 (1985): Input Units Type	√	
10207	Set AGA-3 (1985): Orifice Material	√	
10208	Set AGA-3 (1985): Pipe Material	√	
10209	Set AGA-3 (1985): Static Pressure Tap Location	√	
10210	Set AGA-3 (1985): Orifice Diameter	√	
10211	Set AGA-3 (1985): Orifice Measurement Reference Temperature	√	
10212	Set AGA-3 (1985): Pipe Diameter	√	
10213	Set AGA-3 (1985): Pipe Diameter Measurement Reference Temperature	√	
10214	Set AGA-3 (1985): Isentropic Exponent	√	
10215	Set AGA-3 (1985): Viscosity	√	
10216	Set AGA-3 (1985): Base Temperature	√	
10217	Set AGA-3 (1985): Base Pressure	√	
10218	Set AGA-3 (1985): Atmospheric Pressure	√	
10219	Failed To Set AGA-3 (1985) Configuration		√
10220	Set AGA-3 (1985): Contract Units Type	√	
10221	Set AGA-3 (1985): Temperature deadband	√	
10222	Set AGA-3 (1985): Static Pressure deadband	√	
10223	Set AGA-3 (1985): Differential Pressure deadband	√	

AGA-3 (1985) Alarms and Events Description

AGA-3 (1992) Events and Alarms

These events and alarms are specific to the AGA-3 (1992) calculation.

Number	Description	Event	Alarm
10301	Failed To Create AGA-3 (1992) Data Structure		√
10302	Created AGA-3 (1992) with Execution Stopped	√	
10303	Created AGA-3 (1992) with Execution Running		√
10304	Destroyed AGA-3 (1992) Data Structure	√	
10305	Restored from AGA-3 (1992) error	√	
10306	Set AGA-3 (1992): Input Units Type	√	
10307	Set AGA-3 (1992): Orifice Material	√	
10308	Set AGA-3 (1992): Pipe Material	√	
10309	Set AGA-3 (1992): Static Pressure Tap Location	√	
10310	Set AGA-3 (1992): Orifice Diameter	√	
10311	Set AGA-3 (1992): Orifice reference temperature	√	
10312	Set AGA-3 (1992): Pipe Diameter	√	
10313	Set AGA-3 (1992): Pipe Diameter	√	

Number	Description	Event	Alarm
	Measurement Temperature		
10314	Set AGA-3 (1992): Isentropic Exponent	√	
10315	Set AGA-3 (1992): Viscosity	√	
10316	Set AGA-3 (1992): Base Temperature	√	
10317	Set AGA-3 (1992): Base Pressure	√	
10318	Set AGA-3 (1992): Atmospheric Pressure	√	
10319	Failed To Set AGA-3 (1992) Configuration	√	
10320	Set Input: DP Low Level Cutoff	√	
10321	Set Input: DP Low Level Hysteresis	√	
10322	Set Input: DP High Level Cutoff	√	
10323	Set Input: DP High Level Hysteresis	√	
10324	Set AGA-3 (1992): Contract Units Type	√	
10325	Set AGA-3 (1992): Temperature Deadband	√	
10326	Set AGA-3 (1992): Static Pressure Deadband	√	
10327	Set AGA-3 (1992): Differential Pressure Deadband	√	

AGA-3 (1992) Alarms and Events Description

AGA-7 Events and Alarms

These events and alarms are specific to the AGA-7 calculation.

Number	Description	Event	Alarm
10701	Failed To Create AGA-7 Data Structure		√
10702	Created AGA-7 with Execution Stopped	√	
10703	Created AGA-7 with Execution Running		√
10704	Destroyed AGA-7 Data Structure	√	
10705	Recovered from AGA-7 error		√
10706	Set AGA-7: Input Units Type	√	
10707	Set AGA-7: K Factor	√	
10708	Set AGA-7: M Factor	√	
10709	Set AGA-7: Atmospheric Pressure	√	
10710	Set AGA-7: Base Pressure	√	
10711	Set AGA-7: Base Temperature	√	
10712	Failed To Set AGA-7 Configuration	√	
10713	Set Input: Turbine Low Flow Pulse Limit	√	
10714	Set Input: Turbine Low Flow Detect Time	√	
10715	Set AGA-7: Contract Units Type	√	
10716	Set ABA-7: Volume Option	√	

AGA-7 Alarms and Events Description

AGA-11 Events and Alarms

These events and alarms are specific to the AGA-11 calculation.

Number	Description	Event	Alarm
11101	Failed To Create AGA-11 Data Structure		√
11102	Created AGA-11 with Execution Stopped	√	
11103	Created AGA-11 with Execution Running		√

Number	Description	Event	Alarm
11104	Destroy AGA-11 Data Structure	√	
11105	Recovered from AGA-11 error		√
11106	Change in AGA-11 units configuration	√	
11107	Change in AGA-11 contract units config	√	
11108	Change in AGA-11 base temperature	√	
11109	Change in AGA-11 base pressure	√	
11110	Failed To Set AGA-11 Configuration		√
14001	Failed To Set Coriolis Meter		√
14002	Set Coriolis Meter: Meter Address	√	
14003	Set Coriolis Meter: Meter Port	√	
14004	Set Coriolis Meter: Meter Timeout	√	
14005	Coriolis Meter: Lost Communication		√
14006	Coriolis Meter: Communication Restored		√
14007	Coriolis Meter: Not Polled		√
14008	Coriolis Meter: protocol error in response message. • The first byte returned from the meter was not the byte order. • The byte order returned from the meter was not known. • The units code returned from the meter was not known. • The meter has an unexpected configuration.		√

V-Cone Events and Alarms

These events and alarms are specific to the V-Cone calculation.

Number	Description	Event	Alarm
12201	Failed To Create V-Cone Date Structure		√
12202	Created V-Cone with Execution Stopped	√	
12203	Created V-Cone with Execution Running		√
12204	Destroyed V-Cone Data Structure	√	
12205	Recovered from V-Cone Error		√
12206	Failed To Set V-Cone Configuration		√
12207	/* reserved */		
12208	Set V-Cone Input Units Type	√	
12209	Set V-Cone Contract Units Type	√	
12210	Set V-Cone Cone Material	√	
12211	Set V-Cone Pipe Material	√	
12212	Set V-Cone Cone Diameter	√	
12213	Set V-Cone Inside Pipe Diameter	√	
12214	Set V-Cone Pipe reference temperature	√	
12215	Set V-Cone Isentropic Exponent	√	
12216	Set V-Cone Viscosity	√	
12217	Set V-Cone Base Temperature	√	
12218	Set V-Cone Base Pressure	√	
12219	Set V-Cone Atmospheric Pressure	√	
12220	Set Table Point 1 Reynolds Number	√	
12221	Set Table Point 2 Reynolds Number	√	
12222	Set Table Point 3 Reynolds Number	√	

Number	Description	Event	Alarm
12223	Set Table Point 4 Reynolds Number	√	
12224	Set Table Point 5 Reynolds Number	√	
12225	Set Table Point 6 Reynolds Number	√	
12226	Set Table Point 7 Reynolds Number	√	
12227	Set Table Point 8 Reynolds Number	√	
12228	Set Table Point 9 Reynolds Number	√	
12229	Set Table Point 10 Reynolds Number	√	
12230	Set Table Point 1 Flow Coefficient	√	
12231	Set Table Point 2 Flow Coefficient	√	
12232	Set Table Point 3 Flow Coefficient	√	
12233	Set Table Point 4 Flow Coefficient	√	
12234	Set Table Point 5 Flow Coefficient	√	
12235	Set Table Point 6 Flow Coefficient	√	
12236	Set Table Point 7 Flow Coefficient	√	
12237	Set Table Point 8 Flow Coefficient	√	
12238	Set Table Point 9 Flow Coefficient	√	
12239	Set Table Point 10 Flow Coefficient	√	
12240	Set Adiabatic Expansion Factor Method	√	
12241	Set Wet Gas Correction Factor Method	√	
12242	Set Density of liquid at flow conditions	√	
12243	Set Mass flow rate of liquid at flow conditions	√	

V-Cone Alarms and Events Description

AGA-8 Events and Alarms

These events and alarms are specific to the AGA-8 calculation.

Number	Description	Event	Alarm
10801	Failed To Create AGA-8 Data Structure		√
10802	Created AGA-8 with Execution Stopped	√	
	Created AGA-8 with Execution Running		√
10804	Destroyed AGA-8 Data Structure	√	
10805	Set AGA-8 Gas: Change Gas Fractions	√	
10806	Set AGA-8 Gas: Methane (CH4)	√	
10807	Set AGA-8 Gas: Nitrogen	√	
10808	Set AGA-8 Gas: Carbon Dioxide (CO2)	√	
10809	Set AGA-8 Gas: Ethane (C2H6)	√	
10810	Set AGA-8 Gas: Propane (C3H8)	√	
10811	Set AGA-8 Gas: Water	√	
10812	Set AGA-8 Gas: Hydrogen Sulfide (H2S)	√	
10813	Set AGA-8 Gas: Hydrogen	√	
10814	Set AGA-8 Gas: Carbon Monoxide (CO)	√	
10815	Set AGA-8 Gas: Oxygen	√	
10816	Set AGA-8 Gas: iButane	√	
10817	Set AGA-8 Gas: nButane	√	
10818	Set AGA-8 Gas: iPentane	√	
10819	Set AGA-8 Gas: nPentane	√	
10820	Set AGA-8 Gas: nHexane	√	
10821	Set AGA-8 Gas: nHeptane	√	
10822	Set AGA-8 Gas: nOctane	√	
10823	Set AGA-8 Gas: nNonane	√	

Number	Description	Event	Alarm
10824	Set AGA-8 Gas: nDecane	√	
10825	Set AGA-8 Gas: Helium	√	
10826	Set AGA-8 Gas: Argon	√	
10827	Set AGA-8 Gas: Failed To Set	√	
10828	Failed To Set AGA-8 Configuration		√
10829	Set AGA-8: Input Units Type	√	
10830	Set AGA-8: Base Temperature	√	
10831	Set AGA-8: Base Pressure	√	
10832	Set AGA-8: Atmospheric Pressure	√	
10833	Set AGA-8: Static Pressure Tap Location	√	
10834	Set AGA-8: Contract Units Type	√	
10835	Clear Compressibility Error		√
10836	Set AGA-8: Gas Composition Logging	√	
10837	Set AGA-8 Gas: Use combined Hexane + components	√	
10838	Set AGA-8 Hexane + Ratio for n-hexane	√	
10839	Set AGA-8 Hexane + Ratio for n-heptane	√	
10840	Set AGA-8 Hexane + Ratio for n-octane	√	
10841	Set AGA-8 Hexane + Ratio for n-nonane	√	
10842	Set AGA-8 Hexane + Ratio for n-decane	√	
10843	Set AGA-8: Set Laboratory Real Relative Density	√	
10844	Set AGA-8: Set Laboratory Forces Heating Value	√	

AGA-8 Alarms and Events Description

NX-19 Events and Alarms

These events and alarms are specific to the NX-19 calculation.

Number	Description	Events	Alarms
11901	Failed to Create NX-19 Data Structure		√
11902	Created NX-19 with Execution Stopped	√	
11903	Created NX-19 with Execution Running		√
11904	Destroyed NX-19 Data Structure	√	
11905	Restored from NX-19 error		√
11906	Set NX-19: Calculation Method	√	
11907	Set NX-19: Specific Gravity	√	
11908	Set NX-19: Gas: Carbon Dioxide	√	
11909	Set NX-19: Gas: Methane	√	
11910	Set NX-19: Gas: Nitrogen	√	
11911	Set NX-19: Heating Value	√	
11912	Set NX-19: Static Pressure Tap Location	√	
11913	Set NX-19: Base Pressure	√	
11914	Set NX-19: Base Temperature	√	
11915	Failed to set NX-19 Gas Components		√
11916	Failed to set NX-19 Contract Configuration		√
11917	Set NX-19: Contract Units Type	√	
11918	Clear Compressibility Error	√	
11919	Set NX-19: Gas Composition Logging	√	

NX-19 Alarms and Events Description

Sensor Events and Alarms

These events and alarms are specific to the sensor.

Number	***Description***	***Event***	***Alarm***
13100	Set Sensor 1: Polling Status	√	
13101	Set Sensor 1: Serial Port	√	
13102	Set Sensor 1: Address of Transmitter	√	
13103	Set Sensor 1: Timeout	√	
13104	Set Sensor 1: Manufacturer Code	√	
13105	Set Sensor 1: Turnaround Delay Time	√	
13106	Set Sensor 1: Differential Pressure Units	√	
13107	Set Sensor 1: Static Pressure Units	√	
13108	Set Sensor 1: Temperature Units	√	
13109	Set Sensor 1: Serial Number	√	
13110	Set Sensor 1: Tag	√	
13111	Set Sensor 1: Differential Pressure Damping	√	
13112	Set Sensor 1: Differential Pressure Upper Operating Limit	√	
13113	Set Sensor 1: Differential Pressure Lower Operating Limit	√	
13114	Set Sensor 1: Static Pressure Damping	√	
13115	Set Sensor 1: Static Pressure Upper Operating Limit	√	
13116	Set Sensor 1: Static Pressure Lower Operating Limit	√	
13117	Set Sensor 1: Temperature Damping	√	
13118	Set Sensor 1: Temperature Upper Operating Limit	√	
13119	Set Sensor 1: Temperature Lower Operating Limit	√	
13120	Sensor 1: Lost Communication	√	
13121	Sensor 1: Transmitter Configuration Incorrect	√	
13122	Sensor 1: Temperature Sensor Out of Range	√	
13123	Sensor 1: Static Pressure Sensor Out of Range	√	
13124	Sensor 1: Differential Pressure Sensor Out of Range	√	
13125	Sensor 1: Not Polled		√
13126	Set Sensor 1: Type Code	√	
13127	Set Sensor 1: IP Address	√	
13128	Set Sensor 1: IP Protocol	√	
13129	Sensor 1: Temperature Sensor has bad data		
13130	Sensor 1: Static Pressure Sensor has bad data		√
13131	Sensor 1: Differential Pressure Sensor has bad data		√
13132	Set Sensor 1: Set Pressure Type and	√	

Number	Description	Event	Alarm
	Atmospheric Pressure		
13133	Sensor 1: Communication Restored		√
13134	Sensor 1: Alarms Restored		√
13135	Sensor 1: Sensors Offline		√
13136	Sensor 1: RTD Disconnected		√
13137	Sensor 1: Temperature Sensor Above Range		√
13138	Sensor 1: Static Sensor Above Range		√
13139	Sensor 1: Differential Pressure Above Range		√
13140	Sensor 1: Temperature Sensor Below Range		√
13141	Sensor 1: Static Sensor Below Range		√
13142	Sensor 1: Differential Pressure Below Range		√
13150	Set Sensor 2: Polling Status	√	
13151	Set Sensor 2: Serial Port	√	
13152	Set Sensor 2: Address of transmitter	√	
13153	Set Sensor 2: Timeout	√	
13154	Set Sensor 2: Manufacturer Code	√	
13155	Set Sensor 2: Turnaround Delay Time	√	
13156	Set Sensor 2: Differential Pressure Units	√	
13157	Set Sensor 2: Static Pressure Units	√	
13158	Set Sensor 2: Temperature Units	√	
13159	Set Sensor 2: Serial Number	√	
13160	Set Sensor 2: Tag	√	
13161	Set Sensor 2: Differential Pressure Damping	√	
13162	Set Sensor 2: Differential Pressure Upper Operating Limit	√	
13163	Set Sensor 2: Differential Pressure Lower Operating Limit	√	
13164	Set Sensor 2: Static Pressure Damping	√	
13165	Set Sensor 2: Static Pressure Upper Operating Limit	√	
13166	Set Sensor 2: Static Pressure Lower Operating Limit	√	
13167	Set Sensor 2: Temperature Damping	√	
13168	Set Sensor 2: Temperature Upper Operating Limit	√	
13169	Set Sensor 2: Temperature Lower Operating Limit	√	
13170	Sensor 2: Lost Communication		√
13171	Sensor 2: Transmitter Configuration Incorrect		√
13172	Sensor 2: Temperature Sensor Out of Range		√
13173	Sensor 2: Static Pressure Sensor Out of Range		√
13174	Sensor 2: Differential Pressure Sensor Out of Range		√
13175	Sensor 2: Not Polled		√

Number	***Description***	***Event***	***Alarm***
13176	Set Sensor 2: Type Code	√	
13177	Set Sensor 2: IP Address	√	
13178	Set Sensor 2: IP Protocol	√	
13179	Sensor 2: Temperature Sensor has bad data		√
13180	Sensor 2: Static Pressure Sensor has bad data		√
13181	Sensor 2: Differential Pressure Sensor has bad data		√
13182	Set Sensor 2: Set Pressure Type and Atmospheric Pressure	√	
13183	Sensor 2: Communication Restored		√
13184	Sensor 2: Alarms Restored		√
13185	Sensor 2: Sensors Offline		√
13186	Sensor 2: RTD Disconnected		√
13187	Sensor 2: Temperature Sensor Above Range		√
13188	Sensor 2: Static Sensor Above Range		√
13189	Sensor 2: Differential Pressure Above Range		√
13190	Sensor 2: Temperature Sensor Below Range		√
13191	Sensor 2: Static Sensor Below Range		√
13192	Sensor 2: Differential Pressure Below Range		√
13200	Set Sensor 3: Polling Status	√	
13201	Set Sensor 3: Serial Port	√	
13202	Set Sensor 3: Address of Transmitter	√	
13203	Set Sensor 3: Timeout	√	
13204	Set Sensor 3: Manufacturer Code	√	
13205	Set Sensor 3: Turnaround Delay Time	√	
13206	Set Sensor 3: Differential Pressure units	√	
13207	Set Sensor 3: Static Pressure units	√	
13208	Set Sensor 3: Temperature units	√	
13209	Set Sensor 3: Serial number	√	
13210	Set Sensor 3: Tag	√	
13211	Set Sensor 3: Differential Pressure Damping	√	
13212	Set Sensor 3: Differential Pressure Upper Operating Limit	√	
13213	Set Sensor 3: Differential Pressure Lower Operating Limit	√	
13214	Set Sensor 3: Static Pressure Damping	√	
13215	Set Sensor 3: Static Pressure Upper Operating Limit	√	
13216	Set Sensor 3: Static Pressure Lower Operating Limit	√	
13217	Set Sensor 3: Temperature Damping	√	
13218	Set Sensor 3: Temperature Upper Operating Limit	√	
13219	Set Sensor 3: Temperature Lower Operating Limit	√	

Number	***Description***	***Event***	***Alarm***
13220	Sensor 3: Lost Communication		√
13221	Sensor 3: Transmitter Configuration Incorrect		√
13222	Sensor 3: Temperature Sensor Out of Range		√
13223	Sensor 3: Static Pressure Sensor Out of Range		√
13224	Sensor 3: Differential Pressure Sensor Out of Range		√
13225	Sensor 3: Not Polled		√
13226	Set Sensor 3: Type Code	√	
13227	Set Sensor 3: IP Address	√	
13228	Set Sensor 3: IP Protocol	√	
13229	Sensor 3: Temperature Sensor has bad data		√
13230	Sensor 3: Static Pressure Sensor has bad data		√
13231	Sensor 3: Differential Pressure Sensor has bad data		√
13232	Set Sensor 3: Set Pressure Type and Atmospheric Pressure		√
13233	Sensor 3: Communication Restored		√
13234	Sensor 3: Alarms Restored		√
13235	Sensor 3: Sensors Offline		√
13236	Sensor 3: RTD Disconnected		√
13237	Sensor 3: Temperature Sensor Above Range		√
13238	Sensor 3: Static Sensor Above Range		√
13239	Sensor 3: Differential Pressure Above Range		√
13240	Sensor 3: Temperature Sensor Below Range		√
13241	Sensor 3: Static Sensor Below Range		√
13242	Sensor 3: Differential Pressure Below Range		√
13250	Set Sensor 4: Polling Status	√	
13251	Set Sensor 4: Serial Port	√	
13252	Set Sensor 4: Address of Transmitter	√	
13253	Set Sensor 4: Timeout	√	
13254	Set Sensor 4: Manufacturer Code	√	
13255	Set Sensor 4: Turnaround Delay Time	√	
13256	Set Sensor 4: Differential Pressure Units	√	
13257	Set Sensor 4: Static Pressure Units	√	
13258	Set Sensor 4: Temperature Units	√	
13259	Set Sensor 4: Serial Number	√	
13260	Set Sensor 4: Tag	√	
13261	Set Sensor 4: Differential Pressure Damping	√	
13262	Set Sensor 4: Differential Pressure Upper Operating Limit	√	
13263	Set Sensor 4: Differential Pressure Lower Operating Limit	√	

Number	Description	Event	Alarm
13264	Set Sensor 4: Static Pressure Damping	√	
13265	Set Sensor 4: Static Pressure Upper Operating Limit	√	
13266	Set Sensor 4: Static Pressure Lower Operating Limit	√	
13267	Set Sensor 4: Temperature Damping	√	
13268	Set Sensor 4: Temperature Upper Operating Limit	√	
13269	Set Sensor 4: Temperature Lower Operating Limit	√	
13270	Sensor 4: Lost Communication		√
13271	Sensor 4: Transmitter Configuration Incorrect		√
13272	Sensor 4: Temperature Sensor Out of Range		√
13273	Sensor 4: Static Pressure Sensor Out of Range		√
13274	Sensor 4: Differential Pressure Sensor Out of Range		√
13275	Sensor 4: Not Polled		√
13276	Set Sensor 4: Type Code	√	
13277	Set Sensor 4: IP Address	√	
13278	Set Sensor 4: IP Protocol	√	
13279	Sensor 4: Temperature Sensor has bad data		√
13280	Sensor 4: Static Pressure Sensor has bad data		√
13281	Sensor 4: Differential Pressure Sensor has bad data		√
13282	Set Sensor 4: Set Pressure Type and Atmospheric Pressure	√	
13283	Sensor 4: Communication Restored		√
13284	Sensor 4: Alarms Restored		√
13285	Sensor 4: Sensors Offline		√
13286	Sensor 4: RTD Disconnected		√
13287	Sensor 4: Temperature Sensor Above Range		√
13288	Sensor 4: Static Sensor Above Range		√
13289	Sensor 4: Differential Pressure Above Range		√
13290	Sensor 4: Temperature Sensor Below Range		√
13291	Sensor 4: Static Sensor Below Range		√
13292	Sensor 4: Differential Pressure Below Range		√
13300	Set Sensor 5: Polling Status	√	
13301	Set Sensor 5: Serial Port	√	
13302	Set Sensor 5: Address of Transmitter	√	
13303	Set Sensor 5: Timeout	√	
13304	Set Sensor 5: Manufacturer Code	√	
13305	Set Sensor 5: Turnaround Delay Time	√	
13306	Set Sensor 5: Differential Pressure Units	√	

Number	***Description***	***Event***	***Alarm***
13307	Set Sensor 5: Static Pressure Units	√	
13308	Set Sensor 5: Temperature Units	√	
13309	Set Sensor 5: Serial Number	√	
13310	Set Sensor 5: Tag	√	
13311	Set Sensor 5: Differential Pressure Damping	√	
13312	Set Sensor 5: Differential Pressure Upper Operating Limit	√	
13313	Set Sensor 5: Differential Pressure Lower Operating Limit	√	
13314	Set Sensor 5: Static Pressure Damping	√	
13315	Set Sensor 5: Static Pressure Upper Operating Limit	√	
13316	Set Sensor 5: Static Pressure Lower Operating Limit	√	
13317	Set Sensor 5: Temperature Damping	√	
13318	Set Sensor 5: Temperature Upper Operating Limit	√	
13319	Set Sensor 5: Temperature Lower Operating Limit	√	
13320	Sensor 5: Lost Communication		√
13321	Sensor 5: Transmitter Configuration Incorrect		√
13322	Sensor 5: Temperature Sensor Out of Range		√
13323	Sensor 5: Static Pressure Sensor Out of Range		√
13324	Sensor 5: Differential Pressure Sensor Out of Range		√
13325	Sensor 5: Not Polled		√
13326	Set Sensor 5: Type Code	√	
13327	Set Sensor 5: IP Address	√	
13328	Set Sensor 5: IP Protocol	√	
13329	Sensor 5: Temperature Sensor has bad data		√
13330	Sensor 5: Static Pressure Sensor has bad data		√
13331	Sensor 5: Differential Pressure Sensor has bad data		√
13332	Set Sensor 5: Set Pressure Type and Atmospheric Pressure	√	
13333	Sensor 5: Communication Restored		√
13334	Sensor 5: Alarms Restored		√
13335	Sensor 5: Sensors Offline		√
13336	Sensor 5: RTD Disconnected		√
13337	Sensor 5: Temperature Sensor Above Range		√
13338	Sensor 5: Static Sensor Above Range		√
13339	Sensor 5: Differential Pressure Above Range		√
13340	Sensor 5: Temperature Sensor Below Range		√

Number	Description	Event	Alarm
13341	Sensor 5: Static Sensor Below Range		√
13342	Sensor 5: Differential Pressure Below Range		√
13350	Set Sensor 6: Polling Status	√	
13351	Set Sensor 6: Serial Port	√	
13352	Set Sensor 6: Address of Transmitter	√	
13353	Set Sensor 6: Timeout	√	
13354	Set Sensor 6: Manufacturer Code	√	
13355	Set Sensor 6: Turnaround Delay Time	√	
13356	Set Sensor 6: Differential Pressure Units	√	
13357	Set Sensor 6: Static Pressure Units	√	
13358	Set Sensor 6: Temperature Units	√	
13359	Set Sensor 6: Serial Number	√	
13360	Set Sensor 6: Tag	√	
13361	Set Sensor 6: Differential Pressure Damping	√	
13362	Set Sensor 6: Differential Pressure Upper Operating Limit	√	
13363	Set Sensor 6: Differential Pressure Lower Operating Limit	√	
13364	Set Sensor 6: Static Pressure Damping	√	
13365	Set Sensor 6: Static Pressure Upper Operating Limit	√	
13366	Set Sensor 6: Static Pressure Lower Operating limit	√	
13367	Set Sensor 6: Temperature Damping	√	
13368	Set Sensor 6: Temperature Upper Operating Limit	√	
13369	Set Sensor 6: Temperature Lower Operating Limit	√	
13370	Sensor 6: Lost Communication		√
13371	Sensor 6: Transmitter Configuration Incorrect		√
13372	Sensor 6: Temperature Sensor Out of Range		√
13373	Sensor 6: Static Pressure Sensor Out of Range		√
13374	Sensor 6: Differential Pressure Sensor Out of Range		√
13375	Sensor 6: Not Polled		√
13376	Set Sensor 6: Type Code	√	
13377	Set Sensor 6: IP Address	√	
13378	Set Sensor 6: IP Protocol	√	
13379	Sensor 6: Temperature Sensor has bad data		√
13380	Sensor 6: Static Pressure Sensor has bad data		√
13381	Sensor 6: Differential Pressure Sensor has bad data		√
13382	Set Sensor 6: Set Pressure Type and Atmospheric Pressure	√	
13383	Sensor 6: Communication Restored		√

Number	Description	Event	Alarm
13384	Sensor 6: Alarms Restored		√
13385	Sensor 6: Sensors Offline		√
13386	Sensor 6: RTD Disconnected		√
13387	Sensor 6: Temperature Sensor Above Range		√
13388	Sensor 6: Static Sensor Above Range		√
13389	Sensor 6: Differential Pressure Above Range		√
13390	Sensor 6: Temperature Sensor Below Range		√
13391	Sensor 6: Static Sensor Below Range		√
13392	Sensor 6: Differential Pressure Below Range		√
13400	Set Sensor 7: Polling Status	√	
13401	Set Sensor 7: Serial Port	√	
13402	Set Sensor 7: Address of Transmitter	√	
13403	Set Sensor 7: Timeout	√	
13404	Set Sensor 7: Manufacturer Code	√	
13405	Set Sensor 7: Turnaround Delay Time	√	
13406	Set Sensor 7: Differential Pressure Units	√	
13407	Set Sensor 7: Static Pressure Units	√	
13408	Set Sensor 7: Temperature Units	√	
13409	Set Sensor 7: Serial Number	√	
13410	Set Sensor 7: Tag	√	
13411	Set Sensor 7: Differential Pressure Damping	√	
13412	Set Sensor 7: Differential Pressure Upper Operating Limit	√	
13413	Set Sensor 7: Differential Pressure Lower Operating Limit	√	
13414	Set Sensor 7: Static Pressure Damping	√	
13415	Set Sensor 7: Static Pressure Upper Operating Limit	√	
13416	Set Sensor 7: Static Pressure Lower Operating Limit	√	
13417	Set Sensor 7: Temperature Damping	√	
13418	Set Sensor 7: Temperature Upper Operating Limit	√	
13419	Set Sensor 7: Temperature Lower Operating Limit	√	
13420	Sensor 7: Lost Communication		√
13421	Sensor 7: Transmitter Configuration Incorrect		√
13422	Sensor 7: Temperature Sensor Out of Range		√
13423	Sensor 7: Static Pressure Sensor Out of Range		√
13424	Sensor 7: Differential Pressure Sensor Out of Range		√
13425	Sensor 7: Not Polled		√
13426	Set Sensor 7: Type Code	√	
13427	Set Sensor 7: IP Address	√	

Number	Description	Event	Alarm
13428	Set Sensor 7: IP Protocol	√	
13429	Sensor 7: Temperature Sensor has bad data		√
13430	Sensor 7: Static Pressure Sensor has bad data		√
13431	Sensor 7: Differential Pressure Sensor has bad data		√
13432	Set Sensor 7: Set Pressure Type and Atmospheric Pressure	√	
13433	Sensor 7: Communication Restored		√
13434	5Sensor 7: Alarms Restored		√
13435	Sensor 7: Sensors Offline		√
13436	Sensor 7: RTD Disconnected		√
13437	Sensor 7: Temperature Sensor Above Range		√
13438	Sensor 7: Static Sensor Above Range		√
13439	Sensor 7: Differential Pressure Above Range		√
13440	Sensor 7: Temperature Sensor Below Range		√
13441	Sensor 7: Static Sensor Below Range		√
13442	Sensor 7: Differential Pressure Below Range		√
13450	Set Sensor 8: Polling Status	√	
13451	Set Sensor 8: Serial Sort	√	
13452	Set Sensor 8: Address of Transmitter	√	
13453	Set Sensor 8: Timeout	√	
13454	Set Sensor 8: Manufacturer Code	√	
13455	Set Sensor 8: Turnaround Delay Time	√	
13456	Set Sensor 8: Differential Pressure Units	√	
13457	Set Sensor 8: Static Pressure Units	√	
13458	Set Sensor 8: Temperature Units	√	
13459	Set Sensor 8: Serial Number	√	
13460	Set Sensor 8: Tag	√	
13461	Set Sensor 8: Differential Pressure Damping	√	
13462	Set Sensor 8: Differential Pressure Upper Operating Limit	√	
13463	Set Sensor 8: Differential Pressure Lower Operating Limit	√	
13464	Set Sensor 8: Static Pressure Damping	√	
13465	Set Sensor 8: Static Pressure Upper Operating Limit	√	
13466	Set Sensor 8: Static Pressure Lower Operating Limit	√	
13467	Set Sensor 8: Temperature Damping	√	
13468	Set Sensor 8: Temperature Upper Operating Limit	√	
13469	Set Sensor 8: Temperature Lower Operating Limit	√	
13470	Sensor 8: Lost Communication		√
13471	Sensor 8: Transmitter Configuration		√

Number	Description	Event	Alarm
	Incorrect		
13472	Sensor 8: Temperature Sensor Out of Range		√
13473	Sensor 8: Static Pressure Sensor Out of Range		√
13474	Sensor 8: Differential Pressure Sensor Out of Range		√
13475	Sensor 8: Not Polled		√
13476	Set Sensor 8: Type Code	√	
13477	Set Sensor 8: IP Address	√	
13478	Set Sensor 8: IP Protocol	√	
13479	Sensor 8: Temperature Sensor has bad data		√
13480	Sensor 8: Static Pressure Sensor has bad data		√
13481	Sensor 8: Differential Pressure Sensor has bad data		√
13482	Set Sensor 8: Set Pressure Type and Atmospheric Pressure	√	
13483	Sensor 8: Communication Restored		√
13484	Sensor 8: Alarms Restored		√
13485	Sensor 8: Sensors Offline		√
13486	Sensor 8: RTD Disconnected		√
13487	Sensor 8: Temperature Sensor Above Range		√
13488	Sensor 8: Static Sensor Above Range		√
13489	Sensor 8: Differential Pressure Above Range		√
13490	Sensor 8: Temperature Sensor Below Range		√
13491	Sensor 8: Static Sensor Below Range		√
13492	Sensor 8: Differential Pressure Below Range		√
13500	Set Sensor 9: Polling Status	√	
13501	Set Sensor 9: Serial Port	√	
13502	Set Sensor 9: Address of Transmitter	√	
13503	Set Sensor 9: Timeout	√	
13504	Set Sensor 9: Manufacturer Code	√	
13505	Set Sensor 9: Turnaround Delay Time	√	
13506	Set Sensor 9: Differential Pressure Units	√	
13507	Set Sensor 9: Static Pressure Units	√	
13508	Set Sensor 9: Temperature Units	√	
13509	Set Sensor 9: Serial Number	√	
13510	Set Sensor 9: Tag	√	
13511	Set Sensor 9: Differential Pressure Damping	√	
13512	Set Sensor 9: Differential Pressure Upper Operating Limit	√	
13513	Set Sensor 9: Differential Pressure Lower Operating Limit	√	
13514	Set Sensor 9: Static Pressure Damping	√	
13515	Set Sensor 9: Static Pressure Upper	√	

Number	Description	Event	Alarm
	Operating Limit		
13516	Set Sensor 9: Static Pressure Lower Operating Limit	√	
13517	Set Sensor 9: Temperature Damping	√	
13518	Set Sensor 9: Temperature Upper Operating Limit	√	
13519	Set Sensor 9: Temperature Lower Operating Limit	√	
13520	Sensor 9: Lost Communication		√
13521	Sensor 9: Transmitter Configuration Incorrect		√
13522	Sensor 9: Temperature Sensor Out of Range		√
13523	Sensor 9: Static Pressure Sensor Out of Range		√
13524	Sensor 9: Differential Pressure Sensor Out of Range		√
13525	Sensor 9: Not Polled		√
13526	Set Sensor 9: Type Code	√	
13527	Set Sensor 9: IP Address	√	
13528	Set Sensor 9: IP Protocol	√	
13529	Sensor 9: Temperature Sensor has bad data		√
13530	Sensor 9: Static Pressure Sensor has bad data		√
13531	Sensor 9: Differential Pressure Sensor has bad data		√
13532	Set Sensor 9: Set Pressure Type and Atmospheric Pressure	√	
13533	Sensor 9: Communication Restored		√
13534	Sensor 9: Alarms Restored		√
13535	Sensor 9: Sensors Offline		√
13536	Sensor 9: RTD Disconnected		√
13537	Sensor 9: Temperature Sensor Above Range		√
13538	Sensor 9: Static Sensor Above Range		√
13539	Sensor 9: Differential Pressure Above Range		√
13540	Sensor 9: Temperature Sensor Below Range		√
13541	Sensor 9: Static Sensor Below Range		√
13542	Sensor 9: Differential Pressure Below Range		√
13550	Set Sensor 10: Polling Status	√	
13551	Set Sensor 10: Serial Port	√	
13552	Set Sensor 10: Address of Transmitter	√	
13553	Set Sensor 10: Timeout	√	
13554	Set Sensor 10: Manufacturer Code	√	
13555	Set Sensor 10: Turnaround Delay Time	√	
13556	Set Sensor 10: Differential Pressure Units	√	
13557	Set Sensor 10: Static Pressure Units	√	

Number	***Description***	***Event***	***Alarm***
13558	Set Sensor 10: Temperature Units	√	
13559	Set Sensor 10: Serial Number	√	
13560	Set Sensor 10: Tag	√	
13561	Set Sensor 10: Differential Pressure Damping	√	
13562	Set Sensor 10: Differential Pressure Upper Operating Limit	√	
13563	Set Sensor 10: Differential Pressure Lower Operating Limit	√	
13564	Set Sensor 10: Static Pressure Damping	√	
13565	Set Sensor 10: Static Pressure Upper Operating Limit	√	
13566	Set Sensor 10: Static Pressure Lower Operating Limit	√	
13567	Set Sensor 10: Temperature Damping	√	
13568	Set Sensor 10: Temperature Upper Operating Limit	√	
13569	Set Sensor 10: Temperature Lower Operating Limit	√	
13570	Sensor 10: Lost Communication		√
13571	Sensor 10: Transmitter Configuration Incorrect		√
13572	Sensor 10: Temperature Sensor Out of Range		√
13573	Sensor 10: Static Pressure Sensor Out of Range		√
13574	Sensor 10: Differential Pressure Sensor Out of Range		√
13575	Sensor 10: Not Polled		√
13576	Set Sensor 10: Type Code	√	
13577	Set Sensor 10: IP Address	√	
13578	Set Sensor 10: IP Protocol	√	
13579	Sensor 10: Temperature Sensor has bad data		√
13580	Sensor 10: Static Pressure Sensor has bad data		√
13581	Sensor 10: Differential Pressure Sensor has bad data		√
13582	Set Sensor 10: Set Pressure Type and Atmospheric Pressure	√	
13583	Sensor 10: Communication Restored		√
13584	Sensor 10: Alarms Restored		√
13585	Sensor 10: Sensors Offline		√
13586	Sensor 10: RTD Disconnected		√
13587	Sensor 10: Temperature Sensor Above Range		√
13588	Sensor 10: Static Sensor Above Range		√
13589	Sensor 10: Differential Pressure Above Range		√
13590	Sensor 10: Temperature Sensor Below Range		√
13591	Sensor 10: Static Sensor Below Range		√

Number	Description	Event	Alarm
13592	Sensor 10: Differential Pressure Below Range		√

A configuration change will usually cause a created CALC with Execution stopped, for example, 10202, created AGA-3 (1985), with execution stopped; or a Destroyed CALC, for example, 10204, Destroyed AGA-3 (1985 Data Structure), event to be logged as an event unless the meter was running before power was removed. In such cases, this change will be logged as an alarm when power is restored.

A configuration change where there is insufficient memory for the meter variables results in a Failed to Create CALC, for example, 10201 Failed to Create AGA-3 (1985) Data Structure, to be logged as an event unless there is insufficient memory for the meter variables on power up. In such cases, this change is logged as an alarm.

Calibration and User Defined Alarms and Events

Realflo generates these events when performing calibration (not by the flow computer). User-defined events can also be created in the range 19000 to 19999. Refer to the **Log User Event** command for details.

Number	Description
19001	Start Temperature Calibration
19002	Continue Temperature Calibration
19003	As-Found Temperature
19004	As-Left Temperature
19005	Target Re-Zero Temperature
19006	Target Temperature Span
19007	Set Default Temperature
19008	After Re-Zero Temperature
19009	After Calibrate Temperature Span
19011	Start Static Press Calibration
19012	Continue Static Pressure Calibration
19013	As-Found Static Pressure
19014	As-Left Static Pressure
19015	Target Re-Zero Static Pressure
19016	Target Static Pressure Span
19018	After Re-Zero Static Pressure
19019	After Calibrate Static Pressure Span
19021	Start Differential Pressure Calibration
19022	Continue Differential Pressure Calibration
19023	As-Found Differential Pressure
19024	As-Left Differential Pressure
19025	Target Re-Zero Differential Pressure
19026	Target Differential Pressure Span
19028	After Re-Zero Differential Pressure
19029	After Calibrate Differential Pressure Span
19031	Start Pulse Count Calibration
19032	Continue Pulse Count Calibration
19033	As-Found Pulse Count
19034	As-Left Pulse Count
19039	End Pulse Count Calibration

Calibration and User Defined Alarms and Events Description

Flow Computer Error Codes

This section contains tables of the error codes that are created by the flow computer.

Calculation Engine Errors

The flow calculation engine generates these errors.

Number	*Description*
20001	Meter control structure not found
20002	Inputs have not been configured
20003	Temperature input is below zero scale
20004	Temperature input is above full scale
20005	Static pressure input is below zero scale
20006	Static pressure input is above full scale
20007	Differential pressure input is below zero scale
20008	Differential pressure input is above full scale
20010	Forced input register
20011	Removed forced from input register
20050	Restore from temperature input low alarm
20051	Restore from temperature input high alarm
20052	Restore from static pressure input low alarm
20053	Restore from static pressure input high alarm
20054	Restore from differential pressure input low alarm
20055	Restore from differential pressure input high alarm
20056	Restore from low pulse input alarm
20057	Restore from input alarm

Calculation Engine Errors Description

AGA-3 (1985) Calculation Errors

Number	*Description*
20201	AGA-3 (1985) - Input Units system is invalid
20202	AGA-3 (1985) - Pipe diameter is too small
20203	AGA-3 (1985) - Orifice diameter is too small
20204	AGA-3 (1985) - Orifice diameter is larger than the pipe diameter
20205	AGA-3 (1985) - Base pressure is zero or negative
20206	AGA-3 (1985) - Base temperature is at or below absolute zero
20207	AGA-3 (1985) - Relative density is zero or negative
20208	AGA-3 (1985) - Supercompressibility is zero or negative
20209	AGA-3 (1985) - Viscosity is zero or negative
20210	AGA-3 (1985) - Flowing temperature is at or below absolute zero
20211	AGA-3 (1985) - Flow extension is zero or negative
20214	AGA-3 (1985) - Invalid isentropic exponent
20221	AGA-3 (1985) - Invalid pipe material
20222	AGA-3 (1985) - Invalid orifice material
20223	AGA-3 (1985) - Invalid static pressure tap location
20227	AGA-3 (1985) - Differential pressure is zero or negative
20228	AGA-3 (1985) - Configuration flag not set

Number	Description
20229	AGA-3 (1985) - Ratios from AGA-8 or NX-19 were not available
20230	AGA-3 (1985) – Static Pressure Below Differential Pressure
20231	AGA-3 (1985) – Static Pressure Negative or Zero
20234	AGA-3 (1985) – Bad Calculation

AGA-3 (1985) Calculation Errors Description

AGA-3 (1992) Calculation Errors

These errors are generated by the AGA-3 calculation.

Number	Description
20301	AGA-3 (1992) - Input Units system is invalid
20302	AGA-3 (1992) - Pipe diameter is too small
20303	AGA-3 (1992) - Orifice diameter is too small
20304	AGA-3 (1992) - Orifice diameter is larger than the pipe diameter
20305	AGA-3 (1992) - Base pressure is zero or negative
20306	AGA-3 (1992) - Base temperature is at or below absolute zero
20307	AGA-3 (1992) - Relative density is zero or negative
20308	AGA-3 (1992) - Supercompressibility is zero or negative
20309	AGA-3 (1992) - Viscosity is zero or negative
20310	AGA-3 (1992) - Flowing temperature is at or below absolute zero
20311	AGA-3 (1992) - Flow extension is zero or negative
20312	AGA-3 (1992) - Compressibility is negative at base conditions
20313	AGA-3 (1992) - Compressibility is negative at flow conditions
20314	AGA-3 (1992) - Invalid isentropic exponent
20315	AGA-3 (1992) - Ratio of orifice to pipe diameter is small
20316	AGA-3 (1992) - Ratio of orifice to pipe diameter is large
20317	AGA-3 (1992) - Ratio of orifice to pipe diameter is too small
20318	AGA-3 (1992) - Ratio of orifice to pipe diameter is too large
20319	AGA-3 (1992) - Reynolds number is too small
20320	AGA-3 (1992) - Reynolds number is too large
20321	AGA-3 (1992) - Invalid pipe material
20322	AGA-3 (1992) - Invalid orifice material
20323	AGA-3 (1992) - Invalid static pressure tap location
20324	AGA-3 (1992) - The discharge coefficient was not calculated
20325	AGA-3 (1992) - Too many iterations to calculate the discharge coefficient
20326	AGA-3 (1992) - The atmospheric pressure is invalid
20327	AGA-3 (1992) - unused error code
20328	AGA-3 (1992) - Configuration flag not set
20329	AGA-3 (1992) - Ratios from AGA-8 or NX-19 were not available
20330	AGA-3 (1992) - Static Pressure Below Differential Pressure
20331	AGA-3 (1992) - Static Pressure Negative or Zero
20334	AGA-3 (1992) – Bad Calculation

AGA-3 (1992) Calculation Errors Description

AGA-7 Calculation Errors

These errors are generated by the AGA-7 calculation.

Number	***Description***
20701	AGA-7 - Failed to create
20702	AGA-7 - Unused error code
20703	AGA-7 - Input Units system is invalid
20704	AGA-7 - Base pressure is low
20705	AGA-7 - Base temperature is at or below absolute zero
20706	AGA-7 - K factor is negative or zero
20707	AGA-7 - M factor is negative or zero
20708	AGA-7 - Atmospheric pressure is negative
20709	AGA-7 - Supercompressibility is zero or negative
20710	AGA-7 - Compressibility is negative at base conditions
20711	AGA-7 - Pulse count is negative
20712	AGA-7 - Flow temperature is low
20713	AGA-7 - Flow pressure is low
20714	AGA-7 - Pulse count is low
20715	AGA-7 - Configuration flag not set
20716	AGA-7 - Ratios from AGA-8 or NX-19 are not available
20717	AGA-7 - Input values are not available
20718	AGA-7 - Contract Units system is invalid
20719	AGA-7 – Volume Option is Invalid
20720	AGA-7 – Bad Calculation

AGA-7 Calculation Errors Description

AGA-11 Calculation Errors

These errors are generated by the AGA-11 calculation.

Number	***Description***
21101	AGA-11 - Bad units
21102	AGA-11 - Bad contract units
21103	AGA-11 - Base Pressure negative or zero
21104	AGA-11 - Base Temperature negative or zero
21105	AGA-11 - Bad calculation
21106	AGA-11 - Configuration flag not set
21107	AGA-11 - Ratios from AGA-8 were not available
21108	AGA-11 – Input not available

AGA-11 Calculation Errors Description

V-Cone Calculation Errors

These errors are generated by the V-Cone calculation.

Number	***Description***
22201	V-Cone - Input Units system is invalid
22202	V-Cone - Contract units system is invalid
22203	V-Cone - Invalid pipe material
22204	V-Cone - Invalid cone material
22205	V-Cone - Pipe diameter is too small
22206	V-Cone - Cone diameter is too small
22207	V-Cone - cone diameter is larger than the pipe diameter
22208	V-Cone - Base pressure is zero or negative

Number	Description
22209	V-Cone - Base temperature is zero or negative
22210	V-Cone - Viscosity is zero or negative
22211	V-Cone - Invalid isentropic exponent
22212	V-Cone - The atmospheric pressure is invalid
22213	V-Cone - Reynolds/coefficient table length is invalid
22214	V-Cone - First Reynolds/coefficient point is invalid
22215	V-Cone - A Reynolds/coefficient point is invalid
22216	V-Cone - Reynolds number lower than previous point
22217	V-Cone - Coefficient lower than previous point
22218	V-Cone - Supercompressibility is zero or negative
22219	V-Cone - Compressibility is negative at base conditions
22220	V-Cone - Compressibility is negative at flow conditions
22221	V-Cone - Flow temperature is at or below absolute zero
22222	V-Cone - Configuration flag not set
22223	V-Cone - Ratios from AGA-8 or NX-19 were not available
22224	V-Cone - Input values were not available
22225	V-Cone - Calculated Reynolds number is too small
22226	V-Cone - Calculated Reynolds number is too large
22227	V-Cone - Too many iterations for the Reynolds number to converge
22228	V-Cone – Static Pressure Below Differential Pressure
22229	V-Cone – Static Pressure Negative or Zero
22230	V-Cone – Bad Calculation
22232	V-Cone – Invalid Adiabatic Expansion Factor Setting.
22233	Froude number invalid – wet gas correction cannot be done.

V-Cone Calculation Errors Description

AGA-8 Calculation Errors

These errors are generated by the AGA-8 calculation.

Number	Description
20801	AGA-8 - Failed to create
20802	AGA-8 - Input Units system is invalid
20803	AGA-8 - Bad gas component
20804	AGA-8 - Components do not sum to 1.000
20805	AGA-8 - Base temperature is out of range
20806	AGA-8 - Heating-value temperature is out of range
20807	AGA-8 - Base pressure is high
20808	AGA-8 - Invalid static pressure tap location
20809	AGA-8 - Flow temperature is low
20810	AGA-8 - Flow temperature is high
20811	AGA-8 - Flow pressure is low
20812	AGA-8 - Flow pressure is high
20813	AGA-8 - Invalid calculation code
20814	AGA-8 - Not configured
20815	AGA-8 - Bracket exceed iterates
20816	AGA-8 - Bracket negative derivative
20817	AGA-8 - Not running
20818	AGA-8 - Atmospheric pressure is invalid
20819	AGA-8 - No gas components
20820	AGA-8 - No inputs received

Number	Description
20821	AGA-8 - Contract Units system is invalid
20822	AGA-8 - Bad log option
20823	AGA-8 Bad Hexanes+ option
20824	AGA-8 Bad Hexanes+ ratio
20825	AGA-8 Hexanes+ ratios to not sum to 100
20826	AGA-8 – Bad laboratory real relative density
20827	AGA-8 – Bad laboratory heating value

AGA-8 Calculation Errors Description

NX-19 Calculation Errors

These errors are generated by the NX-19 calculation.

Number	Description
21901	NX-19 - Failed to create
21902	NX-19 - Input Units system is invalid
21903	NX-19 - Base temperature is out of range
21904	NX-19 - Base pressure is high
21905	NX-19 - Invalid static pressure tap location
21906	NX-19 - Bad method
21907	NX-19 - Gravity is out of range
21908	NX-19 - CO2 is out of range
21909	NX-19 - Methane is out of range
21910	NX-19 - Nitrogen is out of range
21911	NX-19 - Gas fractions are out of range
21912	NX-19 - Heating value temperature is out of range
21913	NX-19 - Temperature is out of range
21914	NX-19 - Flow pressure is low
21915	NX-19 - Flow pressure is high
21916	NX-19 - Configuration flag not set
21917	NX-19 - Gas ratios were not available
21918	NX-19 - Input values were not available
21919	NX-19 - Not running
21920	NX-19 - Contract Units system is invalid
21921	NX-19 – Density Temperature High

NX-19 Errors Description

Flow Calculation Engine Command Errors

These errors are generated by commands executed by the flow calculation engine.

Number	Description
30001	Invalid meter number
30002	Invalid user number
30003	Illegal meter number
30004	Illegal user number
30005	Undefined command
30006	Unmatched meter number
30007	Cannot change configuration while the calculations are running
30008	Calculation units out of range
30009	Illegal calculation type for flow calculation

Number	Description
30010	Illegal calculation type for compressibility calculation
30011	Failed to set the contract configuration
30012	Failed to change the gas fractions
30013	Invalid register address
30014	Negative value for input scale
30015	Full scale input less than zero scale input
30016	Contract hour is too high
30017	Invalid data in a time register
30018	First event position is zero or larger than queue size
30019	Requested number of events is zero or too large
30020	Did not find any event data for the passed parameters
30023	Failed to flush the event log
30024	NX-19 calculation is not configured
30025	Day offset is too large
30026	userID does not exist
30027	User is not authorized to perform this function.
30028	Flow Computer is not in calibration mode
30029	Forced temperature is out of valid range
30030	Calibration temperature is out of valid range
30031	The contract is not configured
30032	Temperature level limit not within input range
30033	Static pressure level limit not within input range
30034	Temperature level hysteresis is invalid
30035	Static pressure hysteresis is invalid
30036	No temperature range remains between hysteresis limits
30037	No static pressure range remains between hysteresis limits
30038	Save input events selection is invalid
30039	Invalid static pressure tap location
30040	Atmospheric pressure is less than zero
30041	Atmospheric pressure is too high
30042	Forced static pressure is invalid
30043	Forced differential pressure is invalid
30044	Forced pulse count is invalid
30045	The execution state is invalid
30046	The execution state did not change, may not be configured
30047	The event ID is not a valid user defined event ID
30048	The register type is invalid
30049	Attempted to set an invalid number of active runs.
30050	Attempted to reduce the number of active runs when one still running.
30051	Attempted to start a valid but inactive run.
30052	Flow computer cannot execute the command because the event log is full. Read the event log then retry the operation.
30053	The Alarm register position is not valid.
30054	The Alarm register size is not valid.
30055	The Alarm register data is not valid.
30056	Failed to acknowledge alarms.
30057	Attempted to set an invalid altitude.
30058	Attempted to set an invalid latitude.
30059	Attempted to set an invalid Wet Gas Meter Factor
30064	Flow Computer cannot execute the command because the

Number	Description
	Measurement Canada lockout jumper is installed.
30065	Illegal gas quality source type
30066	Flow Direction Control setting is invalid
30067	Flow Direction Register setting is invalid
30068	Forced mass flow rate is invalid
30074	On Indicates setting is invalid

Engine Commands Errors Description

MVT Command Errors

The following new error codes are defined.

Number	Description
30101	Sensor search parameters invalid
30102	Sensor address invalid
30103	Invalid sensor number
30104	Sensor did not respond
30105	Polling status is invalid
30106	Serial port is invalid
30107	Address of sensor is invalid
30108	Timeout is invalid
30109	Turnaround delay time is invalid
30110	Differential pressure units is invalid
30111	Static pressure units is invalid
30112	Temperature units is invalid
30113	Differential pressure damping is invalid
30114	Differential pressure upper operating limit is invalid
30115	Differential pressure lower operating limit is invalid
30116	Static pressure damping is invalid
30117	Static pressure upper operating limit is invalid
30118	Static pressure lower operating limit is invalid
30119	Temperature damping is invalid
30120	Temperature upper operating limit is invalid
30121	Temperature lower operating limit is invalid
30122	Invalid sensor type
30123	Sensor not enabled
30124	Invalid register type
30125	Sensor returned function exception
30126	Sensor returned address exception
30127	Sensor returned value exception
30128	Bad manufacturer or type code for internal SCADAPack 4200 or 4300
30129	Cannot write to device: bad manufacturer, type code or identifier
30130	Display interval is invalid
30131	A display custom item identifier is invalid
30132	Sensor communication error
30133	Invalid protocol type
30134	Atmospheric pressure offset is invalid
30135	Custom display number is invalid
30136	Custom display data type is invalid
30137	Custom display description string is empty.

Coriolis Meter Errors

Number	Description
33001	Coriolis Meter - Address is invalid
33002	Coriolis Meter - Port is invalid
33003	Coriolis Meter - Timeout is invalid
33004	Coriolis Meter - Device code invalid
33005	Coriolis Meter - Adding Coriolis meter failed

SolarPack 410 Errors

Number	Description
30138	Invalid pulse configuration
30139	Invalid gas sampler output configuration
30140	Invalid power management configuration

AGA-3 Command Errors

These errors are generated by commands executed by the AGA-3 calculation.

Number	Description
30301	AGA-3 is not configured
30302	Failed to configure AGA-3
30303	Differential pressure level limit is invalid
30304	Differential pressure level hysterisis is invalid
30305	No differential pressure range remains between hysterisis limits

AGA-3 Command Errors Description

AGA-7 Command Errors

These errors are generated by commands executed by the AGA-7 calculation.

Number	Description
30701	AGA-7 is not configured
30702	Failed to configure AGA-7
30703	Low flow pulse limit is invalid
30704	Low flow pulse duration is invalid

AGA-7 Command Errors Description

AGA-11 Command Errors

These errors are generated by commands executed by the AGA-11 calculation.

Number	Description
31101	AGA-11 - not configured for use
31102	AGA-11 - Failed to configure AGA-11

V-Cone Command Errors Description

V-Cone Command Errors

These errors are generated by commands executed by the V-Cone calculation.

Number	*Description*
32201	V-Cone is not configured
32202	Failed to configure V-Cone

V-Cone Command Errors Description

AGA-8 Command Errors

These errors are generated by the executed by the AGA-8 calculation.

Number	*Description*
30801	AGA-8 is not configured for use
30802	Failed to configure AGA-8

AGA-8 Command Errors Description

NX-19 Command Errors

These errors are generated by the executed by the NX-19 calculation.

Number	*Description*
31901	NX-19 is not configured for use
31902	Failed to configure NX-19 contract items
31903	Failed to configure NX-19 gas components

NX-19 Command Errors Description

Flow Computer Commands

The following table is a complete list of commands used in the command sequence configuration of the flow computer. Refer to the ***TeleBUS Protocol Interface*** section for information on using these commands.

Command Number	*Command Description*
1	Get input configuration
3	Set input configuration
6	Set Real Time Clock
8	Set execution state
9	Adjust Real Time Clock
11	Get hourly history
12	Get daily history
13	Get contract configuration
15	Set contract configuration
16	Set number of runs
17	Set Flow Computer ID
18	Get Flow Computer ID
19	Set runID
20	Get runID
21	Set Long Run ID
22	Get Long Run ID
23	Set Enron Modbus Time Stamp
30	Start Temperature Calibration: Force current temperature
31	Start Temperature Calibration: Force fixed temperature
32	End Temperature Calibration
34	Start Static Pressure Calibration: Force current static pressure
35	Start Static Pressure Calibration: Force fixed static

Command Number	***Command Description***
	pressure
37	End Static Pressure Calibration
38	Start Differential Pressure Calibration: Force current differential pressure
40	Start plate change: force current temperature
41	Start plate change: force fixed temperature
42	End plate change: temperature
43	Start plate change: force current static pressure
44	Start plate change: force fixed static pressure
45	End plate change: static pressure
46	Start plate change: force current differential pressure
47	Start plate change: force fixed differential pressure
48	End plate change: differential pressure
50	Get number of new events
51	Get requested new events
52	Get recent events
53	Acknowledge events
54	Log user defined event
55	Get number of all events
56	Get requested all events
60	Get number of new alarms
60	Get number of new alarms
61	Get requested new alarms
62	Get recent alarms
63	Acknowledge alarms
64	Get number of all alarms
65	Get requested all alarms
75	Start Pulse Count Calibration: Force current pulse count rate
76	Start Pulse Count Calibration: Force fixed pulse count rate
77	End Pulse Count Calibration
78	Force current temperature
79	Force fixed temperature
80	Remove forced temperature
81	Force current static pressure
82	Force fixed static pressure
83	Remove forced static pressure
84	Force current differential pressure
85	Force fixed differential pressure
86	Remove forced differential pressure
87	Force current pulse count rate
88	Force fixed pulse count rate
89	Remove forced pulse count rate
90	Force current mass flow rate
91	Force fixed mass flow rate
92	Remove forced mass rate
93	Start Mass Flow Rate Calibration: Force current Mass Flow Rate
94	Start Mass Flow Rate Calibration: Force fixed Mass Flow Rate

Command Number	***Command Description***
95	End Mass Flow Rate Calibration
100	Lookup user number
101	Lookup userID
102	Delete account
103	Update account
104	Read next account
112	Get Coriolis meter configuration
112	Set Coriolis meter configuration
130	Search for MVT sensor
131	Change address of MVT sensor
132	Get MVT configuration
133	Set MVT configuration
134	Get MVT sensor information
135	Calibrate MVT sensor
136	Read MVT configuration
137	Get Display Control Configuration
138	Set Display Control Configuration
139	Set Sensor Mode
140	Get number of process inputs
142	Get process input
143	Set process input
144	Get number of process outputs
146	Get process output
147	Set process output
150	Get Custom Display Configuration
151	Set Custom Display Configuration
301	Get AGA-3 (1992) configuration
303	Set AGA-3 (1992) configuration
351	Get AGA-3 (1985) configuration
353	Set AGA-3 (1985) configuration
701	Get AGA-7 configuration
703	Set AGA-7 configuration
801	Get AGA-8 gas ratios
802	Get AGA-8 Hexanes+ Gas Ratios
803	Set AGA-8 gas ratios
804	Set AGA-8 Hexanes+ Gas Ratios
1901	Get NX19 gas ratios
1903	Set NX19 gas ratios
2201	Get V-Cone configuration
2203	Set V-Cone Configuration

Flow Computer Register Grouping

Register grouping provides a method to group commonly read data from a SolarPack 410 flow computer. The data that is commonly read is in scattered register locations in the flow computer. Register grouping enables the SCADA Host to read a sequential block of data in a single read command. The start address for the register group is user defined.

SolarPack 410 flow computer version **6.51** or later is required for this feature.

Register Group Data

The flow computer data and the order of the register locations are shown the table below. The data is grouped in consecutive Modbus Input (30000) or Modbus Holding (40000) registers. See the ***Configure Register Group Location*** section below for information on how to define the Start Register.

Data in the register group are floating point values with the high word in the lower numbered register. This format is common to Telepace, ISaGRAF and Realflo and is readily accessible by SCADA Host packages. The Battery Voltage and Contract Hour are internally converted from integer format to floating point format.

The flow computer data for each register is described in the Description column of the table.

The Units column describes the flow computer data units as defined in the flow computer Inputs and Contract configuration. These units are configured using Realflo configuration Inputs tab and Contract tab respectively.

Register Group	**Format**	**Description**	**Units**	**Source**
Start Register	Float	Battery voltage	volts	Instantaneous input
Start Register + 1	Float	Differential pressure (AGA-3 or V-Cone) or pulse rate (AGA-7)	Input	Instantaneous input
Start Register + 2	Float	Static pressure	Input	Instantaneous input
Start Register + 3	Float	Temperature	Input	Instantaneous input
Start Register + 4	Float	Forced inputs flags: register contains the sum of each force flag: 1 = DP or pulse rate forced 10 = SP forced 100 = Temp forced For example if both SP and temperature are forced the value in the	none	Instantaneous input

Register Group	Format	Description	Units	Source
		register will be 110.		
Start Register + 5	Float	Volume rate	Contract	Instantaneous calculated
Start Register + 6	Float	Flow extension (AGA-3) or uncorrected volume rate (AGA-7)	Contract	Instantaneous calculated
Start Register + 7	Float	Accumulated volume today	Contract	Instantaneous calculated
Start Register + 8	Float	Accumulated volume yesterday	Contract	Instantaneous calculated
Start Register + 9	Float	Accumulated energy today	Contract	Instantaneous calculated
Start Register + 10	Float	Accumulated energy yesterday	Contract	Instantaneous calculated
Start Register + 11	Float	Flow duration today	Seconds	Instantaneous calculated
Start Register + 12	Float	Flow duration yesterday	Seconds	Instantaneous calculated
Start Register + 13	Float	Accumulated mass today	Contract	Instantaneous calculated
Start Register + 14	Float	Accumulated mass yesterday	Contract	Instantaneous calculated
Start Register + 15	Float	Heating value	Contract	Instantaneous calculated
Start Register + 16	Float	Mass density	Contract	Instantaneous calculated
Start Register + 17	Float	Orifice diameter (AGA-3) or cone diameter (V-Cone)	Input	Configured
Start Register + 18	Float	Contract hour	None	Configured
Start Register + 19	Float	Pipe diameter	Input	Configured

Configure Register Group Location

The register group is defined, enabled and monitored using a block of three Modbus registers as seen in the table below.

Modbus Register	Format	Description
48520 (input)	UINT	**Register Group Start Register** 30001 to 39760 40501 to 47460 Excluding the flow computer reserved registers 40001 to 40500, 43180 to 43799 and 47500 to 49999. See the ***Register Addresses*** section for information on reserved registers.
48521 (input)	UINT	**Register Group Enable Register** 0 = OFF(Do not copy flow computer data to register group) 1 = ON (Copy flow computer data to register group)
48522 (output)	UINT	**Register Group Status Register** 0 = OFF (Enable is OFF) 1 = ON (flow computer data is copied to register group) 2 = Invalid Start Register 3 = Overlaps flow computer reserved registers. (40001 to 40500, 43180 to 43799, 47500 to 49999 are reserved) 4 = Overlaps Device Identifier reserved registers. (39800 to 39999 are reserved)

To configure the register group the **Register Group Start Register** needs to be defined. To do this write the start register address into register 48520. For example if you want the register group to stat at register 31000 the value 31000 needs to be written to register 48520. In this case the flow computer data is written to registers 31000 (Start Register) through 31020 (Start Register + 19)

Once the register group is configured the **Register Group Enable Register** is used to enable of disable the register group. The register group is enabled by writing a value of 1 into register 48521.The register group is disabled by writing a value of 0 into register 48521.

To monitor the status of the register group monitor register 48522. The status codes are shown in the table above. The **Register Group Status Register** provides immediate feedback about the validity of the settings. The register group data is copied to the registers only when the Register Group Status Register status register has a value of 1.

The Realflo **Custom View** feature is used to write values to the Register Group Start Register (48520) and the Register Group enable Register (48521) and to read the Register Group Status Register (48522). See the ***Custom Views Command*** section for complete details on using the Custom View to write and monitor the register Group registers.

Flow Computer Application ID

Realflo automatically enables device configuration register mapping when the flow computer is run. Device configuration registers provide useful information on the flow computer, logic applications and controller used in a Realflo application.

Refer to the Telepace, ISaGRAF and appropriate C Tools manuals for complete information on enabling and disabling Device Configuration Register mapping.

Flow computers set their application ID using the C API and enable the device configuration register mapping. This can be disabled from a logic application or other C applications.

Application Identifiers

Each flow computer application is identified by a unique value. See the table in the Device Configuration Read Only Registers for the actual registers used.

Description	Value
Company ID	1 = Control Microsystems
Application number	1 = SCADAPack & SCADAPack 4202 Telepace 2 = SCADAPack & SCADAPack 4202 Telepace (Enron Modbus) 3 = SCADAPack & SCADAPack 4202 ISaGRAF 4 = SCADAPack & SCADAPack 4202 ISaGRAF (Enron Modbus) 5 = SCADAPack 32 Telepace 6 = SCADAPack 32 ISaGRAF 7 = SCADAPack 330 & 334 Telepace 8 = SCADAPack 330 & 334 ISaGRAF 9 = SCADAPack 350 Telepace 10 = SCADAPack 350 ISaGRAF 11 = SCADAPack 4203 Telepace 12 = SCADAPack 4203 ISaGRAF 13 = SolarPack 410 Telepace 14 = SolarPack 410 ISaGRAF (not implemented) 15 = Reserved 16 = Reserved 17 = SCADAPack 32 Telepace with PEMEX 18 = SCADAPack 32 ISaGRAF with PEMEX 19 = SCADAPack 330 & 334 Telepace with PEMEX 20 = SCADAPack 330 & 334 ISaGRAF with PEMEX 21 = SCADAPack 350 Telepace with PEMEX 22 = SCADAPack 350 ISaGRAF with PEMEX 23 = SCADAPack 4203 Telepace with PEMEX 24 = SCADAPack 4203 ISaGRAF with PEMEX 25 = SolarPack 410 Telepace with PEMEX 26 = SolarPack 410 ISaGRAF with PEMEX (not

	implemented) 27 = Reserved 28 = Reserved 29 = SCADAPack 32 Telepace with GOST (not implemented) 30 = SCADAPack 32 ISaGRAF with GOST (not implemented) 31 = SCADAPack 330 & 334 Telepace with GOST 32 = SCADAPack 330 & 334 ISaGRAF with GOST 33 = SCADAPack 350 Telepace with GOST 34 = SCADAPack 350 ISaGRAF with GOST 35 = SCADAPack 4203 Telepace with GOST (not implemented) 36 = SCADAPack 4203 ISaGRAF with GOST (not implemented) 37 = SolarPack 410 Telepace with GOST (not implemented) 38 = SolarPack 410 ISaGRAF with GOST (not implemented) 39 = Reserved 40 = Reserved 41 = SCADAPack 314 Telepace 42 = SCADAPack 314 ISaGRAF 43 = SCADAPack 314 Telepace with PEMEX 44 = SCADAPack 314 ISaGRAF with PEMEX 45 = SCADAPack 314 Telepace with GOST 46 = SCADAPack 314 ISaGRAF with GOST
Application version	Current version of the flow computer

Device Configuration Read Only Registers

The Device configuration is stored in Modbus input (3xxxx) registers as shown below. The registers are read with standard Modbus commands. These registers cannot be written to. Device configuration registers used fixed addresses. This facilitates identifying the applications in a standard manner.

The following information is stored in the device configuration. 2 logic application identifiers are provided for compatibility with SCADAPack ES/ER controllers that provide 2 ISaGRAF applications. The second logic application identifier is not used with other controllers. 32 application identifiers are provided to accommodate C applications in SCADAPack 314/330/350 controllers.

Register	Description
39800	Controller ID (ASCII value), first byte.
39801	Controller ID (ASCII value), second byte.
39802	Controller ID (ASCII value), third byte.
39803	Controller ID (ASCII value), fourth byte.
39804	Controller ID (ASCII value), fifth byte.
39805	Controller ID (ASCII value), sixth byte.
39806	Controller ID (ASCII value), seventh byte.
39807	Controller ID (ASCII value), eighth byte.

Register	Description
39808	Firmware version (major*100 + minor)
39809	Firmware version build number (if applicable)
39810	Logic Application 1 - Company ID (see below)
39811	Logic Application 1 - Application number (0 to 65535)
39812	Logic Application 1 - Application version (major*100 + minor)
39813	Logic Application 2 - Company ID (see below)
39814	Logic Application 2 - Application number (0 to 65535)
39815	Logic Application 2 - Application version (major*100 + minor)
39816	Number of applications identifiers used (0 to 32) Identifiers are listed sequentially starting with identifier 1. Unused identifiers will return 0.
39817	Application identifier 1 (see format below)
39820	Application identifier 2 (see format below)
39823	Application identifier 3 (see format below)
39826	Application identifier 4 (see format below)
39829	Application identifier 5 (see format below)
39832	Application identifier 6 (see format below)
39835	Application identifier 7 (see format below)
39838	Application identifier 8 (see format below)
39841	Application identifier 9 (see format below)
39844	Application identifier 10 (see format below)
39847	Application identifier 11 (see format below)
39850	Application identifier 12 (see format below)
39853	Application identifier 13 (see format below)
39856	Application identifier 14 (see format below)
39859	Application identifier 15 (see format below)
39862	Application identifier 16 (see format below)
39865	Application identifier 17 (see format below)
39868	Application identifier 18 (see format below)
39871	Application identifier 19 (see format below)
39874	Application identifier 20 (see format below)
39877	Application identifier 21 (see format below)
39880	Application identifier 22 (see format below)
39883	Application identifier 23 (see format below)
39886	Application identifier 24 (see format below)
39889	Application identifier 25 (see format below)
39892	Application identifier 26 (see format below)
39895	Application identifier 27 (see format below)
39898	Application identifier 28 (see format below)
39901	Application identifier 29 (see format below)
39904	Application identifier 30 (see format below)
39907	Application identifier 31 (see format below)

Register	Description
39910	Application identifier 32 (see format below)
39913 to 39999	Reserved for future expansion

Application Identifier

The application identifier is formatted as follows.

Register	Description
Start	Company ID (see below)
Start +1	Application number (0 to 65535)
Start +2	Application version (major*100 + minor)

Company Identifier

Control Microsystems maintains a list of company identifiers to keep the company ID is unique. Contact Control Microsystems for a Company ID. Company ID 0 indicates an identifier is unused.

Company IDs 1 to 100 are reserved for Control Microsystems use.

Enron Modbus Protocol Interface

The Enron Modbus protocol is used widely in the Oil and Gas industry to obtain data from electronic flow measurement devices. The protocol is a de-facto standard in many industries. Control Microsystems supports this protocol in our flow computer products.

The Enron Modbus protocol is based on the Modbus ASCII and RTU protocols. Message framing is identical to the Modbus protocols. However, there are many differences in message formatting and register numbering, at both the logical and protocol levels.

The document ***Specifications and Requirements for an Electronic Flow Measurement Remote Terminal Unit*** describes the Enron Modbus protocol.

The flow computer supports Enron Modbus and standard Modbus on the same serial port. Standard Modbus will use one station address and Enron Modbus uses a different station address.

The flow computer does not determine which format a message is using, because the station address separates the data streams. This architecture allows standard PC applications to communicate with the flow computer in the normal manner. Enron Modbus hosts can communicate at the same time.

The flow computer program processes Enron Modbus commands, sends master messages, and processes master responses. This architecture allows the Enron Modbus commands to directly access flow computer data.

Flow computer data is accessed directly when a command is processed. When data is written to the numeric registers for configuration, the flow computer reads the existing data structures, replace the targeted fields with new data and attempts to configure the run with the new configuration. This may be repeated with other configuration items when the command message is long.

Some registers are read only. The flow computer will not allow these registers to be written by not providing a write handler for these registers. The flow computer supports the following Enron function codes.

Command	Description
1	Read multiple boolean variables
3	Read multiple numeric variables
5	Write single boolean variable
6	Write single numeric variable
7	Read unit status
15	Write multiple boolean variables
16	Write multiple numeric variables

Register Addresses

The addresses in the messages refer to system addresses, not type specific addresses. The commands will return exception errors if the command refers to addresses outside the valid range for the command.

There are ranges of Enron registers to hold short integers, long integers and single precision floats. The ranges are as follows.

Range	Data Type
32	Event/Alarm archive
701 – 720	Hourly/Daily archive
741 - 750	Hourly Gas Quality History
1001 - 2999	Boolean
3001 - 4999	Short integer
5001 - 6999	Long integer
7000 - 9999	Float

In general, both Numeric and Boolean function codes can be used to read and write any type of registers. Consult the Enron Modbus specification for details.

Refer to the ***Flow Computer Variables*** section of this document for details on the registers allocated to the flow computer.

Variable Types

Boolean Variables

Boolean variables are accessed using commands 1, 5, and 15. These commands are similar to the corresponding standard Modbus commands. They use the Enron Modbus addressing.

Read only registers cannot be written using commands 5 and 15.

Short Integer Variables

Short integer variables are accessed using commands 3, 6, and 16. These commands are similar to the corresponding standard Modbus commands. They use the Enron Modbus addressing.

The size of the data fields for each variable is determined by the variable address. The read command returns two bytes for each requested register. The write command provides two bytes for each register value.

Read only registers cannot be written using commands 6 and 16.

Long Integer and Floating Point Variables

Long integer and floating point variables are accessed using commands 3, 6, and 16. These commands are similar to the corresponding standard Modbus commands. They use the Enron Modbus addressing.

The size of the data fields for each variable is determined by the variable address. The read command returns four bytes for each requested register. The write command provides four bytes for each register value.

Read only registers cannot be written using commands 6 and 16.

Hourly/Daily History

Enron Modbus Hourly/Daily archive registers are used to read Realflo hourly and daily logs. They read the logs one record at a time.

Hourly Gas Quality History

Enron Modbus Hourly Gas Quality archive registers are used to read Realflo hourly gas quality history logs. The logs are read one record at a time.

Gas Quality History is available when the Gas Transmission option bit is enabled for the controller. Only hourly records are supported.

Flow Computer Variables

The Realflo Flow Computer provides up to ten flow runs. Flow runs are configured individually. Gas quality is set for each flow run.

The Flow computer provides up to ten MVT transmitters. Transmitters are configured individually.

Registers may be read/write or read-only. The Access column in the tables indicates the register type. Configuration registers are read/write registers.

The flow computer uses the ranges of Enron Modbus variables shown in the table below.

Purpose	Hourly/ Daily Archive	Boolean	Integer	Long Integer	Floating Point
Events/ Alarms	none	none	none	none	7000
Log Pointers	none	none	none	none	7001 to 7003
System Variables	none	1001 to 1099	3000 to 3099	none	None
Run 1	701 to 702	1100 to 1199	3100 to 3199 4400 to 4429	5100 to 5199	7100 to 7349
Run 2	703 to 704	1200 to 1299	3200 to 3299 4430 to 4459	5200 to 5299	7350 to 7599
Run 3	705 to 706	1300 to 1399	3300 to 3399 4460 to 4489	5300 to 5399	7600 to 7849
Run 4	707 to 708	1400 to 1499	3400 to 3499 4490 to 4519	5400 to 5499	7850 to 8099
Run 5	709 to 710	1500 to 1599	3500 to 3599 4520 to 4549	5500 to 5599	8100 to 8349
Run 6	711 to 712	1600 to 1699	3600 to 3699 4550 to 4579	5600 to 5699	8350 to 8599
Run 7	713 to 714	1700 to 1799	3700 to 3799 4580 to 4609	5700 to 5799	8600 to 8849
Run 8	715 to 716	1800 to 1899	3800 to 3899 4610 to 4639	5800 to 5899	8850 to 9099
Run 9	717 to 718	1900 to 1999	3900 to 3999 4640 to 4669	5900 to 5999	9100 to 9349
Run 10	719 to 720	2000 to 2099	4000 to 4099 4670 to 4699	6000 to 6099	9350 to 9599
MVT - 1	none	none	4100 to 4129 4700 to 4729	6100 to 6129	9600 to 9629
MVT - 2	none	none	4130 to 4159 4730 to 4759	6130 to 6159	9630 to 9659

Purpose	Hourly/ Daily Archive	Boolean	Integer	Long Integer	Floating Point
MVT - 3	none	none	4160 to 4189 4760 to 4789	6160 to 6189	9660 to 9689
MVT - 4	none	none	4190 to 4219 4790 to 4819	6190 to 6219	9690 to 9719
MVT - 5	none	none	4220 to 4249 4820 to 4849	6220 to 6249	9720 to 9749
MVT - 6	none	none	4250 to 4279 4850 to 4879	6250 to 6279	9750 to 9779
MVT - 7	none	none	4280 to 4309 4880 to 4909	6280 to 6309	9780 to 9809
MVT - 8	none	none	4310 to 4339 4910 to 4939	6310 to 6339	9810 to 9839
MVT - 9	none	none	4340 to 4369 4940 to 4969	6340 to 6369	9840 to 9869
MVT - 10	none	none	4370 to 4399 4970 to 4999	6370 to 6399	9870 to 9899

Enron Modbus General Purpose Registers

In some applications it is desirable to have the ability to map Modbus register data into Enron Modbus registers. This removes the need to have a host poll the Modbus station address for data not directly associated with the flow computer and then poll the Enron Modbus station address for flow computer data.

Using fixed register mapping the flow computer mirrors standard Modbus registers into Enron Modbus registers. This allows the host to read and write data to Enron Modbus registers not directly associated with the flow computer.

Register Mapping

Modbus registers are mapped to Enron registers. Read/write registers can be read or written using Enron Modbus. Read only registers can be read using Enron Modbus; data written to the registers is ignored.

Status and Coil Registers

Coil and status registers map to Enron Boolean registers.

Modbus Registers	Enron Registers	Number	Access
00001 to 00100	2101 to 2200	100	Read/Write
10001 to 10099	2201 to 2299	99	Read only

16-Bit Input Registers – Telepace only

In Telepace firmware, 16-bit input registers map to Enron Long Integer registers. Short integer registers are not used as the short integer registers available are used by the flow computer.

Modbus Registers	Enron Registers	Number	Access
30001 to 30100	6800 to 6899	100	read only

Each 16-bit Modbus register is mapped to one 32-bit Enron Modbus long integer. Modbus values are treated as 16-bit signed values and are sign extended when mapped.

16-Bit Holding Registers – Telepace only

In Telepace firmware, 16-bit holding registers are mapped to Enron Long Integer registers. Short integer registers are not used as the short integer registers available are used by the flow computer.

Modbus Registers	Enron Registers	Number	Access
40500 to 40579	6900 to 6979	80	read/write

Each 16-bit Modbus register is mapped to one 32-bit Enron Modbus long integer. Modbus values are treated as 16-bit signed values and are sign extended when mapped. Writing a value to the Enron register that is larger than can be represented by the 16-bit Modbus register will result in only the lower order 16-bits being placed in the Modbus register.

32-Bit Integer Holding Registers

Long values stored in pairs of holding registers are mapped to Enron Long Integer registers. These values are suitable for double integers and 32-bit counters.

Telepace Firmware

This mapping is used in Telepace firmware only.

Modbus Registers	Enron Registers	Number	Access
40580 to 40619	6980 to 6999	20	read/write

Each pair of Modbus registers is mapped to one 32-bit Enron Modbus long integer. Values are 32-bit integers; as there is an exact mapping the registers can be viewed as signed or unsigned values at the user’s choice.

The least significant 16 bits of the number is stored in the lower numbered Modbus register of the pair. This is the format used by Telepace applications to store double integers.

ISaGRAF Firmware

This mapping is used in ISaGRAF firmware only. It allows directly mapping ISaGRAF variables into Enron registers.

Modbus Registers	Enron Registers	Number	Access
40500 to 40619	6900 to 6959	60	read/write

Each pair of Modbus registers is mapped to one 32-bit Enron Modbus long integer. Values are 32-bit integers; as there is an exact mapping the registers can be viewed as signed or unsigned values at the user’s choice.

The least significant 16 bits of the number is stored in the higher numbered Modbus register of the pair. This is the format used by ISaGRAF variables mapped to Modbus registers.

32-Bit Floating Point Holding Registers

Floating point values stored in pairs of holding registers are mapped to Enron Float registers. The second range can be read using the Enron Modbus protocol, but might not be available on some Enron Modbus hosts.

Modbus Registers	Enron Registers	Number	Access
40620 to 40819	9900 to 9999	100	read/write
40820 to 41019	10000 to 10099	100	read/write

Each pair of Modbus registers is mapped to one Enron Modbus float register.

The most significant 16 bits of the number is stored in the lower numbered Modbus register. This is the floating point format used by Telepace and ISaGRAF variables.

Flow Computer Global Variables

The variables described in this section are not meter run specific, but common to each meter run.

Program Information Variables

Program information identifies the version of the flow computer firmware and the flow computer.

The number of runs available is determined by the flow computer options.

Register	Description	Access
3001	Firmware version Range: 100 to 999	Read Only
3002	Controller type 2 = TeleSAFE Micro16 5 = SCADAPack 6 = SCADAPack Light 7 = SCADAPack Plus 9 = SCADAPack 32P 10 = SCADAPack 32 12 = SCADAPack LP 13 = SCADAPack 100 14 = 4202 25 = SCADAPack 100+ 27 = SCADAPack 350 29 = 4202 DR 30 = 4202 DS 31 = 4203 DR 32 = 4203 DS 33 = SCADAPack 330 34 = SCADAPack 334 36 = SCADAPack 314	Read Only
3003	Flow Computer Version Range: 100 to 999	Read Only
3004	Flow Computer Build Number Range: 1 to 255	Read Only
3005	Number of flow runs available Range: 0 to 10	Read Only

Meter Runs Configuration Variable

This register configures the number of flow runs in the flow computer. The number of runs needs to be less than or equal to the number of runs available for the flow computer.

Register	Description	Access
3009	Number of flow runs in use Range: 1 to 10	Read / Write

Real Time Clock Variables

The real time clock can be adjusted in two ways.

To adjust the clock forward or backward by a number of seconds, write to register 3010. This is useful if the time to transmit a message to the flow computer is not known.

To set the clock to a specific time, write to registers 3011 to 3016.

Register	Description	Access
3010	Time adjustment in seconds Range: -32000 to 32000	Write Only
3011	Year Range: 1997 to 2096	Read / Write
3012	Month Range: 1 to 12	Read / Write
3013	Day Range: 1 to 31 with exceptions	Read / Write
3014	Hour Range: 0 to 23	Read / Write
3015	Minute Range: 0 to 59	Read / Write
3016	Second Range: 0 to 59	Read / Write

Flow Computer ID Variables

The flow computer ID is a string stored in 8 consecutive integers. Printable ASCII values, in the range specified need to be used for each character in the string.

Register	Description	Access
3020	Flow computer ID character 1 Range: 33 to 126	Read / Write
3021	Flow computer ID character 2 Range: 33 to 126	Read / Write
3022	Flow computer ID character 3 Range: 33 to 126	Read / Write
3023	Flow computer ID character 4 Range: 33 to 126	Read / Write
3024	Flow computer ID character 5 Range: 33 to 126	Read / Write
3025	Flow computer ID character 6 Range: 33 to 126	Read / Write
3026	Flow computer ID character 7 Range: 33 to 126	Read / Write
3027	Flow computer ID character 8 Range: 33 to 126	Read / Write

Hourly / Daily Archive Records

The Realflo Flow Computer provides up to 10 flow runs. Hourly and daily history records are read using the standard Enron Modbus method.

The Daily Log holds records for the previous 35 days. These can be read by using index numbers 0 through 34 or by using 1 through 35.

The Hourly Log holds record for the previous 35 days plus today. Each day is allowed 30 hours to handle calculation stops, power failures and configuration changes across multiple flow runs. These can be accessed using index numbers 1 through 1080.

Some hourly records will be used by only one run in a multiple run flow computer. The other runs will return a record with the data 030102 (March 1, 2002), time 00:00:00 and flow duration 0. These records should be discarded.

Hourly / Daily Record Format

Each hourly and daily record is in the following format.

- Date (format: MMDDYY)
- Time (format: HHMMSS)
- Flow duration
- Volume
- Energy
- Flow Extension or Flow Product or Uncorrected Flow Volume.
- Temperature
- Pressure
- Differential Pressure or Meter Pulses
- Volume * 1000
- Mass
- Relative Density

Archives are stored in the following registers.

Register	Description	Access
701	Meter Run 1: hourly history	Read Only
702	Meter Run 1: daily history	Read Only
703	Meter Run 2: hourly history	Read Only
704	Meter Run 2: daily history	Read Only
705	Meter Run 3: hourly history	Read Only
706	Meter Run 3: daily history	Read Only
707	Meter Run 4: hourly history	Read Only
708	Meter Run 4: daily history	Read Only
709	Meter Run 5: hourly history	Read Only
710	Meter Run 5: daily history	Read Only
711	Meter Run 6: hourly history	Read Only
712	Meter Run 6: daily history	Read Only
713	Meter Run 7: hourly history	Read Only
714	Meter Run 7: daily history	Read Only
715	Meter Run 8: hourly history	Read Only
716	Meter Run 8: daily history	Read Only
717	Meter Run 9: hourly history	Read Only
718	Meter Run 9: daily history	Read Only
719	Meter Run 10: hourly history	Read Only
720	Meter Run 10: daily history	Read Only

Pointers to the hourly and daily history records are stored in the following registers. The pointers apply to archives in the flow computer.

Register	Description	Access
7001	hourly log pointer	Read Only
7002	daily log pointer	Read Only

Hourly Gas Quality Archive Records

The hourly gas analysis history is added for flow computer versions 6.77 and higher.

Hourly Gas Quality Record Format

Not all gas quality elements supported by the flow computer are defined in the Enron Specification. Those elements, starting with water, are added at the end of the defined stream. Gas components are in %, not in % MOLE.

Each hourly and daily record is in the following format.

Field	**Format / Units**
Date	MMDDYY.0
Time	HHMMSS.0
Time: split of a second	second
Relative Density	-
Heating Value	BTU(60)/ft^3
Carbon Dioxide	%
Nitrogen	%
Methane	%
Ethane	%
Propane	%
i-butane	%
n-Butane	%
i-Pentane	%
n-Pentane	%
n-Hexane	%
n-Heptane	%
n-Octane	%
n-Nonane	%
Hydrogen Sulfide	%
Hydrogen	%
Helium	%
Oxygen	%
Carbon Monoxide	%
Water	%
n-Decane	%
Argon	%
Hexanes+	%

Archives are stored in the following registers.

Register	**Description**	**Access**
741	Meter Run 1: hourly gas quality history	Read Only
742	Meter Run 2: hourly gas quality history	Read Only
743	Meter Run 3: hourly gas quality history	Read Only
744	Meter Run 4: hourly gas quality history	Read Only
745	Meter Run 5: hourly gas quality history	Read Only
746	Meter Run 6: hourly gas quality history	Read Only
747	Meter Run 7: hourly gas quality history	Read Only

748	Meter Run 8: hourly gas quality history	Read Only
749	Meter Run 9: hourly gas quality history	Read Only
750	Meter Run 10: hourly gas quality history	Read Only

Pointers to the hourly and daily history records are stored in the following registers. The pointers apply to archives in the flow computer.

Register	Description	Access
7003	hourly gas quality log pointer	Read Only

Flow Computer Events Variables

The Flow Computer Events variables record changes in the flow computer status. Events will be recorded for these variables when the corresponding status changes. Reading these registers will return zero. The registers exist only to provide a reference for events in the event log.

Register	Description	Access
1001	Power On - Cold Boot	Read Only
1002	Power On – Warm Boot	Read Only
1003	Power Off	Read Only

The registers in the table below apply to Run 1. Refer to the table in section ***Flow Computer Variables*** for register ranges for other runs.

Register	Description	Access
1100	Recovered from Input Error	Read Only
1101	Meter control structure not found	Read Only

User Account Events Variables

These variables record events relating to the user accounts. Events will be recorded for these variables when the user accounts are configured. Reading these registers will return zero. The registers exist only to provide a reference for events in the event log.

Register	Description	Access
3030	Set User Number	Read Only
3031	Set User Security Level	Read Only

Event/Alarm Archive Variable

This variable indicates the number of events and alarms.

Register	Description	Access
7000	Number of events and alarms	Read Only

Event and Alarm Log Events Variables

These variables record events relating to the event log. Events will be recorded for these variables when the logs are accessed. Reading these registers will return zero. The registers exist only to provide a reference for events in the event log.

The registers in the table below apply to Run 1. Refer to the table in section ***Flow Computer Variables*** for register ranges for other runs.

Register	Description	Access
3101	Number of lost alarms	Read Only
3102	Number of acknowledged alarms	Read Only
3103	Number of lost events	Read Only
3104	Number of acknowledged events	Read Only
3105	Invalid user event	Read Only

Event Record Format

Events use the Enron Modbus record format defined in the Enron Modbus standard.

Byte	Description	Format
1,2	Operator change bit map	Uint16
3,4	Modbus register number of variable	Uint16
5-8	Time (HHMMSS)	Float
9-12	Date (MMDDYY) 80 is added to the date value to convert the RTU event log dates to the current year (see Enron Modbus specification Appendix D).	Float
13-16	Previous value of variable	Float
17-20	New value of variable	Float

The operator change bit map is:

Bit	Description
0	Fixed value
1	Zero scale
2	Full scale
3	Operator entry work value
4	Boolean fixed bit
5	Fixed/variable flag
6	Table entry change
7	System command change
8	Unused
9	Operator change event identifier bit
10	LoLo limit
11	Lo limit
12	Hi limit
13	HiHi limit
14	Rate of change limit
15	unused

Alarm Record Format

Alarms use the Enron Modbus record format defined in the Enron Modbus standard.

Byte	Description	Format
1,2	Alarm change bit map	Uint16
3,4	Modbus register number of variable	Uint16
5-8	Time (HHMMSS)	Float

9-12	Date (MMDDYY) 80 is added to the date value to convert the RTU event log dates to the current year (see Enron Modbus specification Appendix D).	Float
13-16	Current (alarmed) value of variable	Float
17-20	Unused (0)	Float

The operator change bit map is:

Bit	Description
0	Unused
1	Unused
2	Unused
3	Unused
4	Unused
5	Unused
6	Unused
7	Unused
8	Unused
9	Operator change event identifier bit
10	LoLo limit
11	Lo limit
12	Hi limit
13	HiHi limit
14	Rate of change limit
15	Set/reset Alarm (1=set, 0=reset)

Meter Run 1 Data Variables

Meter run 1 data variables are shown in detail in the following sections.

Meter Run 1 Flow Computer Execution State Variable

This variable displays and controls the execution of the meter run 1 flow calculation.

Register	Description	Access
3165	Execution state 0 = not set (read only) 1 = stop 2 = run	Read / Write

Meter Run 1 Instantaneous and Accumulated Variables

These variables display the current state of the flow calculation for meter run 1.

Instantaneous Input Variables

The Instantaneous Input variables contain the value of the inputs at the time they were last read.

Register	Description	Access
7220	Temperature	Read Only
7221	Static Pressure	Read Only
7222	Differential Pressure (AGA-3 and V-cone only)	Read Only
7223	Calibration flags	Read Only

Register	Description	Access
5100 5157	Turbine meter pulses (AGA-7) Forced Pulse Rate (AGA-7 only)	Read Only Read Only

Instantaneous Input Alarms

These variables are used to show the status of the Instantaneous Input Variables.

Register	Description	Access
4400	Temperature input alarm	Read Only
4401	Static pressure input alarm	Read Only
4402	Flow (Differential pressure or turbine pulses) input alarm	Read Only

Instantaneous Flow Variables

The Instantaneous Flow variables contain the results of the flow calculation. Values are updated each time the flow calculation executes. Check the time of last update registers to determine when the calculation was performed.

Register	Description	Access
7224	Date of flow update (days since Jan 1, 1970)	Read Only
7225	Time of flow update (seconds since	Read Only

Register	Description	Access
	00:00:00)	
7226	Flow volume rate	Read Only
7227	Flow mass rate	Read Only
7228	Flow energy rate	Read Only
7229	Flow extension (AGA-3 1990 only) Flow product (AGA-3 1985 only) Uncorrected flow volume (AGA-7 only)	Read Only
7230	Input or flow calculation error code	Read Only
7252	Flow volume rate * 1000	Read Only
7282	Forced Temperature	Read Only
7283	Forced Static Pressure	Read Only
7284	Forced Differential Pressure (AGA-3 and V-Cone only)	Read Only

Compressibility Variables

The Compressibility variables contain the results of the compressibility calculation. Values are updated each time the compressibility calculation recalculates. This time varies according to the calculation type and the changes in the inputs to the calculation (including configuration parameters). Check the time of last update registers to determine when the calculation was performed.

Register	Description	Access
7231	Date of compressibility update (days since Jan 1, 1970)	Read Only
7232	Time of compressibility update (seconds since 00:00:00)	Read Only
7233	Supercompressibility	Read Only
7234	Real relative gas density	Read Only
7235	Mass density at flow conditions	Read Only
7236	Mass density at base conditions	Read Only
7237	Heating value	Read Only
7238	Compressibility calculation error code	Read Only
7239	Compressibility approximated flag 0 = compressibility value is calculated result 1 = compressibility value is approximate	Read Only

Accumulated Flow Variables

The Accumulated Flow variables contain the cumulative flow for the current and previous contract day and the current and previous month. Values for the current contact day include flow for the contract day, even if an event causes a separate day record in the hourly history. Values for the previous contract day are updated at the end of the contract day.

Register	Description	Access
5101	Number of flow calculations during the previous contract day	Read Only
5102	Number of flow calculations during the contract day	Read Only

Register	Description	Access

Register	Description	Access
7240	Duration of flow during the contract day (seconds)	Read Only
7241	Flow volume at base conditions during the contract day	Read Only
7242	Flow mass at base conditions during the contract day	Read Only
7243	Flow energy at base conditions during the contract day	Read Only
7244	Total accumulated flow volume at base conditions	Read Only
7245	Duration of flow during the previous contract day (seconds)	Read Only
7246	Flow volume at base conditions during the previous contract day	Read Only
7247	Flow mass at base conditions during the previous contract day	Read Only
7248	Flow energy at base conditions during the previous contract day	Read Only
7249	Static Pressure Altitude and Latitude compensation 0 = ignore 1 = compensate	Read/Write
7250	Altitude	Read/Write
7251	Latitude in decimal degrees	Read/Write
7285	Flow duration in current month.	Read Only
7286	Flow volume in current month	Read Only
7287	Flow duration in previous month	Read Only
7288	Flow volume in previous month	Read Only
7289	Uncorrected flow volume during the contract day (AGA-7 only)	Read Only
7290	Uncorrected flow volume during the previous contract day (AGA-7 only)	Read Only
7291	Uncorrected flow volume during the current month (AGA-7 only)	Read Only
7292	Uncorrected flow volume during the previous month (AGA-7 only)	Read Only

Enron Log Variables

The following registers are added to show the date of last configuration change.

Register	Description	Access
5103	Date of last flow configuration change (days since January 1, 1997).	Read Only
5104	Time of last flow configuration change (seconds since midnight).	Read Only
5105	Date of last density configuration change (days since January 1, 1997).	Read Only
5106	Time of last density configuration change (seconds since midnight).	Read Only

Meter Run 1 Input Configuration Variables

The flow calculation routines require a temperature transmitter input, static pressure transmitter input and a differential pressure transmitter input (AGA-3 or V-Cone), or pulse input (AGA-7).

General Input Configuration Variables

The General Input Configuration variables are set to contain the meter run number, type of units used and the flow and compressibility calculation types.

Register	Description	Access
7100	Input units type 0 = US1 1 = US2 2 = US3 3 = IP 4 = Metric1 5 = Metric2 6 = Metric3 7 = SI 8 = US4 9 = US5 10 = US6 11 = US7 12 = US8	Read / Write
7101	Flow calculation type 2 = AGA-3 (1985) 3 = AGA-3 (1992) 7 = AGA-7 12 = AGA-11 22 = V-Cone	Read / Write
7102	Compressibility calculation type 8 = AGA 8 19 = NX-19	Read / Write
7103	Static pressure tap location 0 = upstream 1 = downstream	Read / Write
7104	Log out of range events action 0= ignore Out Of Range events 1= log Out Of Range events	Read / Write

Temperature Input Variables

The temperature input variables are set to contain the source register; the minimum and maximum scaled and unscaled values, and the level limits and hysteresis.

The input register type describes the type of data in the input registers. For floating-point input registers, floating-point scaling values need to be used. For integer input registers, integer scaling values need to be used.

Register	Description	Access
7105	Temperature input register type 0 = Telepace uint requiring scaling 2 = float in engineering units (no scaling required) 3 = float requiring scaling 4 = MVT 5 = ISaGRAF integer requiring scaling 6 = SCADAPack 4202 or 4203	Read / Write
7106	Temperature input register Modbus address 30001 to 39999 or 40001 to 49999 or MVT transmitter number (1 to 10)	Read / Write

Register	Description	Access
	or use 1 for SCADAPack 4202 or 4203	
7107	Zero scale temperature input (used with type 0 and 5 inputs)	Read / Write
7108	full scale temperature input (used with type 0 and 5 inputs)	Read / Write
7109	zero scale temperature input (used with type 3 inputs)	Read / Write
7110	Full scale temperature input (used with type 3 inputs)	Read / Write
7111	Temperature at zero scale	Read / Write
7112	Temperature at full scale	Read / Write
7113	Temperature low level cutoff	Read / Write
7114	Temperature low level hysteresis	Read / Write
7115	Temperature high level hysteresis	Read / Write
7116	Temperature high level cutoff	Read / Write

Static Pressure Input Variables

The static pressure input variables are set to contain the source register; the minimum and maximum scaled and unscaled values, and the level limits and hysteresis.

The input register type describes the type of data in the input registers. For floating-point input registers, floating-point scaling values need to be used. For integer input registers, integer-scaling values need to be used.

Register	Description	Access
7117	Static pressure input register type 0 = Telepace uint requiring scaling 2 = float in engineering units (no scaling required) 3 = float requiring scaling 4 = MVT 5 = ISaGRAF integer requiring scaling 6 = SCADAPack 4202 or 4203	Read / Write
7118	Static pressure input register Modbus address 30001 to 39999 or 40001 to 49999 or MVT transmitter number (1 to 10) or use 1 for SCADAPack 4202 or 4203	Read / Write
7119	Zero scale static pressure input (used with type 0 and 5 inputs)	Read / Write
7120	Full scale static pressure input (used with type 0 and 5 inputs)	Read / Write
7121	Zero scale static pressure input (used with type 3 inputs)	Read / Write
7122	Full scale static pressure input (used with type 3 inputs)	Read / Write
7123	Static pressure at zero scale	Read / Write
7124	Static pressure at full scale	Read / Write
7125	Static pressure low level cutoff	Read / Write

Register	Description	Access
7126	Static pressure low level hysteresis	Read / Write
7127	Static pressure high level hysteresis	Read / Write
7128	Static pressure high level cutoff	Read / Write

Differential Input Variables

The differential pressure input variables are set to contain the source register; the minimum and maximum scaled and unscaled values, and the level limits and hysteresis.

The input register type describes the type of data in the input registers. For floating-point input registers, floating-point scaling values need to be used. For integer input registers, integer-scaling values need to be used.

The differential pressure input is used with AGA-3 and V-Cone calculations only.

Register	Description	Access
7129	Differential pressure input register type 0 = Telepace uint requiring scaling 2 = float in engineering units (no scaling required) 3 = float requiring scaling 4 = MVT 5 = ISaGRAF integer requiring scaling 6 = SCADAPack 4202 or 4203	Read / Write
7130	Differential pressure input register Modbus address 30001 to 39999 or 40001 to 49999 or MVT transmitter number (1 to 10) or use 1 for SCADAPack 4202 or 4203	Read / Write
7131	zero scale differential pressure input (used with type 0 and 5 inputs)	Read / Write
7132	Full scale differential pressure input (used with type 0 and 5 inputs)	Read / Write
7133	zero scale differential pressure input (used with type 3 inputs)	Read / Write
7134	Full scale differential pressure input (used with type 3 inputs)	Read / Write
7135	Differential pressure at zero scale	Read / Write
7136	Differential pressure at full scale	Read / Write
7137	Differential pressure low level cutoff	Read / Write
7138	Differential pressure low level hysteresis	Read / Write
7139	Differential pressure high level hysteresis	Read / Write
7140	Differential pressure high level cutoff	Read / Write

Turbine Input Variables

The turbine counter input registers are set to contain the source register, the low flow minimum pulse limit and the time duration for low flow pulse limit check.

The turbine counter input is used with AGA-7 calculations only

Register	Description	Access
7141	Turbine input register type 0 = Telepace ulong 5 = ISaGRAF integer	Read / Write
7142	Rotation counter input register Modbus address 30001 to 39999 or 40001 to 49999	Read / Write
7143	Time duration for low flow pulse limit check (seconds) Range: 0 to 5 seconds	Read / Write
7144	Low flow minimum pulse limit Range: 0 to 8388607 The low flow minimum pulse limit can be set to values greater than 8388607 by Realflo.	Read / Write
7145	Atmospheric pressure	Read / Write
7146	Output and logs units type: 0 = US1 1 = US2 2 = US3 3 = IP 4 = Metric1 5 = Metric2 6 = Metric3 7 = SI 8 = US4 9 = US5 10 = US6 11 = US7 12 = US8	Read / Write

Meter Run 1 Flow Computer Execution Control Variable

This variable controls the execution of the flow calculations.

Register	Description	Access
3165	Execution state 0 = not set (read only) 1 = stop 2 = run	Read / Write

Meter Run 1 ID Variables

The Run ID is a string stored in 32 consecutive integers. Printable ASCII values in the range specified need to be used for each character in the string. The RUNID string will be terminated with a null unless the full length of the string is used.

Register	Description		Access
3167	Run 1 ID character 1	Range: 33 to 126	Read / Write
3168	Run 1 ID character 2	Range: 33 to 126	Read / Write
3169	Run 1 ID character 3	Range: 33 to 126	Read / Write
3170	Run 1 ID character 4	Range: 33 to 126	Read / Write
3171	Run 1 ID character 5	Range: 33 to 126	Read / Write
3172	Run 1 ID character 6	Range: 33 to 126	Read / Write
3173	Run 1 ID character 7	Range: 33 to 126	Read / Write
3174	Run 1 ID character 8	Range: 33 to 126	Read / Write
3175	Run 1 ID character 9	Range: 33 to 126	Read / Write
3176	Run 1 ID character 10	Range: 33 to 126	Read / Write
3177	Run 1 ID character 11	Range: 33 to 126	Read / Write
3178	Run 1 ID character 12	Range: 33 to 126	Read / Write
3179	Run 1 ID character 13	Range: 33 to 126	Read / Write

Register	Description	Access
3180	Run 1 ID character 14 Range: 33 to 126	Read / Write
3181	Run 1 ID character 15 Range: 33 to 126	Read / Write
3182	Run 1 ID character 16 Range: 33 to 126	Read / Write
3183	Run 1 ID character 17 Range: 33 to 126	Read/Write
3184	Run 1 ID character 18 Range: 33 to 126	Read/Write
3185	Run 1 ID character 19 Range: 33 to 126	Read/Write
3186	Run 1 ID character 20 Range: 33 to 126	Read/Write
3187	Run 1 ID character 21 Range: 33 to 126	Read/Write
3188	Run 1 ID character 22 Range: 33 to 126	Read/Write
3189	Run 1 ID character 23 Range: 33 to 126	Read/Write
3190	Run 1 ID character 24 Range: 33 to 126	Read/Write
3191	Run 1 ID character 25 Range: 33 to 126	Read/Write
3192	Run 1 ID character 26 Range: 33 to 126	Read/Write
3193	Run 1 ID character 27 Range: 33 to 126	Read/Write
3194	Run 1 ID character 28 Range: 33 to 126	Read/Write
3195	Run 1 ID character 29 Range: 33 to 126	Read/Write
3196	Run 1 ID character 30 Range: 33 to 126	Read/Write
3197	Run 1 ID character 31 Range: 33 to 126	Read/Write
3198	Run 1 ID character 32 Range: 33 to 126	Read/Write

Meter Run 1 Contract Configuration Variables

The Contract Configuration variables define the gas measurement contract.

Changes to the Contract Configuration are not allowed while the flow calculation is running.

Register	Description	Access
7146	Output and log units type: 0 = US1 1 = US2 2 = US3 3 = Imperial 4 = Metric1 5 = Metric2 6 = Metric3 7 = SI 8 = US4 9 = US5 10= US6 11 = US7 12= US8	Read / Write
7147	Contract hour Range: 0 to 23	Read / Write
7148	Base temperature	Read / Write
7149	Base static pressure	Read / Write
7150	Input Error Action 0 = do not accumulate flow when inputs in error 1 = accumulate flow when inputs in error	Read / Write
7293	Wet gas meter factor Version 6.10 or greater. Default value is 1.0. The value 0.0 indicates that the parameter	Read / Write

Register	Description	Access
	is not supported and that 1.0 should be substituted for it.	

Meter Run 1 AGA-3 Configuration Variables

AGA-3 configuration variables define the AGA-3 calculation.

Register	Description	Access
7151	Orifice material 0 = stainless, 1 = Monel, 2 = carbon steel	Read / Write
7152	Pipe material 0 = stainless, 1 = Monel, 2 = carbon steel	Read / Write
7153	Orifice diameter	Read / Write
7154	Reference temperature for orifice measurement	Read / Write
7155	Pipe diameter	Read / Write
7156	Reference temperature for pipe diameter measurement	Read / Write
7157	Isentropic exponent	Read / Write
7158	Viscosity	Read / Write
7159	Temperature dead band	Read / Write
7160	Static pressure dead band	Read / Write
7161	Differential pressure dead band	Read / Write

Meter Run 1 V-Cone Configuration Variables

V-Cone configuration variables define the V-Cone calculation.

In the original McCrometer V-Cone Application Sizing sheet that is included with V-Cone meters uses the terminology **Cd** (discharge coefficient) rather than **Cf** (flow coefficient). You will need to use the **Re** and **Cd** values from the V-Cone Application Sizing sheet for the **Re** and **Cf** entries. If the **Re** value is the same for each entry in the table only the first pair is used.

McCrometer now supplies one value of **Cd** in the sizing document. You need to enter one **Re/Cd** pair only. See the McCrometer Application Sizing sheet for the **Re/Cd** pair for your meter.

Register	Description	Access
7162	V-Cone material 2 = carbon steel 3 = stainless 304 4 = stainless 316	Read / Write
7163	Pipe material 2 = carbon steel 3 = stainless 304 4 = stainless 316	Read / Write
7164	Cone diameter	Read / Write
7165	Reference temperature for cone diameter measurement.	Read / Write
7166	Inside meter diameter	Read / Write
7167	Reference temperature for inside meter	Read / Write

Register	Description	Access
	diameter measurement	
7168	Isentropic exponent	Read / Write
7169	Viscosity	Read / Write
7170	Number of points	Read / Write
7171	Point 1 Reynolds number Range: 0.1 to 200000000	Read / Write
7172	Point 1 Coefficient Range: 0 to 10	Read / Write
7173	Point 2 Reynolds number Range: 0.1 to 200000000	Read / Write
7174	Point 2 Coefficient Range: 0 to 10	Read / Write
7175	Point 3 Reynolds number Range: 0.1 to 200000000	Read / Write
7176	Point 3 Coefficient Range: 0 to 10	Read / Write
7177	Point 4 Reynolds number Range: 0.1 to 200000000	Read / Write
7178	Point 4 Coefficient Range: 0 to 10	Read / Write
7179	Point 5 Reynolds number Range: 0.1 to 200000000	Read / Write
7180	Point 5 Coefficient Range: 0 to 10	Read / Write
7181	Point 6 Reynolds number Range: 0.1 to 200000000	Read / Write
7182	Point 6 Coefficient Range: 0 to 10	Read / Write
7183	Point 7 Reynolds number Range: 0.1 to 200000000	Read / Write
7184	Point 7 Coefficient Range: 0 to 10	Read / Write
7185	Point 8 Reynolds number Range: 0.1 to 200000000	Read / Write
7186	Point 8 Coefficient Range: 0 to 10	Read / Write
7187	Point 9 Reynolds number Range: 0.1 to 200000000	Read / Write
7188	Point 9 Coefficient Range: 0 to 10	Read / Write
7189	Point 10 Reynolds number Range: 0.1 to 200000000	Read / Write
7190	Point 10 Coefficient Range: 0 to 10	Read / Write

Meter Run 1 AGA-7 Configuration Variables

AGA-7 Configuration variables define the AGA-7 calculation.

Register	Description	Access
7191	K factor Range: 0.001 to 1000000	Read / Write
7192	M factor	Read / Write

Register	Description	Access
	Range: 0.001 to 1000	

Meter Run 1 AGA-8 Configuration Variables

Mole Fractions

AGA-8 Configuration variables define the gas quality for each run. The gas is made up of a number of components. These components are represented as fraction values, i.e. 0 to 1.0000.

Realflo checks the validity of the entered components using the following limits:

- Individual components are in the ranges listed in the table above.
- The Total of all Components field displays the sum of all components. The total of all components needs to be 1.0000 (+/- 0.00001) if Composition Units is set to Mole Fractions or 100% (+/- 0.00001%) if Composition Units is set to Percent.

The **n-hexane** register contains the fraction of hexane when individual gas components are used. The register contains the fraction of the high-carbon gases combined. The high-carbon gases are n-hexane, n-heptane, n-octane, n-nonane, and n-decane. Together they are known as Hexanes+.

In Flow Computer versions 6.73 and older, when gas ratios are written to the flow computer the new gas ratios are saved in temporary memory, not the Enron Modbus registers, until a new Density calculation is started with the new values. Once a density calculation is started by the flow computer the Enron Modbus registers are then loaded with the new gas ratios. The new gas ratios are not available to SCADA host software reading the Enron Modbus registers until a new density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when gas ratios are written to the flow computer the new gas ratios are updated in the Enron Modbus registers. This allows a SCADA host to immediately confirm the new ratios were written to the flow computer. The new gas ratios are not used by the flow computer until a new density calculation is started.

Register	Description	Access
7193	Methane Range: see table below	Read / Write
7194	Nitrogen Range: see table below	Read / Write
7195	Carbon Dioxide Range: see table below	Read / Write
7196	Ethane Range: see table below	Read / Write
7197	Propane Range: see table below	Read / Write
7198	Water Range: see table below	Read / Write
7199	Hydrogen Sulphide Range: see table below	Read / Write
7200	Hydrogen Range: see table below	Read / Write

Register	Description	Access
7201	Carbon Monoxide Range: see table below	Read / Write
7202	Oxygen Range: see table below	Read / Write
7203	i-butane Range: see table below	Read / Write
7204	n-butane Range: see table below	Read / Write
7205	i-pentane Range: see table below	Read / Write
7206	n-pentane Range: see table below	Read / Write
7207	n-hexane (when using individual gas components) n-hexane + (when using combined value for hexane and higher components)	Read / Write
7208	n-heptane Range: see table below	Read / Write
7209	n-octane Range: see table below	Read / Write
7210	n-nonane Range: see table below	Read / Write
7211	n-decane Range: see table below	Read / Write
7212	Helium Range: see table below	Read / Write
7213	Argon Range: see table below	Read / Write
7219	Composition logging control 0 = log composition changes 1 = do not log composition changes	Read / Write
7280	0 = calculate real relative density 0.07 to 1.52 = use as laboratory value for real relative density	Read / Write
7281	0 = calculate heating value other values = use as laboratory value for heating value 0 to 1800 BTU(60)/ft^3 0 to 67.066 MJ/m^3 0 to 67066 J/m^3	Read / Write

There is no single valid range for each component. There are two ranges for each gas component in the table below. The flow computer accepts any value in the Expanded Range. Only values in the Normal Range will work in all circumstances.

The run-time error message **"Bracket derivative negative"** occurs when the combination of the components at the current pressure and temperature results in an error. The AGA-8 calculation will produce a result even if the error occurs, but the accuracy of the result will be suspect.

Component	Normal Range	Expanded Range
Methane CH_4	0.4500 to 1.0000	0 to 1.0000
Nitrogen	0 to 0.5000	0 to 1.0000

Component	Normal Range	Expanded Range
Carbon Dioxide	0 to 0.3000	0 to 1.0000
Ethane C_2H_6	0 to 0.1000	0 to 1.0000
Propane C_3H_8	0 to 0.0400	0 to 0.1200
Water	0 to 0.0005	0 to 0.0300
Hydrogen Sulphide	0 to 0.0002	0 to 1.0000
Hydrogen	0 to 0.1000	0 to 1.0000
Carbon Monoxide	0 to 0.0300	0 to 0.0300
Oxygen	0	0 to 0.2100
Total Butanes i-Butane n-Butane	0 to 0.0100	0 to 0.0600
Total Pentanes i-Pentane n-Pentane	0 to 0.0300	0 to 0.0400
Total Hexane to Decane n-Hexane n-Heptane n-Octane n-Nonane n-Decane	0 to 0.0200	0 to 0.0400
Helium	0 to 0.0200	0 to 0.0300
Argon	0	0 to 0.0100

Percentages

AGA-8 Configuration variables define the gas quality for each run. The gas is made up of a number of components. These components can be represented as percentage values (i.e. 0 to 100.00 %) instead of mole fractions.

The n-hexane register contains the percentage of hexane when individual gas components are used. The register contains the percentage of the high-carbon gases combined. The high-carbon gases are n-hexane, n-heptane, n-octane, n-nonane, and n-decane. Together they are known as Hexanes+.

The gas quality values are floating point numbers. The sum of the values in the gas quality needs to equal 100.

Register	Description	Access
7253	Methane Range: see table below	Read / Write
7254	Nitrogen Range: see table below	Read / Write
7255	Carbon Dioxide Range: see table below	Read / Write
7256	Ethane Range: see table below	Read / Write
7257	Propane Range: see table below	Read / Write
7258	Water Range: see table below	Read / Write
7259	Hydrogen Sulphide Range: see table below	Read / Write
7260	Hydrogen Range: see table below	Read / Write
7261	Carbon Monoxide Range: see table below	Read / Write
7262	Oxygen Range: see table below	Read / Write
7263	i-butane Range: see table below	Read / Write
7264	n-butane Range: see table below	Read / Write
7265	i-pentane Range: see table below	Read / Write
7266	n-pentane Range: see table below	Read / Write

Register	Description		Access
7267	n-hexane (when using individual gas components) n-hexane + (when using combined value for hexane and higher components)		Read / Write
7268	n-heptane	Range: see table below	Read / Write
7269	n-octane	Range: see table below	Read / Write
7270	n-nonane	Range: see table below	Read / Write
7271	n-decane	Range: see table below	Read / Write
7272	Helium	Range: see table below	Read / Write
7273	Argon	Range: see table below	Read / Write
7219	Composition logging control 0 = log composition changes 1 = do not log composition changes		Read / Write

There is no single valid range for each component. There are two ranges for each gas component in the table below. The flow computer accepts any value in the Expanded Range. Only values in the Normal Range will work in all circumstances.

The run-time error message **"Bracket derivative negative"** occurs when the combination of the components at the current pressure and temperature results in an error. The AGA-8 calculation will produce a result even if the error occurs, but the accuracy of the result is susspect.

Component	Normal Range	Expanded Range
Methane CH_4	45.00 to 100.00	0 to 100.00
Nitrogen	0 to 50.00	0 to 100.00
Carbon Dioxide	0 to 30.00	0 to 100.00
Ethane C_2H_6	0 to 10.00	0 to 100.00
Propane C_3H_8	0 to 4.00	0 to 12.00
Water	0 to 0.05	0 to 3.00
Hydrogen Sulphide	0 to 0.02	0 to 100.00
Hydrogen	0 to 10.00	0 to 100.00
Carbon Monoxide	0 to 3.00	0 to 3.00
Oxygen	0	0 to 21.00
Total Butanes i-Butane n-Butane	0 to 1.00	0 to 6.00
Total Pentanes i-Pentane n-Pentane	0 to 3.00	0 to 4.00
Total Hexane to Decane n-Hexane n-Heptane n-Octane n-Nonane n-Decane	0 to 2.00	0 to 4.00
Helium	0 to 2.00	0 to 3.00
Argon	0	0 to 1.00

Hexane + Ratios Percentages

These registers control if individual or combined gas components are used, and contain the ratio of the five high-carbon gases for the combined method.

If combined high-carbon gases are used, the ratios of the five gases n-hexane, n-heptane, n-octane, n-nonane, and n-decane needs to sum to 100 percent. The percentage of the overall gas represented by these components combined is set in register 7267.

Register	Description	Access
7274	Set AGA-8 Hexane + Component method 0 = Use individual gas components (default) 1 = Use combined value for hexane and higher components.	Read / Write
7275	Set AGA-8 Hexane + Ratio for n-hexane	Read / Write
7276	Set AGA-8 Hexane + Ratio for n-heptane	Read / Write
7277	Set AGA-8 Hexane + Ratio for n-octane	Read / Write
7278	Set AGA-8 Hexane + Ratio for n-nonane	Read / Write
7279	Set AGA-8 Hexane + Ratio for n-decane	Read / Write

Meter Run 1 NX-19 Configuration Variables

NX-19 configuration variables define the gas quality for the NX-19 calculation method.

In Flow Computer versions 6.73 and older, when NX-19 gas quality values are written to the flow computer the new values are saved in temporary memory, not the Enron Modbus registers, until a new Density calculation is started with the new values. Once a density calculation is started by the flow computer the Enron Modbus registers are then loaded with the new NX-19 gas quality values. The new values are not available to SCADA host software reading the Enron Modbus registers until a new density calculation is started with the new values.

In Flow Computer versions 6.74 and newer when NX-19 gas quality values are written to the flow computer the new NX-19 gas quality values are updated in the Enron Modbus registers. This allows a SCADA host to immediately confirm the new values were written to the flow computer. The new NX-19 gas quality values are not used by the flow computer until a new density calculation is started.

Register	Description	Access
7214	Specific gravity Range: 0.0 to 10.0	Read / Write
7215	Fraction of Carbon Dioxide Range: 0.0 to 1.0	Read / Write
7216	Fraction of Nitrogen Range: 0.0 to 1.0	Read / Write
7217	Heating Value	Read / Write
7218	Composition logging control 0 = log composition changes 1 = do not log composition changes	Read / Write

Plate Change Events Variables

The Plate Change Events variables record plate change events. Events are created for these variables when the plate change occurs.

Reading these registers will return zero. The registers exist only to provide a reference for events in the event log.

Temperature Plate Change Event Variables

The temperature calibration event variables record calibration of the temperature input. The calibration needs to be done using Realflo. Events will be recorded for these variables when the calibration occurs.

Register	Description	Access
7315	Start plate change: temperature	Read Only
7316	Stop plate change: temperature	Read Only

Static Pressure Plate Change Event Variables

The static pressure calibration event variables record calibration of the static pressure input. The calibration needs to be done using Realflo. Events will be recorded for these variables when the calibration occurs.

Register	Description	Access
7317	Start plate change: static pressure	Read Only
7318	Stop plate change: static pressure	Read Only

Differential Pressure Plate Change Event Variables

The DP calibration event variables record calibration of the differential pressure input. The calibration needs to be done using Realflo. Events will be recorded for these variables when the calibration occurs.

Register	Description	Access
7319	Start plate change: DP	Read Only
7320	Stop plate change: DP	Read Only

Enron Forcing Events Variables

The Forcing Events variables record force events. Events are created for these variables when the plate change occurs.

Reading these registers will return zero. The registers exist only to provide a reference for events in the event log.

Temperature Force Event Variables

The temperature force event variables record force of the temperature input. The force needs to be done using Realflo. Events will be recorded for these variables when the force occurs.

Register	Description	Access
7321	Forced temperature input	Read Only
7322	Removed forced temperature input	Read Only

Static Pressure Force Event Variables

The static pressure force event variables record force of the static pressure input. The force needs to be done using Realflo. Events will be recorded for these variables when the force occurs.

Register	Description	Access
7323	Forced static pressure input	Read Only
7324	Removed forced static pressure input	Read Only

Differential Pressure Force Event Variables

The DP force event variables record force of the differential pressure input. The force needs to be done using Realflo. Events will be recorded for these variables when the force occurs.

Register	Description	Access
7325	Forced differential pressure input	Read Only
7326	Removed forced differential pressure input	Read Only

Counter Force Event Variables

The counter force event variables record force of the counter input. The force needs to be done using Realflo. Events will be recorded for these variables when the force occurs.

Register	Description	Access
5155	Forced pulse count rate	Read Only
5156	Removed forced pulse count rate	Read Only

Meter Run 1 Flow Computer Events Variables

The flow computer event and alarm logs can be read as the Enron Modbus event/alarm log. The flow computer alarms events numbers are converted to changes in the Enron Modbus Variables. The tables below show the flow computer alarms/events and the corresponding Enron Modbus Variable.

Alarms and events correspond to variables used for reporting data or settings configuration. A small number of events and alarms don't have a corresponding variable. So that they can be reported in the Enron Modbus event/alarm log, variables have been created for them. These variables are read only and return zero. They exist only so events in the log have a corresponding variable.

Input Alarms Variables

The Input Alarms variables record alarms due to out of range inputs. Alarms are created for these variables when the error occurs. Reading these registers will return zero. The registers exist only to provide a reference for events in the event log.

Register	Description	Access
3106	Temperature input low	Read Only
3107	Temperature input high	Read Only
3108	Static pressure low	Read Only
3109	Static pressure high	Read Only
3110	Differential pressure low	Read Only
3111	Differential pressure high	Read Only

Register	Description	Access
4403	Forced input register	Read Only
4404	Removed force from input register	Read Only
4405	Restore from temperature input low alarm	Read Only
4406	Restore from temperature input high alarm	Read Only
4407	Restore from static pressure input low alarm	Read Only
4408	Restore from static pressure input high	Read Only

Register	Description	Access
	alarm	
4409	Restore from differential pressure input low alarm	Read Only
4410	Restore from differential pressure input high alarm	Read Only
4411	Restore from low pulse input alarm	Read Only
4412	Restore from input alarm	Read Only

Compressibility Events Variables

The Compressibility Events variables record errors with the compressibility calculation. Events are created for these variables when the error occurs. Reading these registers will return zero. The registers exist only to provide a reference for events in the event log.

Register	Description	Access
3112	Compressibility calculation inputs invalid	Read Only

AGA-8 Variables

These compressibility event variables refer to the AGA-8 calculation only.

Reading these registers will return zero. The registers exist only to provide a reference for events in the event log.

Register	Description	Access
3113	Failed To Create AGA-8 Data Structure	Read Only
3114	Created AGA-8 with Execution Stopped	Read Only
3115	Created AGA-8 with Execution Running	Read Only
3116	Destroyed AGA-8 Data Structure	Read Only
3117	Clear Compressibility Error	Read Only
3118	Failed To Set AGA-8 Gas Fractions	Read Only
3119	Failed To Set AGA-8 Configuration	Read Only
3120	AGA-8 - Not configured	Read Only
3121	AGA-8 - No gas components	Read Only
3166	AGA-8 – Flow Pressure is Low	Read Only
4413	Density temperature low alarm	Read Only
4414	Density temperature high alarm	Read Only
4416	Density pressure high alarm	Read Only

NX-19 Variables

These compressibility event variables refer to the NX-19 calculation only.

Reading these registers will return zero. The registers exist only to provide a reference for events in the event log.

Register	Description	Access
3122	Failed to Create NX-19 Data Structure	Read Only
3123	Created NX-19 with Execution Stopped	Read Only
3124	Created NX-19 with Execution Running	Read Only
3125	Destroyed NX-19 Data Structure	Read Only
3126	Clear Compressibility Error	Read Only
3127	Failed to set NX-19 Gas Components	Read Only
3128	Failed to set NX-19 Contract Configuration	Read Only
3129	NX-19 - Configuration flag not set	Read Only
3130	NX-19 - Gas ratios were not available	Read Only

Register	Description	Access
4413	Density temperature low alarm	Read Only
4414	Density temperature high alarm	Read Only
4415	Density pressure low alarm	Read Only
4416	Density pressure high alarm	Read Only

Flow Events Variables

The Flow Events variables record errors with the flow calculation. Events are created for these variables when the error occurs.

Reading these registers will return zero. The registers exist only to provide a reference for events in the event log.

AGA-3 (1985) Variables

These compressibility event variables refer to the AGA-3 (1985) calculation only.

Register	Description	Access
3131	Failed To Create AGA-3 (1985) Data Structure	Read Only
3132	Created AGA-3 (1985) with Execution Stopped	Read Only
3133	Created AGA-3 (1985) with Execution Running	Read Only
3134	Destroyed AGA-3 (1985) Data Structure	Read Only
3135	Recovered from AGA-3 (1985) error	Read Only
3136	Failed To Set AGA-3 (1985) Configuration	Read Only
3137	AGA-3 (1985) - Ratios from AGA-8 or NX-19 were not available	Read Only
3138	AGA-3 (1985) - Static pressure below differential	Read Only
3139	AGA-3 (1985) - Static pressure zero or negative	Read Only
4417	Flow temperature low alarm	Read Only

AGA-3 (1992) Variables

These compressibility event variables refer to the AGA-3 (1992) calculation only.

Register	Description	Access
3140	Failed To Create AGA-3 (1992) Data Structure	Read Only
3141	Created AGA-3 (1992) with Execution Stopped	Read Only
3142	Created AGA-3 (1992) with Execution Running	Read Only
3143	Destroyed AGA-3 (1992) Data Structure	Read Only
3144	Restored from AGA-3 (1992) error	Read Only
3145	Failed To Set AGA-3 (1992) Configuration	Read Only
3146	AGA-3 (1992) – Ratios from AGA-8 or NX-19 were not available	Read Only
3147	AGA-3 (1992) - Static pressure below differential	Read Only
3148	AGA-3 (1992) - Static pressure zero or negative	Read Only

Register	Description	Access
4417	Flow temperature low alarm	Read Only

AGA-7 Variables

These compressibility event variables refer to the AGA-7 calculation only.

Register	Description	Access
3149	Failed To Create AGA-7 Data Structure	Read Only
3150	Created AGA-7 with Execution Stopped	Read Only
3151	Created AGA-7 with Execution Running	Read Only
3152	Destroyed AGA-7 Data Structure	Read Only
3153	Restored from AGA-7 error	Read Only
3154	Failed To Set AGA-7 Configuration	Read Only
3155	AGA-7 - Low pulse rate	Read Only
3156	AGA-7 - Ratios from AGA-8 or NX-19 are not available	Read Only
4417	Flow temperature low alarm	Read Only
4418	Flow pressure low alarm	Read Only

V-Cone Variables

These compressibility event variables refer to the V-Cone calculation only.

Register	Description	Access
3157	Failed To Create V-Cone Date Structure	Read Only
3158	Created V-Cone with Execution Stopped	Read Only
3159	Created V-Cone with Execution Running	Read Only
3160	Destroyed V-Cone Data Structure	Read Only
3161	Restored from V-Cone Error	Read Only
3162	Failed To Set V-Cone Configuration	Read Only
3163	V-Cone – Ratios from AGA-8 or NX-19 were not available	Read Only
3164	V-Cone – Static pressure below differential pressure	Read Only
3199	V-Cone – Static pressure zero or negative	Read Only
4417	Flow temperature low alarm	Read Only

Calibration Events Variables

Temperature Calibration Event Variables

The temperature calibration event variables record calibration of the temperature input. The calibration needs to be done using Realflo. Events will be recorded for these variables when the calibration occurs.

Register	Description	Access
7300	Start temperature calibration	Read Only
7301	Continue temperature calibration	Read Only
7302	Temperature as found	Read Only
7303	Temperature as left	Read Only
7304	Stop temperature calibration	Read Only

Static Pressure Calibration Event Variables

The static pressure calibration event variables record calibration of the static pressure input. The calibration needs to be done using Realflo. Events will be recorded for these variables when the calibration occurs.

Register	Description	Access
7305	Start static pressure calibration	Read Only
7306	Continue static pressure calibration	Read Only
7307	Static pressure as found	Read Only
7308	Static pressure as left	Read Only
7309	Stop static pressure calibration	Read Only

Differential Pressure Calibration Event Variables

The DP calibration event variables record calibration of the differential pressure input. The calibration needs to be done using Realflo. Events will be recorded for these variables when the calibration occurs.

Register	Description	Access
7310	Start DP calibration	Read Only
7311	Continue DP calibration	Read Only
7312	Differential pressure as found	Read Only
7313	Differential pressure as left	Read Only
7314	Stop DP calibration	Read Only

Counter Calibration Event Variables

The counter calibration event variables record calibration of the counter input. The calibration needs to be done using Realflo. Events will be recorded for these variables when the calibration occurs.

Register	Description	Access
5150	Start counter calibration	Read Only
5151	Continue counter calibration	Read Only
5152	Counter as found	Read Only
5153	Counter as left	Read Only
5154	Stop counter calibration	Read Only

Meter Run 2 Data Variables

Meter run 2 data variables use the same structure as Meter run 1 data variables described above. Meter run 2 variables are offset from Meter run 1 variables according to the following table.

Range	Data Type	Description
3200 - 3299	Short integer	Meter Run 2 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 100
5200 - 5299	Long integer	Meter Run 2 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 100
7350 - 7599	Float	Meter Run 2 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 250

Meter Run 3 Data Variables

Meter run 3 data variables use the same structure as Meter run 1 data variables described above. Meter run 3 variables are offset from Meter run 1 variables according to the following table.

Range	Data Type	Description
3300 - 3399	Short integer	Meter Run 3 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 200
5300 - 5399	Long integer	Meter Run 3 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 200
7600 – 7849	Float	Meter Run 3 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 500

Meter Run 4 Data Variables

Meter run 4 data variables use the same structure as Meter run 1 data variables described above. Meter run 4 variables are offset from Meter run 1 variables according to the following table.

Range	Data Type	Description
3400 - 3499	Short integer	Meter Run 4 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 300
5400 - 5499	Long integer	Meter Run 4 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 300
7850 - 8099	Float	Meter Run 2 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 750

Meter Run 5 Data Variables

Meter run 5 data variables use the same structure as Meter run 1 data variables described above. Meter run 5 variables are offset from Meter run 1 variables according to the following table.

Range	Data Type	Description
3500 - 3599	Short integer	Meter Run 5 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 400
5500 - 5599	Long integer	Meter Run 5 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 400
8100 - 8349	Float	Meter Run 5 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 1000

Meter Run 6 Data Variables

Meter run 6 data variables use the same structure as Meter run 1 data variables described above. Meter run 6 variables are offset from Meter run 1 variables according to the following table.

Range	Data Type	Description
3600 - 3699	Short integer	Meter Run 6 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 500
5600 - 5699	Long integer	Meter Run 6 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 500
8350 - 8599	Float	Meter Run 6 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 1250

Meter Run 7 Data Variables

Meter run 7 data variables use the same structure as Meter run 1 data variables described above. Meter run 7 variables are offset from Meter run 1 variables according to the following table.

Range	Data Type	Description
3700 - 3799	Short integer	Meter Run 7 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 600
5200 - 5299	Long integer	Meter Run 7 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 600
8600 - 8849	Float	Meter Run 7 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 1500

Meter Run 8 Data Variables

Meter run 8 data variables use the same structure as Meter run 1 data variables described above. Meter run 8 variables are offset from Meter run 1 variables according to the following table.

Range	Data Type	Description
3800 - 3899	Short integer	Meter Run 8 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 700
5800 - 5899	Long integer	Meter Run 8 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 700

Range	Data Type	Description
8850 - 9099	Float	Meter Run 8 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 1750

Meter Run 9 Data Variables

Meter run 9 data variables use the same structure as Meter run 1 data variables described above. Meter run 9 variables are offset from Meter run 1 variables according to the following table.

Range	Data Type	Description
3900 - 3999	Short integer	Meter Run 9 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 800
5900 - 5999	Long integer	Meter Run 9 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 800
9100 – 9349	Float	Meter Run 9 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 2000

Meter Run 10 Data Variables

Meter run 10 data variables use the same structure as Meter run 1 data variables described above. Meter run 10 variables are offset from Meter run 1 variables according to the following table.

Range	Data Type	Description
4000 – 4099	Short integer	Meter Run 10 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 900
6000 – 6099	Long integer	Meter Run 10 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 900
9350 – 9599	Float	Meter Run 10 Data Variables • Identical structure to Meter Run 1 Data Variables. • Offset by value of 2250

MVT-1 Data and Configuration Variables

The flow computer polls the MVT transmitters and updates the data registers.

The sensor status values are the same for each transmitter.

0 = response OK

1 = communication failed

2 = value below operating limit

3 = transmitter configuration invalid

4 = not polled, may be disabled

5 = bad value

6 = value above operating limit

7 = sensor is off line, may be calibrating

8 = RTD cut (temperature sensor only)

Register	Description	Access
4100	Transmitter 1: differential pressure sensor status	Read Only
4101	Transmitter 1: static pressure sensor status	Read Only
4102	Transmitter 1: temperature pressure sensor status	Read Only

These registers show the current inputs.

Register	Description	Access
9600	Transmitter 1: differential pressure	Read Only
9601	Transmitter 1: static pressure	Read Only
9602	Transmitter 1: temperature	Read Only

MVT-1 MVT Configuration Variables

MVT configuration defines the operation of the MVT transmitter and polling by the flow computer.

Register	Description	Access
9603	Transmitter polling status 0 = disabled 1 = enabled	Read / Write
9604	Serial Port: 0 = unused, for internal SCADAPack 4202 or 4203 in slot 1 1 = com1 2 = com2 3 = com3 4 = com4 100 = LAN (4102, 4000 only)	Read / Write
9605	Address of transmitter: 0 = unused, for internal SCADAPack 4202 or 4203 in slot 1 1 to 247 (Rosemount 3095FB, 4101) 1 to 255 (4102, SCADAPack 4202 or 4203 standard mode) 1 to 65534 (SCADAPack 4000, SCADAPack 4202 or 4203 extended mode)	Read / Write
9606	Timeout: 0 = unused, for internal SCADAPack 4202 or 4203 in slot 1 10 to 10000 ms	Read / Write

Register	Description	Access
9607	Manufacturer Code	Read / Write
9608	Turnaround Delay Time: 0 to 200 ms (3095FB only)	Read / Write
9609	Differential Pressure units: 1 = inches of water at 60°F (3095FB only) 2 = Pascal 3 = kiloPascal 6 = inches of water at 68°F	Read / Write
9610	Static Pressure units: 3 = kiloPascal 4 = megaPascal 5 = psi	Read / Write
9611	Temperature units: 20 = Celsius 21 = Fahrenheit	Read / Write
9612	Differential Pressure damping: 3095FB: 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824, or 27.648 SCADAPack 4000 and SCADAPack 4202 or 4203: 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, or 32.0 seconds	Read / Write
9613	Differential Pressure upper operating limit	Read / Write
9614	Differential Pressure lower operating limit	Read / Write
9615	Static Pressure damping: 3095FB: 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824, or 27.648 SCADAPack 4000 and SCADAPack 4202 or 4203: 0.0 (damping off), 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, or 32.0 seconds	Read / Write
9616	Static Pressure upper operating limit	Read / Write
9617	Static Pressure lower operating limit	Read / Write
9618	Temperature damping: 3095FB: 0.108, 0.216, 0.432, 0.864, 1.728, 3.456, 6.912, 13.824, or 27.648 SCADAPack 4000 and SCADAPack 4202 or 4203: Not supported	Read / Write
9619	Temperature upper operating limit	Read / Write
9620	Temperature lower operating limit	Read / Write

Register	Description	Access
9621	Type Code (not used with SCADAPack 4101) 31 = 3095FB MVT Type Code (not used with SCADAPack 4101) 31 = 3095FB MVT 40120 = 4012 Absolute 40121 = 4012 Gauge 40320 = 4032 41020 = 4102 Serial 41021 = 4102 Serial and LAN 4202 = 4202 DR 42021 = 4202 DS 42990 = 4203 DR 42991 = 4203 DS	Read / Write
9622	Atmospheric pressure (used by SCADAPack 4102 and SCADAPack 4202 or 4203) 0 = absolute pressure >0 to 30 psia (or equivalent) = gage pressure	Read/Write

Register	Description	Access
6100	Serial number (3095FB only)	Read
6101	IP Address (SCADAPack 4000 and SCADAPack 4202 or 4203 only)	Read / Write

Register	Description		Access
4103	Tag character 1	Range: 32 to 126	Read / Write
4104	Tag character 2	Range: 32 to 126	Read / Write
4105	Tag character 3	Range: 32 to 126	Read / Write
4106	Tag character 4	Range: 32 to 126	Read / Write
4107	Tag character 5	Range: 32 to 126	Read / Write
4108	Tag character 6	Range: 32 to 126	Read / Write
4109	Tag character 7	Range: 32 to 126	Read / Write
4110	Tag character 8	Range: 32 to 126	Read / Write

MVT-1 Events Variables

The MVT Events variables record changes in the MVT configuration. Events will be recorded for these variables when the corresponding status changes.

Reading these registers will return zero. The registers exist only to provide a reference for events in the event log.

Register	Description	Access
4111	recovered from MVT error	Read Only
4112	MVT Transmitter 1: lost communication	Read Only
4113	MVT Transmitter 1: transmitter configuration incorrect	Read Only
4114	MVT Transmitter 1: temperature sensor out of range	Read Only

Register	Description	Access
4115	MVT Transmitter 1: static pressure sensor out of range	Read Only
4116	MVT Transmitter 1: differential pressure sensor out of range	Read Only
4117	MVT Transmitter 1: not polled	Read Only
4118	Manufacture date: This is stored as bits in the format YYYYYYYMMMMDDDDD, where these bits correspond to Year+1986/Month/Day. (SCADAPack 4101 or 4102 and SCADAPack 4202 or 4203 only)	Read Only
4119	Core number (SCADAPack 4101 or 4102 and SCADAPack 4202 or 4203 only)	Read Only
4120	IP Protocol (SCADAPack 4102, 4000 only)	Read / Write
4121	Bad temperature sensor value	Read Only
4122	Bad static pressure sensor value	Read Only
4123	Bad differential pressure value	Read Only
4124	Restore for all communication alarms	Read Only
4125	Restore for all alarms	Read Only
4126	Sensors are Off Line	Read Only
4127	RTD Disconnected	Read Only
4700	Temperature sensor above range	Read Only
4701	Static Pressure sensor above range	Read Only
4702	Differential Pressure sensor above range	Read Only
4703	Temperature sensor below range	Read Only
4704	Static Pressure sensor below range	Read Only
4705	Differential Pressure sensor below range	Read Only

MVT-2 Data and Configuration Variables

MVT-2 Data Variables use the same structure as MVT-1 Data Variables described above. MVT-2 Data Variables are offset from MVT-1 Data Variables according to the following table.

Range	Data Type	Description
4130 – 4159	Short integer	MVT-2 Data Variables • Identical structure to MVT-1 Data Variables. • Offset by value of 30
4730 - 4735	Short integer	MVT-2 Data Variables • Identical structure to MVT-1 Data Variables. • Offset by value of 30
6130 – 6159	Long integer	MVT-2 Data Variables • Identical structure to MVT-1 Data Variables. • Offset by value of 30
9630 – 9659	Float	MVT-2 Data Variables • Identical structure MVT-1 Data Variables. • Offset by value of 30

MVT-3 Data and Configuration Variables

MVT-3 Data Variables use the same structure as MVT-1 Data Variables described above. MVT-3 Data Variables are offset from MVT-1 Data Variables according to the following table.

Range	Data Type	Description
4160 – 4189	Short integer	MVT-3 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 60
4760 - 4765	Short integer	MVT-2 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 30
6160 – 6159	Long integer	MVT-3 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 60
9660 – 9689	Float	MVT-3 Data Variables Identical structure MVT-1 Data Variables. Offset by value of 60

MVT-4 Data and Configuration Variables

MVT-4 Data Variables use the same structure as MVT-1 Data Variables described above. MVT-4 Data Variables are offset from MVT-1 Data Variables according to the following table.

Range	Data Type	Description
4190 – 4219	Short integer	MVT-4 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 90
4790 - 4795	Short integer	MVT-2 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 30
6190 – 6219	Long integer	MVT-4 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 90
9690 – 9719	Float	MVT-4 Data Variables Identical structure MVT-1 Data Variables. Offset by value of 90

MVT-5 Data and Configuration Variables

MVT-5 Data Variables use the same structure as MVT-1 Data Variables described above. MVT-5 Data Variables are offset from MVT-1 Data Variables according to the following table.

Range	Data Type	Description
4220 – 4249	Short integer	MVT-5 Data Variables

Range	Data Type	Description
		Identical structure to MVT-1 Data Variables. Offset by value of 120
4820 - 4825	Short integer	MVT-2 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 30
6220 – 6249	Long integer	MVT-5 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 120
9720 – 9749	Float	MVT-5 Data Variables Identical structure MVT-1 Data Variables. Offset by value of 120

MVT-6 Data and Configuration Variables

MVT-6 Data Variables use the same structure as MVT-1 Data Variables described above. MVT-6 Data Variables are offset from MVT-1 Data Variables according to the following table.

Range	Data Type	Description
4250 – 4279	Short integer	MVT-6 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 150
4850 - 4855	Short integer	MVT-2 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 30
6250 – 6279	Long integer	MVT-6 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 150
9750 – 9779	Float	MVT-6 Data Variables Identical structure MVT-1 Data Variables. Offset by value of 150

MVT-7 Data and Configuration Variables

MVT-7 Data Variables use the same structure as MVT-1 Data Variables described above. MVT-7 Data Variables are offset from MVT-1 Data Variables according to the following table.

Range	Data Type	Description
4280 – 4309	Short integer	MVT-7 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 180
4890 - 4895	Short integer	MVT-2 Data Variables Identical structure to MVT-1 Data Variables.

Range	Data Type	Description
		Offset by value of 30
6280 – 6309	Long integer	MVT-7 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 180
9780 – 9809	Float	MVT-7 Data Variables Identical structure MVT-1 Data Variables. Offset by value of 180

MVT-8 Data and Configuration Variables

MVT-8 Data Variables use the same structure as MVT-1 Data Variables described above. MVT-8 Data Variables are offset from MVT-1 Data Variables according to the following table.

Range	Data Type	Description
4310 – 4339	Short integer	MVT-8 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 210
4920 - 4925	Short integer	MVT-2 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 30
6310 – 6339	Long integer	MVT-8 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 210
9810 – 9839	Float	MVT-8 Data Variables Identical structure MVT-1 Data Variables. Offset by value of 210

MVT-9 Data and Configuration Variables

MVT-9 Data Variables use the same structure as MVT-1 Data Variables described above. MVT-9 Data Variables are offset from MVT-1 Data Variables according to the following table.

Range	Data Type	Description
4340 – 4369	Short integer	MVT-9 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 240
4950 - 4955	Short integer	MVT-2 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 30
6340 – 6369	Long integer	MVT-9 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 240
9840 – 9869	Float	MVT-9 Data Variables

Range	Data Type	Description
		Identical structure MVT-1 Data Variables. Offset by value of 240

MVT-10 Data and Configuration Variables

MVT-10 Data Variables use the same structure as MVT-1 Data Variables described above. MVT-10 Data Variables are offset from MVT-1 Data Variables according to the following table.

Range	Data Type	Description
4370 – 4399	Short integer	MVT-10 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 270
4980 - 4985	Short integer	MVT-2 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 30
6370 – 6399	Long integer	MVT-10 Data Variables Identical structure to MVT-1 Data Variables. Offset by value of 270
9870 – 9899	Float	MVT-10 Data Variables Identical structure MVT-1 Data Variables. Offset by value of 270

Event and Alarm Log

The flow computer event and alarm logs can be read as the Enron Modbus event/alarm log. The flow computer alarms events numbers are converted to changes in the Enron Modbus Variables. The tables below show the flow computer alarms/events and the corresponding Enron Modbus Variable.

Alarms and events correspond to variables used for reporting data or settings configuration. A small number of events and alarms don't have a corresponding variable. So that they can be reported in the Enron Modbus event/alarm log, variables have been created for them. These variables are read only and return zero. They exist only so events in the log have a corresponding variable.

In the following tables, some variables are described with an offset. The offset is determined by the flow run.

Run	Short Integer Offset	Long Integer Offset	Float Offset
1	0	0	0
2	100	100	250
3	200	200	500
4	300	300	750
5	400	400	1000
6	500	500	1250
7	600	600	1500
8	700	700	1750
9	800	800	2000
10	900	900	2250

The flow computer logs contain information that needs to be mapped into the Enron Modbus event format.

- The Event ID is mapped into the change bit map and the register number.
- The Sequential event or alarm number is not reported.
- The User number is not reported directly, as there is no field. There is a bit indicating the source of the alarm or event as the operator or the flow computer. The user number is mapped into this.
- The date of event or alarm is converted to the Enron date format.
- The time of event or alarm is converted to the Enron time format.
- The new data associated with the event or alarm is reported in the alarm/event.
- The previous data associated with the event or alarm is reported in the alarm/event.

The Enron interface assumes that there is one log for all of the flow runs. It contains alarms and events. Alarms and events have similar but not identical formats. Alarms and events are returned in the same response to a command.

Alarms and events cannot be read after they have been acknowledged. This happens immediately after they are read from the flow computer.

Enron and Realflo are not expected to work together. However they will co-exist if the Read All Events option is selected when reading events using Realflo. This allows alarms and events can be read by Enron Modbus correctly.

The existing alarm and event logs will be enhanced to support the Enron functionality and interface. This will include new data items and new access functions. The changes need to still permit alarms and events to be read via Enron and by Realflo without losing any. The logs will mark the read records as inaccessible, to the Enron interface, when the log is acknowledged.

Global Alarms and Events

The gas flow computation engine creates these events.

Number	Description	Enron Variable
10001	Power On - Cold Boot	1001
10002	Power On – Warm Boot	1002
10003	Lost Events	3103 + offset
10004	Recovered from Input Error	1100 + offset
10005	Set Input: Units Type	7100 + offset
10006	Set Input: Flow Calculation Type	7101 + offset
10007	Set Input: Compressibility Calculation Type	7102 + offset
10008	Set Input: Temperature Register	7106 + offset
10009	Set Input: Temperature Input at Zero Scale	7107 + offset
10010	Set Input: Temperature Input at Full Scale	7108 + offset
10011	Set Input: Temperature at Zero Scale	7111 + offset
10012	Set Input: Temperature at Full Scale	7112 + offset
10013	Set Input: Pressure Register	7118 + offset
10014	Set Input: Pressure Input at Zero Scale	7119 + offset
10015	Set Input: Pressure Input at Full Scale	7120 + offset
10016	Set Input: Pressure at Zero Scale	7123 + offset
10017	Set Input: Pressure at Full Scale	7124 + offset
10018	Set Input: DP Register	7130 + offset
10019	Set Input: DP Input at Zero Scale	7131 + offset
10020	Set Input: DP Input at Full Scale	7132 + offset
10021	Set Input: DP at Zero Scale	7135 + offset
10022	Set Input: DP at Full Scale	7136 + offset
10023	Set Contract: Units Type	7146 + offset
10024	Set Contract: Base Temperature	7148 + offset
10025	Set Contract: Base Pressure	7149 + offset
10026	Set Input: Atmospheric Pressure	7145 + offset
10027	Set Input: Static Pressure Tap Location	7103 + offset
10028	Set Contract: Contract Hour	7147 + offset
10029	Change Execution State	3165 + offset
10030	Set RTC Year	3011
10031	Set RTC Month	3012
10032	Set RTC Day	3013
10033	Set RTC Hour	3014
10034	Set RTC Minute	3015
10035	Set RTC Second	3016
10036	Set Input: Temperature Low Level Cutoff	7113 + offset
10037	Set Input: Temperature Low Level hysteresis	7114 + offset

Number	Description	Enron Variable
10038	Set Input: Temperature High Level Cutoff	7115 + offset
10039	Set Input: Temperature High Level Hysteresis	7116 + offset
10040	Set Input: Pressure Low Level Cutoff	7125 + offset
10041	Set Input: Pressure Low Level Hysteresis	7126 + offset
10042	Set Input: Pressure High Level Cutoff	7127 + offset
10043	Set Input: Pressure High Level Hysteresis	7128 + offset
10044	Set Input: Save Low/High Flow Events	7104 + offset
10046	Invalid User Event	3105 + offset
10047	Start Temperature Calibration: Forced temperature input	7300 + offset
10048	End Temperature Calibration: Removed forced temperature input	7304 + offset
10049	Start Static Pressure Calibration: Forced SP input	7305 + offset
10050	End Static Pressure Calibration: Removed forced SP input	7309 + offset
10051	Start Differential Pressure Calibration: Forced DP input	7310 + offset
10052	End Differential Pressure Calibration: Removed forced DP input	7314 + offset
10053	Start Pulse Counter Calibration: Forced pulse count rate	5150 + offset
10054	End Pulse Counter Calibration: Removed forced pulse count rate	5154 + offset
10055	Set User Number	3030
10056	Set User Security Level	3031
10057	Set Input: Temperature Register Type	7105 + offset
10058	Set Input: Pressure Register Type	7117 + offset
10059	Set Input: DP Register Type	7129 + offset
10060	Set Input: Temperature Input at Zero Scale	7109 + offset
10061	Set Input: Temperature Input at Full Scale	7110 + offset
10062	Set Input: Pressure Input at Zero Scale	7121 + offset
10063	Set Input: Pressure Input at Full Scale	7122 + offset
10064	Set Input: DP Input at Zero Scale	7133 + offset
10065	Set Input: DP Input at Full Scale	7134 + offset
10066	Set Input: Pulse Counter Register	7142 + offset
10067	Set Input: Pulse Counter Register Type	7141 + offset
10068	Set Active Runs	3009
10069	Lost Alarms	3101 + offset
10071	Firmware Version	3001
10072	Application Version	3003
10073	Set Flow Computer ID	3020
10074	Set Contract: Input Err Action	7150 + offset
10076	Power Off	1003
10077	Start Plate Change: Forced temperature input	7315 + offset
10078	End Plate Change: Removed forced temperature input	7316 + offset
10079	Start Plate Change: Forced static pressure input	7317 + offset

Number	Description	Enron Variable
10080	End Plate Change: Removed forced static pressure input	7318 + offset
10081	Start Plate Change: Forced differential pressure input	7319 + offset
10082	End Plate Change: Removed forced differential pressure input	7320 + offset
10083	Set Input: altitude and latitude compensation	7249 + offset
10084	Set Input: altitude	7250 + offset
10085	Set Input: latitude	7251 + offset
10086	Forced temperature input	7321 + offset
10087	Removed forced temperature input	7322 + offset
10088	Forced static pressure input	7323 + offset
10089	Removed forced static pressure input	7324 + offset
10090	Forced differential pressure input	7325 + offset
10091	Removed forced differential pressure input	7326 + offset
10092	Forced pulse count rate	5155 + offset
10093	Removed forced pulse count rate	5156 + offset
10094	Set Contract: wet gas meter factor	7293 + offset
10105	Set Input: Flow Direction Control	10100 + offset
10106	Set Input: Flow Direction Register	10101 + offset
10107	Forced mass flow input	10102 + offset
10108	Restored live mass flow input	10103 + offset
10109	Starting Calibration: Forced mass flow rate input	10104 + offset
10110	Ending Calibration: Restored live mass flow rate input	10105 + offset
10111	Set Input: Mass Flow Rate Register Type	10106 + offset
10114	Set Input: On Indicates	10107 + offset

AGA-3 (1985) Alarms and Events

These events are specific to the AGA-3 (1985) calculation.

Number	Description	Enron Variable
10201	Failed To Create AGA-3 (1985) Data Structure	3131 + offset
10202	Created AGA-3 (1985) with Execution Stopped	3132 + offset
10203	Created AGA-3 (1985) with Execution Running	3133 + offset
10204	Destroyed AGA-3 (1985) Data Structure	3134 + offset
10205	Recovered from AGA-3 (1985) error	3135 + offset
10206	Set AGA-3 (1985): Input Units Type	7100 + offset
10207	Set AGA-3 (1985): Orifice Material	7151 + offset
10208	Set AGA-3 (1985): Pipe Material	7152 + offset
10209	Set AGA-3 (1985): Static Pressure Tap Location	7103 + offset
10210	Set AGA-3 (1985): Orifice Diameter	7153 + offset
10211	Set AGA-3 (1985): Orifice Measurement Reference Temperature	7154 + offset

Number	Description	Enron Variable
10212	Set AGA-3 (1985): Pipe Diameter	7155 + offset
10213	Set AGA-3 (1985): Pipe Diameter Measurement Reference Temperature	7156 + offset
10214	Set AGA-3 (1985): Isentropic Exponent	7157 + offset
10215	Set AGA-3 (1985): Viscosity	7158 + offset
10216	Set AGA-3 (1985): Base Temperature	7148 + offset
10217	Set AGA-3 (1985): Base Pressure	7149 + offset
10218	Set AGA-3 (1985): Atmospheric Pressure	7145 + offset
10219	Failed To Set AGA-3 (1985) Configuration	3136 + offset
10220	Set AGA-3 (1985): Contract Units Type	7146 + offset
10221	Set AGA-3 (1985): Temperature deadband	7159 + offset
10222	Set AGA-3 (1985): Static Pressure deadband	7160 + offset
10223	Set AGA-3 (1985): Differential Pressure deadband	7161 + offset

AGA-3 (1992) Alarms and Events

These events are specific to the AGA-3 (1992) calculation.

Number	Description	Enron Variable
10301	Failed To Create AGA-3 (1992) Data Structure	3140 + offset
10302	Created AGA-3 (1992) with Execution Stopped	3141 + offset
10303	Created AGA-3 (1992) with Execution Running	3142 + offset
10304	Destroyed AGA-3 (1992) Data Structure	3143 + offset
10305	Restored from AGA-3 (1992) error	3144 + offset
10306	Set AGA-3 (1992): Input Units Type	7100 + offset
10307	Set AGA-3 (1992): Orifice Material	7151 + offset
10308	Set AGA-3 (1992): Pipe Material	7152 + offset
10309	Set AGA-3 (1992): Static Pressure Tap Location	7103 + offset
10310	Set AGA-3 (1992): Orifice Diameter	7153 + offset
10311	Set AGA-3 (1992): Orifice reference temperature	7154 + offset
10312	Set AGA-3 (1992): Pipe Diameter	7155 + offset
10313	Set AGA-3 (1992): Pipe Diameter Measurement Temperature	7156 + offset
10314	Set AGA-3 (1992): Isentropic Exponent	7157 + offset
10315	Set AGA-3 (1992): Viscosity	7158 + offset
10316	Set AGA-3 (1992): Base Temperature	7148 + offset
10317	Set AGA-3 (1992): Base Pressure	7149 + offset
10318	Set AGA-3 (1992): Atmospheric Pressure	7145 + offset
10319	Failed To Set AGA-3 (1992) Configuration	3145 + offset
10320	Set Input: DP Low Level Cutoff	7137 + offset
10321	Set Input: DP Low Level Hysteresis	7138 + offset
10322	Set Input: DP High Level Cutoff	7139 + offset
10323	Set Input: DP High Level Hysteresis	7140 + offset

Number	Description	Enron Variable
10324	Set AGA-3 (1992): Contract Units Type	7146 + offset
10325	Set AGA-3 (1992): Temperature deadband	7159 + offset
10326	Set AGA-3 (1992): Static Pressure deadband	7160 + offset
10327	Set AGA-3 (1992): Differential Pressure deadband	7161 + offset

AGA-7 Alarms and Events

These events are specific to the AGA-7 calculation.

Number	Description	Enron Variable
10701	Failed To Create AGA-7 Data Structure	3149 + offset
10702	Created AGA-7 with Execution Stopped	3150 + offset
10703	Created AGA-7 with Execution Running	3151 + offset
10704	Destroyed AGA-7 Data Structure	3152 + offset
10705	Restored from AGA-7 error	3153 + offset
10706	Set AGA-7: Input Units Type	7100 + offset
10707	Set AGA-7: K factor	7191 + offset
10708	Set AGA-7: M factor	7192 + offset
10709	Set AGA-7: Atmospheric Pressure	7145 + offset
10710	Set AGA-7: Base Pressure	7149 + offset
10711	Set AGA-7: Base Temperature	7148 + offset
10712	Failed To Set AGA-7 Configuration	3154 + offset
10713	Set Input: Turbine Low Flow Pulse Limit	7143 + offset
10714	Set Input: Turbine Low Flow Detect Time	7144 + offset
10715	Set AGA-7: Contract Units Type	7146 + offset

AGA-11 Alarms and Events

These events are specific to the AGA-11 calculation.

Number	Description	Enron Variable
11101	Failed To Create AGA-11 Data Structure	10110 + offset
11102	Created AGA-11 with Execution Stopped	10111 + offset
11103	Created AGA-11 with Execution Running	10112 + offset
11104	Destroy AGA-11 Data Structure	10113 + offset
11105	Recovered from AGA-11 error	10114 + offset
11106	Change in AGA-11 units configuration	10115 + offset
11107	Change in AGA-11 contract units config	10116 + offset
11108	Change in AGA-11 base temperature	10117 + offset
11109	Change in AGA-11 base pressure	10118 + offset
11110	Failed To Set AGA-11 Configuration	10119 + offset

V-Cone Alarms and Events

These events are specific to the V-Cone calculation.

Number	Description	Enron Variable
12201	Failed To Create V-Cone Date Structure	3157 + offset

Number	Description	Enron Variable
12202	Created V-Cone with Execution Stopped	3158 + offset
12203	Created V-Cone with Execution Running	3159 + offset
12204	Destroyed V-Cone Data Structure	3160 + offset
12205	Restored from V-Cone Error	3161 + offset
12206	Failed To Set V-Cone Configuration	3162 + offset
12207	/* reserved */	none
12208	Set V-Cone Input Units Type	7100 + offset
12209	Set V-Cone Contract Units Type	7146 + offset
12210	Set V-Cone Cone Material	7162 + offset
12211	Set V-Cone Pipe Material	7163 + offset
12212	Set V-Cone Cone Diameter	7164 + offset
12213	Set V-Cone Inside Pipe Diameter	7166 + offset
12214	Set V-Cone Pipe reference temperature	7167 + offset
12215	Set V-Cone Isentropic Exponent	7168 + offset
12216	Set V-Cone Viscosity	7169 + offset
12217	Set V-Cone Base Temperature	7148 + offset
12218	Set V-Cone Base Pressure	7149 + offset
12219	Set V-Cone Atmospheric Pressure	7145 + offset
12220	Set Table Point 1 Reynolds Number	7171 + offset
12221	Set Table Point 2 Reynolds Number	7173 + offset
12222	Set Table Point 3 Reynolds Number	7175 + offset
12223	Set Table Point 4 Reynolds Number	7177 + offset
12224	Set Table Point 5 Reynolds Number	7179 + offset
12225	Set Table Point 6 Reynolds Number	7181 + offset
12226	Set Table Point 7 Reynolds Number	7183 + offset
12227	Set Table Point 8 Reynolds Number	7185 + offset
12228	Set Table Point 9 Reynolds Number	7187 + offset
12229	Set Table Point 10 Reynolds Number	7189 + offset
12230	Set Table Point 1 Flow Coefficient	7172 + offset
12231	Set Table Point 2 Flow Coefficient	7174 + offset
12232	Set Table Point 3 Flow Coefficient	7176 + offset
12233	Set Table Point 4 Flow Coefficient	7178 + offset
12234	Set Table Point 5 Flow Coefficient	7180 + offset
12235	Set Table Point 6 Flow Coefficient	7182 + offset
12236	Set Table Point 7 Flow Coefficient	7184 + offset
12237	Set Table Point 8 Flow Coefficient	7186 + offset
12238	Set Table Point 9 Flow Coefficient	7188 + offset
12239	Set Table Point 10 Flow Coefficient	7190 + offset
12240	Set Adiabatic Expansion Factor Method	7295 + offset
12241	Set Wet Gas Correction Factor Method	7296 + offset
12242	Set Density of liquid at flow conditions	7297 + offset
12243	Set Mass flow rate of liquid at flow conditions	7298 + offset

AGA-8 Alarms and Events

These events are specific to the AGA-8 calculation.

Number	Description	Enron Variable
10801	Failed To Create AGA-8 Data Structure	3113 + offset

Number	Description	Enron Variable
10802	Created AGA-8 with Execution Stopped	3114 + offset
10803	Created AGA-8 with Execution Running	3115 + offset
10804	Destroyed AGA-8 Data Structure	3116 + offset
10805	Set AGA-8 Gas: Change Gas Fractions	
10806	Set AGA-8 Gas: Methane (CH4)	7193 + offset
10807	Set AGA-8 Gas: Nitrogen	7194 + offset
10808	Set AGA-8 Gas: Carbon Dioxide (CO2)	7195 + offset
10809	Set AGA-8 Gas: Ethane (C2H6)	7196 + offset
10810	Set AGA-8 Gas: Propane (C3H8)	7197 + offset
10811	Set AGA-8 Gas: Water	7198 + offset
10812	Set AGA-8 Gas: Hydrogen Sulphide (H2S)	7199 + offset
10813	Set AGA-8 Gas: Hydrogen	7200 + offset
10814	Set AGA-8 Gas: Carbon Monoxide (CO)	7201 + offset
10815	Set AGA-8 Gas: Oxygen	7202 + offset
10816	Set AGA-8 Gas: I-Butane	7203 + offset
10817	Set AGA-8 Gas: n-Butane	7204 + offset
10818	Set AGA-8 Gas: I-Pentane	7205 + offset
10819	Set AGA-8 Gas: n-Pentane	7206 + offset
10820	Set AGA-8 Gas: n-hexane (when using individual gas components) Set AGA-8 Gas: n-hexane + (when using combined value for hexane and higher components)	7207 + offset
10821	Set AGA-8 Gas: n-Heptane	7208 + offset
10822	Set AGA-8 Gas: n-Octane	7209 + offset
10823	Set AGA-8 Gas: n-Nonane	7210 + offset
10824	Set AGA-8 Gas: n-Decane	7211 + offset
10825	Set AGA-8 Gas: Helium	7212 + offset
10826	Set AGA-8 Gas: Argon	7213 + offset
10827	Set AGA-8 Gas: Failed To Set	3118 + offset
10828	Failed To Set AGA-8 Configuration	3119 + offset
10829	Set AGA-8: Input Units Type	7100 + offset
10830	Set AGA-8: Base Temperature	7148 + offset
10831	Set AGA-8: Base Pressure	7149 + offset
10832	Set AGA-8: Atmospheric Pressure	7145 + offset
10833	Set AGA-8: Static Pressure Tap Location	7103 + offset
10834	Set AGA-8: Contract Units Type	7146 + offset
10835	Clear Compressibility Error	3117 + offset
10836	Set AGA-8: gas composition logging	7219 + offset
10837	Set AGA-8 Gas: Use Hexanes+	7274 + offset
10838	Set AGA-8 Hexane + Ratio for n-hexane	7275 + offset
10839	Set AGA-8 Hexane + Ratio for n-heptane	7276 + offset
10840	Set AGA-8 Hexane + Ratio for n-octane	7277 + offset
10841	Set AGA-8 Hexane + Ratio for n-nonane	7278 + offset
10842	Set AGA-8 Hexane + Ratio for n-decane	7279 + offset
10843	Set AGA-8 Laboratory real relative density 0 = calculate value 0.07 to 1.52 = use value	7280 + offset
10844	Set AGA-8 Laboratory heating value: 0 = calculate value 0 to 1800 = use value	7281 + offset

NX-19 Alarms and Events

These events are specific to the NX-19 calculation.

Number	Description	Enron Variable
11901	Failed to Create NX-19 Data Structure	3122 + offset
11902	Created NX-19 with Execution Stopped	3123 + offset
11903	Created NX-19 with Execution Running	3124 + offset
11904	Destroyed NX-19 Data Structure	3125 + offset
11905	Restored from NX-19 error	3126 + offset
11906	Set NX-19: Calculation Method	
11907	Set NX-19: Specific Gravity	7214 + offset
11908	Set NX-19: Gas: Carbon Dioxide	7215 + offset
11909	Set NX-19: Gas: Methane	
11910	Set NX-19: Gas: Nitrogen	7216 + offset
11911	Set NX-19: Heating Value	7217 + offset
11912	Set NX-19: Static Pressure Tap Location	7103 + offset
11913	Set NX-19: Base Pressure	7149 + offset
11914	Set NX-19: Base Temperature	7148 + offset
11915	Failed to set NX-19 Gas Components	3127 + offset
11916	Failed to set NX-19 Contract Configuration	3128 + offset
11917	Set NX-19: Contract Units Type	7146 + offset
11918	Clear Compressibility Error	3126 + offset
11919	Set NX-19: gas composition logging disabled	7218 + offset

MVT Alarms and Events

These events are specific to the MVT transmitter.

Number	Description	Enron Variable
13100	Set MVT Transmitter 1: polling status	9603 + offset
13101	Set MVT Transmitter 1: serial port	9604 + offset
13102	Set MVT Transmitter 1: Address of transmitter	9605 + offset
13103	Set MVT Transmitter 1: Timeout	9606 + offset
13104	Set MVT Transmitter 1: Manufacturer Code	9607 + offset
13105	Set MVT Transmitter 1: Turnaround Delay Time	9608 + offset
13106	Set MVT Transmitter 1: Differential Pressure units	9609 + offset
13107	Set MVT Transmitter 1: Static Pressure units	9610 + offset
13108	Set MVT Transmitter 1: Temperature units	9611 + offset
13109	Set MVT Transmitter 1: Serial number	6100 + offset
13110	Set MVT Transmitter 1: Tag	4103 + offset
13111	Set MVT Transmitter 1: Differential Pressure damping	9612 + offset
13112	Set MVT Transmitter 1: Differential Pressure upper operating limit	9613 + offset
13113	Set MVT Transmitter 1: Differential Pressure lower operating limit	9614 + offset

Number	Description	Enron Variable
13114	Set MVT Transmitter 1: Static Pressure damping	9615 + offset
13115	Set MVT Transmitter 1: Static Pressure upper operating limit	9616 + offset
13116	Set MVT Transmitter 1: Static Pressure lower operating limit	9617 + offset
13117	Set MVT Transmitter 1: Temperature damping	9618 + offset
13118	Set MVT Transmitter 1: Temperature upper operating limit	9619 + offset
13119	Set MVT Transmitter 1: Temperature lower operating limit	9620 + offset
13120	MVT Transmitter 1: lost communication	4112 + offset
13121	MVT Transmitter 1: transmitter configuration incorrect	4113 + offset
13122	MVT Transmitter 1: temperature sensor out of range	4114 + offset
13123	MVT Transmitter 1: static pressure sensor out of range	4115 + offset
13124	MVT Transmitter 1: differential pressure sensor out of range	4116 + offset
13125	MVT Transmitter 1: not polled	4117 + offset
13126	Set MVT Transmitter 1: Type Code	9621 + offset
13127	Set MVT Transmitter 1: IP Address	6101 + offset
13128	Set MVT Transmitter 1: IP Protocol	4120 + offset
13129	MVT Transmitter 1: temperature sensor value is bad	4121 + offset
13130	MVT Transmitter 1: static pressure sensor value is bad	4122 + offset
13131	MVT Transmitter 1: differential pressure sensor value is bad	4123 + offset
13132	Set MVT Transmitter 1: Atmospheric Pressure Offset	9622 + offset
13133	MVT Transmitter 1: Restore for all communication alarms	4124 + offset
13134	MVT Transmitter 1: Restore for all alarms	4125 + offset
13135	MVT Transmitter 1: Sensors are Off Line	4126 + offset
13136	MVT Transmitter 1: RTD is disconnected	4127 + offset
13137	MVT Transmitter 1: Temperature Sensor Above Range	4127 + offset
13138	MVT Transmitter 1: Static Pressure Above Range	4127 + offset
13139	MVT Transmitter 1: Differential Pressure Above Range	4127 + offset
13140	MVT Transmitter 1: Temperature Sensor Below Range	4127 + offset
13141	MVT Transmitter 1: Static Pressure Below Range	4127 + offset
13142	MVT Transmitter 1: Differential Pressure Below Range	4127 + offset

Coriolis Meter Alarms and Events

These events are specific to the Coriolis meter.

Number	Description	Enron Variable
14001	Failed To Set Coriolis Meter	10200 + offset
14002	Set Coriolis Meter: Meter Address	10201 + offset
14003	Set Coriolis Meter: Meter Port	10202 + offset
14004	Set Coriolis Meter: Meter Timeout	10203 + offset
14005	Coriolis Meter: Lost Communication	10204 + offset
14006	Coriolis Meter: Communication Restored	10205 + offset
14007	Coriolis Meter: Not Polled	10206 + offset
14008	Coriolis Meter: Coriolis Meter has bad response	10207 + offset

Calibration and User Defined Alarms and Events

Realflo generates these events when performing calibration (not by the flow computer). User defined events can also be created in the range 19000 to 19999. Refer to the Log User Event command for details.

Number	Description	Enron Variable
19003	As-Found Temperature	7302 + offset
19004	As-Left Temperature	7303 + offset
19005	Target Re-Zero Temperature	7333 + offset
19006	Target Temperature Span	7334 + offset
19007	Set Default Temperature	7335 + offset
19008	Temperature After ReZero	7327 + offset
19009	Temperature After Span Calibration	7328 + offset
19013	As-Found Static Pressure	7307 + offset
19014	As-Left Static Pressure	7308 + offset
19015	Target Re-Zero Static Pressure	7336 + offset
19016	Target Static Pressure Span	7337 + offset
19018	Static Pressure After ReZero	7329 + offset
19019	Static Pressure After Span Calibration	7330 + offset
19023	As-Found Differential Pressure	7312 + offset
19024	As-Left Differential Pressure	7331 + offset
19025	Target Re-Zero Differential Pressure	7338 + offset
19026	Target Differential Pressure Span	7339 + offset
19028	Differential Pressure After ReZero	7332 + offset
19029	Differential Pressure After Span Calibration	7314 + offset
19032	Continue Pulse Count Calibration	5151 + offset
19033	As-Found Pulse Count	5152 + offset
19034	As-Left Pulse Count	5153 + offset
19039	End Pulse Count Calibration	5154 + offset

Calculation Engine Errors

The flow calculation engine generates these errors.

Number	Description	Enron Variable
20001	Meter control structure not found	1101 + offset
20003	Temperature input is below zero scale	3106 + offset

Number	Description	Enron Variable
20004	Temperature input is above full scale	3107 + offset
20005	Static pressure input is below zero scale	3108 + offset
20006	Static pressure input is above full scale	3109 + offset
20007	Differential pressure input is below zero scale	3110 + offset
20008	Differential pressure input is above full scale	3111 + offset
20009	Compressibility calculation inputs invalid	3112 + offset
20010	Forced input register	4403 + offset
20011	Removed force from input register	4404 + offset
20050	Restore from temperature input low alarm	4405 + offset
20051	Restore from temperature input high alarm	4406 + offset
20052	Restore from static pressure input low alarm	4407 + offset
20053	Restore from static pressure input high alarm	4408 + offset
20054	Restore from differential pressure input low alarm	4409 + offset
20055	Restore from differential pressure input high alarm	4410 + offset
20056	Restore from low pulse input alarm	4411 + offset
20057	Restore from input alarm	4412 + offset

AGA-3 (1985) Calculation Errors

These errors are generated by the AGA-3 (1985) calculation.

Number	Description	Enron Variable
20210	AGA-3 (1985) – Flowing temperature is at or below absolute zero	4417 + offset
20229	AGA-3 (1985) - Ratios from AGA-8 or NX-19 were not available	3137 + offset
20232	AGA-3 (1985) - Static pressure below differential	3138 + offset
20233	AGA-3 (1985) - Static pressure zero or negative	3139 + offset
20234	AGA-3 (1985) – Bad Calculation	4419 + offset

AGA-3 (1992) Calculation Errors

These errors are generated by the AGA-3 (1992) calculation.

Number	Description	Enron Variable
20310	AGA-3 (1992) – Flowing temperature is at or below absolute zero	4417 + offset
20325	AGA-3 (1992) – Too many Iterations	4420 + offset
20329	AGA-3 (1992) – Ratios from AGA-8 or NX-19 were not available	3146 + offset
20332	AGA-3 (1992) - Static pressure below differential	3147 + offset
20333	AGA-3 (1992) - Static pressure zero or negative	3148 + offset

Number	Description	Enron Variable
20334	AGA-3 (1992) – Bad Calculation	4419 + offset

AGA-7 Calculation Errors

These errors are generated by the AGA-7 calculation.

Number	Description	Enron Variable
20712	AGA-7 - Temperature low	4417 + offset
20713	AGA-7 – Static pressure zero or negative	4418 + offset
20714	AGA-7 - Low pulse rate	3155 + offset
20716	AGA-7 - Ratios from AGA-8 or NX-19 are not available	3156 + offset
20720	AGA-7 – Bad Calculation	4419 + offset

V-Cone Calculation Errors

These errors are generated by the V-Cone calculation.

Number	Description	Enron Variable
22221	V-Cone – Temperature low	4417 + offset
22223	V-Cone – Ratios from AGA-8 or NX-19 were not available	3163 + offset
22227	V-Cone – Too many Iterations	4420 + offset
22228	V-Cone – Static pressure below differential pressure	3164 + offset
22229	V-Cone – Static pressure zero or negative	3199 + offset
22230	V-Cone – Bad Calculation	4419 + offset

AGA-8 Calculation Errors

These errors are generated by the AGA-8 calculation.

Number	Description	Enron Variable
20809	AGA-8 – Flow Temperature is Low	4413 + offset
20810	AGA-8 – Flow Temperature is High	4414 + offset
20811	AGA-8 – Flow Pressure is Low	3166 + offset
20812	AGA-8 –Flow Press is High	4416 + offset
20814	AGA-8 - Not configured	3120 + offset
20819	AGA-8 - No gas components	3121 + offset

NX-19 Errors

These errors are generated by the NX-19 calculation.

Number	Description	Enron Variable
21913	NX-19 – Flow Temperature is Low	4413 + offset
21914	NX-19 – Flow Pressure is Low	4415 + offset
21915	NX-19 –Flow Press is High	4416 + offset
21916	NX-19 - Configuration flag not set	3129 + offset
21917	NX-19 - Gas ratios were not available	3130 + offset

Number	Description	Enron Variable
21921	NX-19 – Flow Temperature is High	4414 + offset

PEMEX Modbus Protocol Interface

The PEMEX Modbus protocol is used in the Oil and Gas industry to obtain data from electronic flow measurement devices. Control Microsystems supports this protocol in our flow computer products.

The PEMEX Modbus protocol is an extension of standard Modicon Modbus that supports a subset of Modbus function codes for historical and flow data. Message framing is identical to the Enron Modbus protocol. However, register mapping differs for PEMEX Modbus.

The flow computer supports PEMEX Modbus and standard Modbus on the same serial port. Standard Modbus uses one station address and PEMEX Modbus uses a different station address.

The flow computer does not determine which format a message is using because the station address separates the data streams. This architecture allows standard PC applications to communicate with the flow computer in the normal manner. PEMEX Modbus hosts can communicate at the same time.

The flow computer program processes PEMEX Modbus commands, sends master messages, and processes master responses. This architecture allows the PEMEX Modbus commands to directly access flow computer data.

Flow computer data is accessed directly when a command is processed. When data is written to the numeric registers for configuration, the flow computer reads the existing data structures, replaces the targeted fields with new data and attempts to configure the run with the new configuration. This may be repeated with other configuration items when the command message is long.

Some registers are read only, as listed in the **Access** column in the tables below. Changes made to read only registers are not accepted by the flow computer.

The flow computer supports the following PEMEX function codes.

Command	Description
1	Read coil status
2	Read input status
3	Read holding registers
4	Read input registers
5	Force single coil
6	Preset single register
15	Force multiple coils
16	Preset multiple registers

Register Addresses

The addresses in the messages refer to system addresses, not type specific addresses. The commands will return exception errors if the command refers to addresses outside the valid range for the command.

The ranges are as follows:

Range	Data Type
0001 – 1000	Hourly/Daily archive Alarm/Event retrieval (0032)
1001 – 2000	Real-time status
2001 – 3000	Not used
3001 - 4000	Not used
4001 - 5000	Not used
5001 – 6000	Not used
6001 – 7000	Pointers to current historic archive (6100 – 6300 approx.) Number of events not retrieved (6301)
7001 – 7599	Real-time floating-point data
7600 – 7999	Events
8001 – 9000	Upload or download data (quality of gas and AGA configuration)
9999 – 10000	Time synchronization

Refer to the Flow Computer Variables section of this document for details on the registers allocated to the flow computer.

Meter Run 1 Data Variables

Meter run 1 data variables are show in detail in the following sections.

Meter Run 1 Instantaneous and Accumulated Variables

These variables display the current state of the flow calculation for meter run 1.

Register	Description	PEMEX Units	Access
7001	Static pressure	psi	Read Only
7002	Differential pressure / Pulse count	inches H_2O / Hz	Read Only
7003	Temperature	°F	Read Only
7004	Corrected flow (2nd base conditions)	MSCM/D	Read Only
7005	Corrected flow (1st base conditions)	MSCF/D	Read Only
7006	Hourly volume (2nd base conditions)	MSCM	Read Only
7007	Hourly volume (1st base conditions)	MSCF	Read Only
7008	Daily volume (2nd base conditions)	MSCM	Read Only
7009	Daily volume (1st base conditions)	MSCF	Read Only
7010	Previous hourly volume (2nd base conditions)	MSCM	Read Only

Register	Description	PEMEX Units	Access
7011	Previous hourly volume (1st base conditions)	MSCF	Read Only
7012	Previous daily volume (2nd base conditions)	MSCM	Read Only
7013	Previous daily volume (1st base conditions)	MSCF	Read Only
7014	Energy flow rate	Giga calories/D	Read Only
7015	Hourly energy	Giga calories	Read Only
7016	Daily energy	Giga calories	Read Only
7017	Previous hourly energy	Giga calories	Read Only
7018	Previous daily energy	Giga calories	Read Only

Meter Run 1 Historic Variables

These registers are used to retrieve the historic information for meter run 1.

The host first retrieves the history index value. The host then retrieves the relevant historic records based on the value of the history index. The host can specify which historic record to retrieve by setting the “Number of Registers” in the request. See section Historic Data Variables for more information.

Register	Description	Access
701	Daily history records	Read Only
721	Hourly history records	Read Only
741	Hourly gas quality history records	Read Only
6101	Daily history index	Read Only
6121	Hourly history index	Read Only
6201	Hourly gas quality history index	Read Only

Meter Run 2 Data Variables

Meter run 2 data variables are show in detail in the following sections.

Meter Run 2 Instantaneous and Accumulated Variables

These variables display the current state of the flow calculation for meter run 2.

Register	Description	PEMEX Units	Access
7031	Static pressure	psi	Read Only
7032	Differential pressure / Pulse count	inches H_2O / Hz	Read Only
7033	Temperature	°F	Read Only
7034	Corrected flow (2nd base conditions)	MSCM/D	Read Only
7035	Corrected flow (1st base conditions)	MSCF/D	Read Only
7036	Hourly volume (2nd base conditions)	MSCM	Read Only
7037	Hourly volume (1st base conditions)	MSCF	Read Only
7038	Daily volume (2nd base conditions)	MSCM	Read Only

Register	Description	PEMEX Units	Access
7039	Daily volume (1st base conditions)	MSCF	Read Only
7040	Previous hourly volume (2nd base conditions)	MSCM	Read Only
7041	Previous hourly volume (1st base conditions)	MSCF	Read Only
7042	Previous daily volume (2nd base conditions)	MSCM	Read Only
7043	Previous daily volume (1st base conditions)	MSCF	Read Only
7044	Energy flow rate	Giga calories/D	Read Only
7045	Hourly energy	Giga calories	Read Only
7046	Daily energy	Giga calories	Read Only
7047	Previous hourly energy	Giga calories	Read Only
7048	Previous daily energy	Giga calories	Read Only

Meter Run 2 Historic Variables

These registers are used to retrieve the historic information for meter run 2.

The host first retrieves the history index value. The host then retrieves the relevant historic records based on the value of the history index. The host can specify which historic record to retrieve by setting the “Number of Registers” in the request. See section **Historic Data Variables** for more information.

Register	Description	Access
702	Daily history records	Read Only
722	Hourly history records	Read Only
742	Hourly gas quality history records	Read Only
6102	Daily history index	Read Only
6122	Hourly history index	Read Only
6202	Hourly gas quality history index	Read Only

Meter Run 3 Data Variables

Meter run 3 data variables are show in detail in the following sections.

Meter Run 3 Instantaneous and Accumulated Variables

These variables display the current state of the flow calculation for meter run 3.

Register	Description	PEMEX Units	Access
7061	Static pressure	psi	Read Only
7062	Differential pressure / Pulse count	inches H_2O / Hz	Read Only
7063	Temperature	°F	Read Only
7064	Corrected flow (2nd base conditions)	MSCM/D	Read Only
7065	Corrected flow (1st base conditions)	MSCF/D	Read Only
7066	Hourly volume (2nd base	MSCM	Read Only

	conditions)		
7067	Hourly volume (1st base conditions)	MSCF	Read Only
7068	Daily volume (2nd base conditions)	MSCM	Read Only
7069	Daily volume (1st base conditions)	MSCF	Read Only
7070	Previous hourly volume (2nd base conditions)	MSCM	Read Only
7071	Previous hourly volume (1st base conditions)	MSCF	Read Only
7072	Previous daily volume (2nd base conditions)	MSCM	Read Only
7073	Previous daily volume (1st base conditions)	MSCF	Read Only
7074	Energy flow rate	Giga calories/D	Read Only
7075	Hourly energy	Giga calories	Read Only
7076	Daily energy	Giga calories	Read Only
7077	Previous hourly energy	Giga calories	Read Only
7078	Previous daily energy	Giga calories	Read Only

Meter Run 3 Historic Variables

These registers are used to retrieve the historic information for meter run 3.

The host first retrieves the history index value. The host then retrieves the relevant historic records based on the value of the history index. The host can specify which historic record to retrieve by setting the “Number of Registers” in the request. See section **Historic Data Variables** for more information.

Register	Description	Access
703	Daily history records	Read Only
723	Hourly history records	Read Only
743	Hourly gas quality history records	Read Only
6103	Daily history index	Read Only
6123	Hourly history index	Read Only
6203	Hourly gas quality history index	Read Only

Meter Run 4 Data Variables

Meter run 4 data variables are show in detail in the following sections.

Meter Run 4 Instantaneous and Accumulated Variables

These variables display the current state of the flow calculation for meter run 4.

Register	Description	PEMEX Units	Access
7091	Static pressure	psi	Read Only
7092	Differential pressure / Pulse count	inches H_2O / Hz	Read Only
7093	Temperature	°F	Read Only
7094	Corrected flow (2nd base	MSCM/D	Read Only

	conditions)		
7095	Corrected flow (1st base conditions)	MSCF/D	Read Only
7096	Hourly volume (2nd base conditions)	MSCM	Read Only
7097	Hourly volume (1st base conditions)	MSCF	Read Only
7098	Daily volume (2nd base conditions)	MSCM	Read Only
7109	Daily volume (1st base conditions)	MSCF	Read Only
7100	Previous hourly volume (2nd base conditions)	MSCM	Read Only
7101	Previous hourly volume (1st base conditions)	MSCF	Read Only
7102	Previous daily volume (2nd base conditions)	MSCM	Read Only
7103	Previous daily volume (1st base conditions)	MSCF	Read Only
7104	Energy flow rate	Giga calories/D	Read Only
7105	Hourly energy	Giga calories	Read Only
7106	Daily energy	Giga calories	Read Only
7107	Previous hourly energy	Giga calories	Read Only
7108	Previous daily energy	Giga calories	Read Only

Meter Run 4 Historic Variables

These registers are used to retrieve the historic information for meter run 1.

The host first retrieves the history index value. The host then retrieves the relevant historic records based on the value of the history index. The host can specify which historic record to retrieve by setting the “Number of Registers” in the request. See section **Historic Data Variables** for more information.

Register	Description	Access
704	Daily history records	Read Only
724	Hourly history records	Read Only
744	Hourly gas quality history records	Read Only
6104	Daily history index	Read Only
6124	Hourly history index	Read Only
6204	Hourly gas quality history index	Read Only

Historic Data Variables

PEMEX Modbus Hourly/Daily archive registers are used to read Realflo hourly and daily logs. The registers read the logs record by record.

The Daily Log holds records for the previous 35 days. These can be read by using index numbers one through 35.

The Hourly Log holds records for the previous 841 hours. These can be read using index numbers one through 841.

The Gas Composition Log holds (hourly) records for the previous 841 hours. These can be read using index numbers one through 841.

An index of 0 implies that a log has not yet occurred. Polling for index 0 will result in an illegal data address response in PEMEX Modbus.

Historic Record Format

Each hourly and daily record is in the following format.

Felds are in floating-point format.

Field	PEMEX Units
Date (at the start of the period)	MMDDYY.0
Time (at the start of the period)	HHMMSS.0
Duration of flow in period	Minutes
Up-time (in contract day)	Minutes
Average differential pressure/ Average Frequency	inches H_20 / Hz
Average static pressure	psia
Average temperature	°F
Average relative density	-
Average heating value	BTU(60)/SCF
Average flow extension	-
Volume (2nd base conditions)	MCF
Energy	Mega calories
Number of events	-
Number of alarms	-
Meter ID	-
Quality	-
Volume (1st base conditions)	MCF
Total energy in period	Giga calories

Gas Quality History Record Format

Each gas quality history record is in the following format.

Gas components are in %, not in mole fractions.

Field	Format / Units	Notes
Date	MMDDYY.0	
Time	HHMMSS.0	
Methane	%	
Nitrogen	%	
Carbon Dioxide	%	
Ethane	%	
Propane	%	
Water	%	
Hydrogen Sulfide	%	
Hydrogen	%	
Carbon Monoxide	%	
Oxygen	%	
i-butane	%	
n-Butane	%	
i-Pentane	%	
n-Pentane	%	
n-Hexane	%	

Field	Format / Units	Notes
n-Heptane	%	
n-Octane	%	
n-Nonane	%	
n-Decane	%	
Helium	%	
Argon	%	
Hexanes+	%	Not used
Relative Density	-	
Heating Value	BTU(60)/ft^3	

Meter Run 1 Configuration

AGA Configuration

These registers are used to configure the AGA configuration for meter run 1.

Register	Field	PEMEX Units
8601	Atmospheric pressure	kg/cm^2 ABS
8602	Base pressure	kg/cm^2
8603	Base temperature	°C
8604	Contract hour	-
8605	Low flow cut-off mark	inches H_2O
8606	Meter ID	-
8607	Run enable	See **Run Enable**
8608	Calculated compressibility	See **Gas Composition Configuration**
8609	Tap location	See **Tap Location**
8610	Pipe diameter	inches
8611	Orifice diameter	inches
8612	AGA calculation method	See **AGA Calculation Method**

Gas Composition Configuration

These registers configure the gas composition for stream 1. Stream 1 values are used by each flow run.

Realflo checks the validity of the entered components using the following limits:

- Individual components are in the ranges listed in the table below.
- The Total of all Components field displays the sum of all components. The total of all components needs to be 1.0000 (+/- 0.00001) if Composition Units is set to Mole Fractions or 100% (+/- 0.00001%) if Composition Units is set to Percent.

Register	Field	Format / Units
8031	Methane	%
8032	Nitrogen	%
8033	Carbon Dioxide	%
8034	Ethane	%

8035	Propane	%
8036	Water	%
8037	Hydrogen Sulphide	%
8038	Hydrogen	%
8039	Carbon Monoxide	%
8040	Oxygen	%
8041	i-Butane	%
8042	n-Butane	%
8043	i-Pentane	%
8044	n-Pentane	%
8045	n-Hexane	%
8046	n-Heptane	%
8047	n-Octane	%
8048	n-Nonane	%
8049	n-Decane	%
8050	Helium	%
8051	Argon	%
8052	unused	
8053	Relative Density	-
8054	Heating Value	BTU(60)/ft^3

Gas Component Ranges

The range of the fractional values of the components cannot be predetermined. The valid gas components are shown below. There are two ranges shown for each gas component. Realflo accepts any value in the Expanded Range. Only values in the Normal Range will work in all circumstances.

Component	***Normal Range***	***Expanded Range***
Methane CH_4	.4500 to 1.0000	0 to 1.0000
Nitrogen	0 to 0.5000	0 to 1.0000
Carbon Dioxide	0 to 0.3000	0 to 1.0000
Ethane C_2H_6	0 to 0.1000	0 to 1.0000
Propane C_3H_8	0 to 0.0400	0 to 0.1200
Water	0 to 0.0005	0 to 0.0300
Hydrogen Sulfide	0 to 0.0002	0 to 1.0000
Hydrogen	0 to 0.1000	0 to 1.0000
Carbon Monoxide	0 to 0.0300	0 to 0.0300
Oxygen	0	0 to 0.2100
Total Butanes iButane nButane	0 to 0.0100	0 to 0.0600
Total Pentanes iPentane	0 to 0.0300	0 to 0.0400

Component	***Normal Range***	***Expanded Range***
nPentane		
Total Hexane Plus nHexane nHeptane nOctane nNonane nDecane	0 to 0.0200	0 to 0.0400
Helium	0 to 0.0200	0 to 0.0300
Argon	0	0 to 0.0100

Meter Run 2 Configuration

AGA Configuration

These registers are used to configure the AGA configuration for meter run 1.

Register	**Field**	**PEMEX Units**
8621	Atmospheric pressure	kg/cm^2 ABS
8622	Base pressure	kg/cm^2
8623	Base temperature	°C
8624	Contract hour	-
8625	Low flow cut-off mark	inches H_2O
8626	Meter ID	-
8627	Run enable	See **Run Enable**
8628	Calculated compressibility	See **Gas Composition Configuration**
8629	Tap location	See **Tap Location**
8630	Pipe diameter	inches
8631	Orifice diameter	inches
8632	AGA calculation method	See **AGA Calculation Method**

Gas Composition Configuration

Gas composition configuration is shared with run 1 in registers 8031 to 8054.

Meter Run 3 Configuration

AGA Configuration

These registers are used to configure the AGA configuration for meter run 1.

Register	**Field**	**PEMEX Units**
8641	Atmospheric pressure	kg/cm^2 ABS
8642	Base pressure	kg/cm^2
8643	Base temperature	°C

8644	Contract hour	-
8645	Low flow cut-off mark	inches H_2O
8646	Meter ID	-
8647	Run enable	See **Run Enable**
8648	Calculated compressibility	See **Gas Composition Configuration**
8649	Tap location	See **Tap Location**
8650	Pipe diameter	inches
8651	Orifice diameter	inches
8652	AGA calculation method	See **AGA Calculation Method**

Gas Composition Configuration

Gas composition configuration is shared with run 1 in registers 8031 to 8054.

Meter Run 4 Configuration

AGA Configuration

These registers are used to configure the AGA configuration for meter run 1.

Register	Field	PEMEX Units
8661	Atmospheric pressure	kg/cm^2 ABS
8662	Base pressure	kg/cm^2
8663	Base temperature	°C
8664	Contract hour	-
8665	Low flow cut-off mark	inches H_2O
8666	Meter ID	-
8667	Run enable	See **Run Enable**
8668	Calculated compressibility	See **Gas Composition Configuration**
8669	Tap location	See **Tap Location**
8670	Pipe diameter	inches
8671	Orifice diameter	inches
8672	AGA calculation method	See **AGA Calculation Method**

Gas Composition Configuration

Gas composition configuration is shared with run 1 in registers 8031 to 8054.

Configuration Values

Calculated Compressibility

The values used for the Calculated Compressibility field are specified below.

Value	Calculated Compressibility
5.0	AGA-8 1992 Detailed

Tap Location

The values used for the Tap Location field are specified below.

Value	Tap Location

0.0	Tap upstream
1.0	Tap downstream

Run Enable

The values used for the Run Enable field are specified below.

Value	Run Enable
0.0	Inhibit
1.0	Enable

AGA Calculation Method

The values used for the AGA Calculation Method field are specified below.

Value	AGA Calculation Method
0.0	AGA-3 1985
1.0	AGA-7 1985
2.0	AGA-3 1992
3.0	V-Cone

Time Synchronization

Time synchronization registers are in floating point format.

The Modbus registers for time synchronization are downloaded using function code 16 (hex 10).

The Modbus registers for time synchronization are uploaded using function code 3.

The configuration request (upload/download) uses 2 registers and 8 bytes.

Modbus Register	Description	Format	Access
9999	Date	MMDDYY.0	Read / Write
10000	Time	HHMMSS.0	Read / Write

Event and Alarm Log

The Flow Computer event and alarm logs can be read as the PEMEX Modbus event/alarm log. The Flow Computer alarms events numbers are converted to changes in the PEMEX Modbus Variables. The tables below show the Flow Computer alarms/events and the corresponding PEMEX Modbus item number.

A large number of events and alarms don't have a corresponding item number in the PEMEX Modbus specification. So that they can be reported in the PEMEX Modbus event/alarm log, item numbers have been created for them. These item numbers begin at 8001.

In the following tables, some variables are described with an offset. The offset is determined by the flow run.

Run	Poffset	Noffset
1	0	0
2	18	1000
3	36	2000
4	54	3000
5	72	4000

Run	Poffset	Noffset
6	90	5000
7	108	6000

The Flow Computer logs contain information that needs to be mapped into the PEMEX Modbus event format.

- The Event ID is mapped into the change bit map and the register number.
- The Sequential event or alarm number is not reported.
- The User number is not reported directly, as there is no field. There is a bit indicating the source of the alarm or event as the operator or the flow computer. The user number is mapped into this.
- The date of event or alarm is converted to the PEMEX date format.
- The time of event or alarm is converted to the PEMEX time format.
- The new data associated with the event or alarm is reported in the alarm/event.
- The previous data associated with the event or alarm is reported in the alarm/event.

The PEMEX interface assumes that there is one log for all of the flow runs. It contains alarms and events. Alarms and events have similar but not identical formats. Alarms and events are returned in the same response to a command.

Alarms and events cannot be read after they have been acknowledged. This happens immediately after they are read from the flow computer.

When using Realflo to retrieve events or flow history, the read all events selection needs to be used, otherwise the events will be acknowledged as being read, and the host will not have direct access to that data.

Global Alarms and Events

The gas flow computation engine creates these events.

Realflo Number	Description	Pemex Item
10001	Power On - Cold Boot	8001
10002	Power On – Warm Boot	8002
10003	Lost Events	9001 + Noffset
10004	Recovered from Input Error	9002 + Noffset
10005	Set Input: Units Type	9003 + Noffset
10006	Set Input: Flow Calculation Type	9004 + Noffset
10007	Set Input: Compressibility Calculation Type	7616 + Poffset
10008	Set Input: Temperature Register	9005 + Noffset
10009	Set Input: Temperature Input at Zero Scale	9006 + Noffset
10010	Set Input: Temperature Input at Full Scale	9007 + Noffset
10011	Set Input: Temperature at Zero Scale	9008 + Noffset
10012	Set Input: Temperature at Full Scale	9009 + Noffset
10013	Set Input: Pressure Register	9010 + Noffset
10014	Set Input: Pressure Input at Zero Scale	9011 + Noffset
10015	Set Input: Pressure Input at Full Scale	9012 + Noffset

Realflo Number	Description	Pemex Item
10016	Set Input: Pressure at Zero Scale	9013 + Noffset
10017	Set Input: Pressure at Full Scale	9014 + Noffset
10018	Set Input: DP Register	9015 + Noffset
10019	Set Input: DP Input at Zero Scale	9016 + Noffset
10020	Set Input: DP Input at Full Scale	9017 + Noffset
10021	Set Input: DP at Zero Scale	9018 + Noffset
10022	Set Input: DP at Full Scale	9019 + Noffset
10023	Set Contract: Units Type	9020 + Noffset
10024	Set Contract: Base Temperature	7622 + Poffset
10025	Set Contract: Base Pressure	7621 + Poffset
10026	Set Input: Atmospheric Pressure	7623 + Poffset
10027	Set Input: Static Pressure Tap Location	7615 + Poffset
10028	Set Contract: Contract Hour	7624 + Poffset
10029	Change Execution State	7612 + Poffset
10030	Set RTC Year	8003
10031	Set RTC Month	8004
10032	Set RTC Day	8005
10033	Set RTC Hour	8006
10034	Set RTC Minute	8007
10035	Set RTC Second	8008
10036	Set Input: Temperature Low Level Cutoff	9021 + Noffset
10037	Set Input: Temperature Low Level hysteresis	9022 + Noffset
10038	Set Input: Temperature High Level Cutoff	9023 + Noffset
10039	Set Input: Temperature High Level Hysteresis	9024 + Noffset
10040	Set Input: Pressure Low Level Cutoff	9025 + Noffset
10041	Set Input: Pressure Low Level Hysteresis	9026 + Noffset
10042	Set Input: Pressure High Level Cutoff	9027 + Noffset
10043	Set Input: Pressure High Level Hysteresis	9028 + Noffset
10044	Set Input: Save Low/High Flow Events	9029 + Noffset
10046	Invalid User Event	9031 + Noffset
10047	Start Temperature Calibration: Forced temperature input	9032 + Noffset
10048	End Temperature Calibration: Removed forced temperature input	9033 + Noffset
10049	Start Static Pressure Calibration: Forced SP input	9034 + Noffset
10050	End Static Pressure Calibration: Removed forced SP input	9035 + Noffset
10051	Start Differential Pressure Calibration: Forced DP input	9036 + Noffset
10052	End Differential Pressure Calibration: Removed forced DP input	9037 + Noffset
10053	Start Pulse Counter Calibration: Forced pulse count rate	9038 + Noffset
10054	End Pulse Counter Calibration: Removed forced pulse count rate	9039 + Noffset
10055	Set User Number	8009
10056	Set User Security Level	8010
10057	Set Input: Temperature Register Type	9040 + Noffset

Realflo Number	Description	Pemex Item
10058	Set Input: Pressure Register Type	9041 + Noffset
10059	Set Input: DP Register Type	9042 + Noffset
10060	Set Input: Temperature Input at Zero Scale	9043 + Noffset
10061	Set Input: Temperature Input at Full Scale	9044 + Noffset
10062	Set Input: Pressure Input at Zero Scale	9045 + Noffset
10063	Set Input: Pressure Input at Full Scale	9046 + Noffset
10064	Set Input: DP Input at Zero Scale	9047 + Noffset
10065	Set Input: DP Input at Full Scale	9048 + Noffset
10066	Set Input: Pulse Counter Register	9049 + Noffset
10067	Set Input: Pulse Counter Register Type	9050 + Noffset
10068	Set Active Runs	7604
10069	Lost Alarms	9051 + Noffset
10071	Firmware Version	8011
10072	Application Version	8012
10073	Set Flow Computer ID	7603
10074	Set Contract: Input Err Action	9053 + Noffset
10075	Set Run ID	7611 + Poffset
10076	Power Off	8013
10077	Start Plate Change: Forced temperature input	9054 + Noffset
10078	End Plate Change: Removed forced temperature input	9055 + Noffset
10079	Start Plate Change: Forced static pressure input	9056 + Noffset
10080	End Plate Change: Removed forced static pressure input	9057 + Noffset
10081	Start Plate Change: Forced differential pressure input	9058 + Noffset
10082	End Plate Change: Removed forced differential pressure input	9059 + Noffset
10083	Set Input: altitude and latitude compensation	9060 + Noffset
10084	Set Input: altitude	9061 + Noffset
10085	Set Input: latitude	9062 + Noffset
10086	Forced temperature input	7628 + Poffset
10087	Removed forced temperature input	7628 + Poffset
10088	Forced static pressure input	7627 + Poffset
10089	Removed forced static pressure input	7627 + Poffset
10090	Forced differential pressure input	7625 + Poffset
10091	Removed forced differential pressure input	7625 + Poffset
10092	Forced pulse count rate	7626 + Poffset
10093	Removed forced pulse count rate	7626 + Poffset
10094	Set Contract: wet gas meter factor	9063 + Noffset
10095	Set Input: Pulse Counter Register	9064 + Noffset
10096	Set Input: Pulse K Factor	9065 + Noffset
10097	Set Input: Pulse Units	9066 + Noffset
10098	Set Input: Base Compressibility Calc	9067 + Noffset
10099	Set Input: Averaging Type	9068 + Noffset
10100	Set Input: Default Input Type	9069 + Noffset
10101	Set Input: Default Temperature	9070 + Noffset
10102	Set Input: Default Static Pressure	9071 + Noffset

Realflo Number	Description	Pemex Item
10103	Set Input: Default Differential Pressure	9072 + Noffset
10104	Set gas quality source (Pemex only)	9073 + Noffset
10105	Set Input: Flow Direction Control	9074 + Noffset
10106	Set Input: Flow Direction Register	9075 + Noffset
10107	Forced mass flow input	9076 + Noffset
10108	Restored live mass flow input	9077 + Noffset
10109	Starting Calibration: Forced mass flow rate input	9078 + Noffset
10110	Ending Calibration: Restored live mass flow rate input	9079 + Noffset
10111	Set Input: Mass Flow Rate Register Type	9080 + Noffset
10114	Set Input: On Indicates	9081 + Noffset

AGA-3 (1985) Alarms and Events

These events are specific to the AGA-3 (1985) calculation.

Realflo Number	Description	PEMEX Item
10201	Failed To Create AGA-3 (1985) Data Structure	9101 + Noffset
10202	Created AGA-3 (1985) with Execution Stopped	9102 + Noffset
10203	Created AGA-3 (1985) with Execution Running	9103 + Noffset
10204	Destroyed AGA-3 (1985) Data Structure	9104 + Noffset
10205	Recovered from AGA-3 (1985) error	9105 + Noffset
10206	Set AGA-3 (1985): Input Units Type	9106 + Noffset
10207	Set AGA-3 (1985): Orifice Material	9107 + Noffset
10208	Set AGA-3 (1985): Pipe Material	9108 + Noffset
10209	Set AGA-3 (1985): Static Pressure Tap Location	7615 + Poffset
10210	Set AGA-3 (1985): Orifice Diameter	7618 + Poffset
10211	Set AGA-3 (1985): Orifice Measurement Reference Temperature	9109 + Noffset
10212	Set AGA-3 (1985): Pipe Diameter	7617 + Poffset
10213	Set AGA-3 (1985): Pipe Diameter Measurement Reference Temperature	9110 + Noffset
10214	Set AGA-3 (1985): Isentropic Exponent	9111 + Noffset
10215	Set AGA-3 (1985): Viscosity	9112 + Noffset
10216	Set AGA-3 (1985): Base Temperature	7622 + Poffset
10217	Set AGA-3 (1985): Base Pressure	7621 + Poffset
10218	Set AGA-3 (1985): Atmospheric Pressure	7623 + Poffset
10219	Failed To Set AGA-3 (1985) Configuration	9113 + Noffset
10220	Set AGA-3 (1985): Contract Units Type	9114 + Noffset
10221	Set AGA-3 (1985): Temperature deadband	9115 + Noffset
10222	Set AGA-3 (1985): Static Pressure deadband	9116 + Noffset
10223	Set AGA-3 (1985): Differential Pressure deadband	9117 + Noffset

AGA-3 (1992) Alarms and Events

These events are specific to the AGA-3 (1992) calculation.

Realflo Number	Description	PEMEX Item
10301	Failed To Create AGA-3 (1992) Data Structure	9151 + Noffset
10302	Created AGA-3 (1992) with Execution Stopped	9152 + Noffset
10303	Created AGA-3 (1992) with Execution Running	9153 + Noffset
10304	Destroyed AGA-3 (1992) Data Structure	9154 + Noffset
10305	Restored from AGA-3 (1992) error	9155 + Noffset
10306	Set AGA-3 (1992): Input Units Type	9156 + Noffset

Realflo Number	Description	PEMEX Item
10307	Set AGA-3 (1992): Orifice Material	9157 + Noffset
10308	Set AGA-3 (1992): Pipe Material	9158 + Noffset
10309	Set AGA-3 (1992): Static Pressure Tap Location	7615 + Poffset
10310	Set AGA-3 (1992): Orifice Diameter	7618 + Poffset
10311	Set AGA-3 (1992): Orifice reference temperature	9159 + Noffset
10312	Set AGA-3 (1992): Pipe Diameter	7617 + Poffset
10313	Set AGA-3 (1992): Pipe Diameter Measurement Temperature	9160 + Noffset
10314	Set AGA-3 (1992): Isentropic Exponent	9161 + Noffset
10315	Set AGA-3 (1992): Viscosity	9162 + Noffset
10316	Set AGA-3 (1992): Base Temperature	7622 + Poffset
10317	Set AGA-3 (1992): Base Pressure	7621 + Poffset
10318	Set AGA-3 (1992): Atmospheric Pressure	7623 + Poffset
10319	Failed To Set AGA-3 (1992) Configuration	9163 + Noffset
10320	Set Input: DP Low Level Cutoff	7619 + Poffset
10321	Set Input: DP Low Level Hysteresis	9164 + Noffset
10322	Set Input: DP High Level Cutoff	9165 + Noffset
10323	Set Input: DP High Level Hysteresis	9166 + Noffset
10324	Set AGA-3 (1992): Contract Units Type	9167 + Noffset
10325	Set AGA-3 (1992): Temperature deadband	9168 + Noffset
10326	Set AGA-3 (1992): Static Pressure deadband	9169 + Noffset
10327	Set AGA-3 (1992): Differential Pressure deadband	9170 + Noffset

AGA-7 Alarms and Events

These events are specific to the AGA-7 calculation.

Realflo Number	Description	PEMEX Item
10701	Failed To Create AGA-7 Data Structure	9201 + Noffset
10702	Created AGA-7 with Execution Stopped	9202 + Noffset
10703	Created AGA-7 with Execution Running	9203 + Noffset
10704	Destroyed AGA-7 Data Structure	9204 + Noffset
10705	Restored from AGA-7 error	9205 + Noffset
10706	Set AGA-7: Input Units Type	9206 + Noffset
10707	Set AGA-7: K factor	7620 + Poffset
10708	Set AGA-7: M factor	9207 + Noffset
10709	Set AGA-7: Atmospheric Pressure	7623 + Poffset
10710	Set AGA-7: Base Pressure	7621 + Poffset
10711	Set AGA-7: Base Temperature	7622 + Poffset
10712	Failed To Set AGA-7 Configuration	9208 + Noffset
10713	Set Input: Turbine Low Flow Pulse Limit	9209 + Noffset
10714	Set Input: Turbine Low Flow Detect Time	9210 + Noffset
10715	Set AGA-7: Contract Units Type	9211 + Noffset
10716	Set AGA-7: Volume Option	9212 + Noffset

AGA-11Alarms and Events

These events are specific to the AGA-11calculation.

Realflo Number	Description	PEMEX Item
11101	Failed To Create AGA-11 Data Structure	9401 + Noffset
11102	Created AGA-11 with Execution Stopped	9402 + Noffset
11103	Created AGA-11 with Execution Running	9403+ Noffset
11104	Destroy AGA-11 Data Structure	9404+ Noffset
11105	Recovered from AGA-11 error	9405 + Noffset
11106	Change in AGA-11 units configuration	9406+ Noffset
11107	Change in AGA-11 contract units config	9407+ Noffset
11108	Change in AGA-11 base temperature	9408+ Noffset
11109	Change in AGA-11 base pressure	9409+ Noffset
11110	Failed To Set AGA-11 Configuration	9410+ Noffset

V-Cone Alarms and Events

These events are specific to the V-Cone calculation.

Realflo Number	Description	PEMEX Item
12201	Failed To Create V-Cone Date Structure	9251 + Noffset
12202	Created V-Cone with Execution Stopped	9252 + Noffset
12203	Created V-Cone with Execution Running	9253 + Noffset
12204	Destroyed V-Cone Data Structure	9254 + Noffset
12205	Restored from V-Cone Error	9255 + Noffset
12206	Failed To Set V-Cone Configuration	9256 + Noffset
12207	Set V-Cone Cone Measurement Temperature	9257 + Noffset
12208	Set V-Cone Input Units Type	9258 + Noffset
12209	Set V-Cone Contract Units Type	9259 + Noffset
12210	Set V-Cone Cone Material	9260 + Noffset
12211	Set V-Cone Pipe Material	9261 + Noffset
12212	Set V-Cone Cone Diameter	9262 + Noffset
12213	Set V-Cone Inside Pipe Diameter	9263 + Noffset
12214	Set V-Cone Pipe reference temperature	9264 + Noffset
12215	Set V-Cone Isentropic Exponent	9265 + Noffset
12216	Set V-Cone Viscosity	9266 + Noffset
12217	Set V-Cone Base Temperature	7622 + Poffset
12218	Set V-Cone Base Pressure	7621 + Poffset
12219	Set V-Cone Atmospheric Pressure	7623 + Poffset
12220	Set Table Point 1 Reynolds Number	9267 + Noffset
12221	Set Table Point 2 Reynolds Number	9268 + Noffset
12222	Set Table Point 3 Reynolds Number	9269 + Noffset
12223	Set Table Point 4 Reynolds Number	9270 + Noffset
12224	Set Table Point 5 Reynolds Number	9271 + Noffset
12225	Set Table Point 6 Reynolds Number	9272 + Noffset
12226	Set Table Point 7 Reynolds Number	9273 + Noffset
12227	Set Table Point 8 Reynolds Number	9274 + Noffset
12228	Set Table Point 9 Reynolds Number	9275 + Noffset
12229	Set Table Point 10 Reynolds Number	9276 + Noffset

Realflo Number	Description	PEMEX Item
12230	Set Table Point 1 Flow Coefficient	9277 + Noffset
12231	Set Table Point 2 Flow Coefficient	9278 + Noffset
12232	Set Table Point 3 Flow Coefficient	9279 + Noffset
12233	Set Table Point 4 Flow Coefficient	9280 + Noffset
12234	Set Table Point 5 Flow Coefficient	9281 + Noffset
12235	Set Table Point 6 Flow Coefficient	9282 + Noffset
12236	Set Table Point 7 Flow Coefficient	9283 + Noffset
12237	Set Table Point 8 Flow Coefficient	9284 + Noffset
12238	Set Table Point 9 Flow Coefficient	9285 + Noffset
12239	Set Table Point 10 Flow Coefficient	9286 + Noffset
12241	Set Wet Gas Correction Factor Method	9287 + Noffset
12242	Set Density of liquid at flow conditions	9288 + Noffset
12243	Set Mass flow rate of liquid at flow conditions	9289 + Noffset

AGA-8 Alarms and Events

These events are specific to the AGA-8 calculation.

Realflo Number	Description	PEMEX Item
10801	Failed To Create AGA-8 Data Structure	9301 + Noffset
10802	Created AGA-8 with Execution Stopped	9302 + Noffset
10803	Created AGA-8 with Execution Running	9303 + Noffset
10804	Destroyed AGA-8 Data Structure	9304 + Noffset
10805	Set AGA-8 Gas: Change Gas Fractions	9305 + Noffset
10806	Set AGA-8 Gas: Methane (CH4)	7719
10807	Set AGA-8 Gas: Nitrogen	7720
10808	Set AGA-8 Gas: Carbon Dioxide (CO2)	7721
10809	Set AGA-8 Gas: Ethane (C2H6)	7722
10810	Set AGA-8 Gas: Propane (C3H8)	7723
10811	Set AGA-8 Gas: Water	7724
10812	Set AGA-8 Gas: Hydrogen Sulphide (H2S)	7725
10813	Set AGA-8 Gas: Hydrogen	7726
10814	Set AGA-8 Gas: Carbon Monoxide (CO)	7727
10815	Set AGA-8 Gas: Oxygen	7728
10816	Set AGA-8 Gas: I-Butane	7729
10817	Set AGA-8 Gas: n-Butane	7730
10818	Set AGA-8 Gas: I-Pentane	7731
10819	Set AGA-8 Gas: n-Pentane	7732
10820	Set AGA-8 Gas: n-hexane (when using individual gas components) Set AGA-8 Gas: n-hexane + (when using combined value for hexane and higher components)	7733
10821	Set AGA-8 Gas: n-Heptane	7734
10822	Set AGA-8 Gas: n-Octane	7735
10823	Set AGA-8 Gas: n-Nonane	7736
10824	Set AGA-8 Gas: n-Decane	7737
10825	Set AGA-8 Gas: Helium	7738
10826	Set AGA-8 Gas: Argon	7739

Realflo Number	Description	PEMEX Item
10827	Set AGA-8 Gas: Failed To Set	9306 + Noffset
10828	Failed To Set AGA-8 Configuration	9307 + Noffset
10829	Set AGA-8: Input Units Type	9308 + Noffset
10830	Set AGA-8: Base Temperature	7622 + Poffset
10831	Set AGA-8: Base Pressure	7621 + Poffset
10832	Set AGA-8: Atmospheric Pressure	7623 + Poffset
10833	Set AGA-8: Static Pressure Tap Location	7615 + Poffset
10834	Set AGA-8: Contract Units Type	9309 + Noffset
10835	Clear Compressibility Error	9310 + Noffset
10836	Set AGA-8: gas composition logging	9311 + Noffset
10837	Set AGA-8 Gas: Use Hexanes+	9312 + Noffset
10838	Set AGA-8 Hexane + Ratio for n-hexane	9313 + Noffset
10839	Set AGA-8 Hexane + Ratio for n-heptane	9314 + Noffset
10840	Set AGA-8 Hexane + Ratio for n-octane	9315 + Noffset
10841	Set AGA-8 Hexane + Ratio for n-nonane	9316 + Noffset
10842	Set AGA-8 Hexane + Ratio for n-decane	9317 + Noffset
10843	Set AGA-8 Laboratory real relative density 0 = calculate value 0.07 to 1.52 = use value	7740
10844	Set AGA-8 Laboratory heating value: 0 = calculate value 0 to 1800 = use value	7741

NX-19 Alarms and Events

These events are specific to the NX-19 calculation.

Realflo Number	Description	PEMEX Item
11901	Failed to Create NX-19 Data Structure	9351 + Noffset
11902	Created NX-19 with Execution Stopped	9352 + Noffset
11903	Created NX-19 with Execution Running	9353 + Noffset
11904	Destroyed NX-19 Data Structure	9354 + Noffset
11905	Restored from NX-19 error	9355 + Noffset
11906	Set NX-19: Calculation Method	9356 + Noffset
11907	Set NX-19: Specific Gravity	7740
11908	Set NX-19: Gas: Carbon Dioxide	7721
11909	Set NX-19: Gas: Methane	7719
11910	Set NX-19: Gas: Nitrogen	7720
11911	Set NX-19: Heating Value	7741
11912	Set NX-19: Static Pressure Tap Location	7615 + Poffset
11913	Set NX-19: Base Pressure	7621 + Poffset
11914	Set NX-19: Base Temperature	7622 + Poffset
11915	Failed to set NX-19 Gas Components	9357 + Noffset
11916	Failed to set NX-19 Contract Configuration	9358 + Noffset
11917	Set NX-19: Contract Units Type	9359 + Noffset
11918	Clear Compressibility Error	9360 + Noffset
11919	Set NX-19: gas composition logging disabled	9361 + Noffset

MVT Alarms and Events

These events are specific to the MVT transmitter.

Realflo Number	Description	PEMEX Item
13100	Set MVT Transmitter 1: polling status	9601 + Noffset
13101	Set MVT Transmitter 1: serial port	9602 + Noffset
13102	Set MVT Transmitter 1: Address of transmitter	9603 + Noffset
13103	Set MVT Transmitter 1: Timeout	9604 + Noffset
13104	Set MVT Transmitter 1: Manufacturer Code	9605 + Noffset
13105	Set MVT Transmitter 1: Turnaround Delay Time	9606 + Noffset
13106	Set MVT Transmitter 1: Differential Pressure units	9607 + Noffset
13107	Set MVT Transmitter 1: Static Pressure units	9608 + Noffset
13108	Set MVT Transmitter 1: Temperature units	9609 + Noffset
13109	Set MVT Transmitter 1: Serial number	9610 + Noffset
13110	Set MVT Transmitter 1: Tag	9611 + Noffset
13111	Set MVT Transmitter 1: Differential Pressure damping	9612 + Noffset
13112	Set MVT Transmitter 1: Differential Pressure upper operating limit	9613 + Noffset
13113	Set MVT Transmitter 1: Differential Pressure lower operating limit	9614 + Noffset
13114	Set MVT Transmitter 1: Static Pressure damping	9615 + Noffset
13115	Set MVT Transmitter 1: Static Pressure upper operating limit	9616 + Noffset
13116	Set MVT Transmitter 1: Static Pressure lower operating limit	9617 + Noffset
13117	Set MVT Transmitter 1: Temperature damping	9618 + Noffset
13118	Set MVT Transmitter 1: Temperature upper operating limit	9619 + Noffset
13119	Set MVT Transmitter 1: Temperature lower operating limit	9620 + Noffset
13120	MVT Transmitter 1: lost communication	9621 + Noffset
13121	MVT Transmitter 1: transmitter configuration incorrect	9622 + Noffset
13122	MVT Transmitter 1: temperature sensor out of range	9623 + Noffset
13123	MVT Transmitter 1: static pressure sensor out of range	9624 + Noffset
13124	MVT Transmitter 1: differential pressure sensor out of range	9625 + Noffset
13125	MVT Transmitter 1: not polled	9626 + Noffset
13126	Set MVT Transmitter 1: Type Code	9627 + Noffset
13127	Set MVT Transmitter 1: IP Address	9628 + Noffset
13128	Set MVT Transmitter 1: IP Protocol	9629 + Noffset

Realflo Number	Description	PEMEX Item
13129	MVT Transmitter 1: temperature sensor value is bad	9630 + Noffset
13130	MVT Transmitter 1: static pressure sensor value is bad	9631 + Noffset
13131	MVT Transmitter 1: differential pressure sensor value is bad	9632 + Noffset
13132	Set MVT Transmitter 1: Atmospheric Pressure Offset	9633 + Noffset
13133	MVT Transmitter 1: Restore for all communication alarms	9634 + Noffset
13134	MVT Transmitter 1: Restore for all alarms	9635 + Noffset
13135	MVT Transmitter 1: Sensors are Off Line	9636 + Noffset
13136	MVT Transmitter 1: RTD is disconnected	9637 + Noffset
13137	MVT Transmitter 1: Temperature Sensor Above Range	9638 + Noffset
13138	MVT Transmitter 1: Static Pressure Above Range	9639 + Noffset
13139	MVT Transmitter 1: Differential Pressure Above Range	9640 + Noffset
13140	MVT Transmitter 1: Temperature Sensor Below Range	9641 + Noffset
13141	MVT Transmitter 1: Static Pressure Below Range	9642 + Noffset
13142	MVT Transmitter 1: Differential Pressure Below Range	9643 + Noffset

Coriolis Meter Alarms and Events

Realflo Number	Description	PEMEX Item
14001	Failed To Set Coriolis Meter	9651 + Noffset
14002	Set Coriolis Meter: Meter Address	9652 + Noffset
14003	Set Coriolis Meter: Meter Port	9653 + Noffset
14004	Set Coriolis Meter: Meter Timeout	9654 + Noffset
14005	Coriolis Meter: Lost Communication	9655 + Noffset
14006	Coriolis Meter: Communication Restored	9656 + Noffset
14007	Coriolis Meter: Not Polled	9657 + Noffset
14008	Coriolis Meter: Coriolis Meter has bad response	9658 + Noffset

Calibration and User Defined Alarms and Events

Realflo generates these events when performing calibration (not by the flow computer).

Realflo Number	Description	PEMEX Item
19003	As-Found Temperature	9703 + Noffset
19004	As-Left Temperature	9704 + Noffset
19005	Target Re-Zero Temperature	9705 + Noffset
19006	Target Temperature Span	9706 + Noffset
19007	Set Default Temperature	9707 + Noffset

Realflo Number	Description	PEMEX Item
19008	After Re-Zero Temperature	9708 + Noffset
19009	After Calibrate Temperature Span	9709 + Noffset
19013	As-Found Static Pressure	9713 + Noffset
19014	As-Left Static Pressure	9714 + Noffset
19015	Target Re-Zero Static Pressure	9715 + Noffset
19016	Target Static Pressure Span	9716 + Noffset
19018	After Re-Zero Static Pressure	9718 + Noffset
19019	After Calibrate Static Pressure Span	9719 + Noffset
19023	As-Found Differential Pressure	9723 + Noffset
19024	As-Left Differential Pressure	9724 + Noffset
19025	Target Re-Zero Differential Pressure	9725 + Noffset
19026	Target Differential Pressure Span	9726 + Noffset
19028	After Re-Zero Differential Pressure	9728 + Noffset
19029	After Calibrate Differential Pressure Span	9729 + Noffset
19033	As-Found Pulse Count	9733 + Noffset
19034	As-Left Pulse Count	9734 + Noffset

Calculation Engine Errors

The flow calculation engine generates these errors.

Realflo Number	Description	PEMEX Item
20001	Meter control structure not found	9751 + Noffset
20003	Temperature input is below zero scale	9752 + Noffset
20004	Temperature input is above full scale	9753 + Noffset
20005	Static pressure input is below zero scale	9754 + Noffset
20006	Static pressure input is above full scale	9755 + Noffset
20007	Differential pressure input is below zero scale	9756 + Noffset
20008	Differential pressure input is above full scale	9757 + Noffset
20009	Compressibility calculation inputs invalid	9758 + Noffset
20010	Forced input register	9759 + Noffset
20011	Removed force from input register	9760 + Noffset
20012	Low battery alarm	9761 + Noffset
20050	Restore from temperature input low alarm	9762 + Noffset
20051	Restore from temperature input high alarm	9763 + Noffset
20052	Restore from static pressure input low alarm	9764 + Noffset
20053	Restore from static pressure input high alarm	9765 + Noffset
20054	Restore from differential pressure input low alarm	9766 + Noffset
20055	Restore from differential pressure input high alarm	9767 + Noffset
20056	Restore from low pulse input alarm	9768 + Noffset
20057	Restore from input alarm	9769 + Noffset

AGA-3 (1985) Calculation Errors

These errors are generated by the AGA-3 (1985) calculation.

Realflo Number	Description	PEMEX Item
20210	AGA-3 (1985) – Flowing temperature is at or below absolute zero	9801 + Noffset
20229	AGA-3 (1985) - Ratios from AGA-8 or NX-19 were not available	9802 + Noffset
20232	AGA-3 (1985) - Static pressure below differential	9803 + Noffset
20233	AGA-3 (1985) - Static pressure zero or negative	9804 + Noffset
20234	AGA-3 (1985) – Bad Calculation	9805 + Noffset
20227	AGA-3 (1985) – Differential Pressure Neg or Zero	9806 + Noffset

AGA-3 (1992) Calculation Errors

These errors are generated by the AGA-3 (1992) calculation.

Realflo Number	Description	PEMEX Item
20310	AGA-3 (1992) – Flowing temperature is at or below absolute zero	9834 + Noffset
20325	AGA-3 (1992) – Too many Iterations	9836 + Noffset
20329	AGA-3 (1992) – Ratios from AGA-8 or NX-19 were not available	9831 + Noffset
20332	AGA-3 (1992) - Static pressure below differential	9832 + Noffset
20333	AGA-3 (1992) - Static pressure zero or negative	9833 + Noffset
20334	AGA-3 (1992) – Bad Calculation	9835 + Noffset
20335	AGA-3 (1992) – Differential Pressure Neg or Zero	9837 + Noffset

AGA-7 Calculation Errors

These errors are generated by the AGA-7 calculation.

Realflo Number	Description	PEMEX Item
20712	AGA-7 - Temperature low	9891 + Noffset
20713	AGA-7 – Static pressure zero or negative	9892 + Noffset
20714	AGA-7 - Low pulse rate	9893 + Noffset
20716	AGA-7 - Ratios from AGA-8 or NX-19 are not available	9894 + Noffset
20720	AGA-7 – Bad Calculation	9895 + Noffset

AGA-11 Calculation Errors

These errors are generated by the AGA-11 calculation.

Realflo Number	Description	PEMEX Item
21101	AGA-11 - Bad units	9861 + Noffset
21102	AGA-11 - Bad contract units	9862 + Noffset
21103	AGA-11 - Base Pressure negative or zero	9863 + Noffset
21104	AGA-11 - Base Temperature negative or zero	9864 + Noffset
21105	AGA-11 - Bad calculation	9865 + Noffset
21107	AGA-11 - Ratios from AGA-8 were not available	9866 + Noffset

V-Cone Calculation Errors

These errors are generated by the V-Cone calculation.

Realflo Number	Description	PEMEX Item
22221	V-Cone – Temperature low	9921 + Noffset
22223	V-Cone – Ratios from AGA-8 or NX-19 were not available	9922 + Noffset
22227	V-Cone – Too many Iterations	9923 + Noffset
22228	V-Cone – Static pressure below differential pressure	9924 + Noffset
22229	V-Cone – Static pressure zero or negative	9925 + Noffset
22230	V-Cone – Bad Calculation	9926 + Noffset
22231	V-Cone – Differential Pressure Neg or Zero	9927 + Noffset

AGA-8 Calculation Errors

These errors are generated by the AGA-8 calculation.

Realflo Number	Description	PEMEX Item
20809	AGA-8 – Flow Temperature is Low	9951 + Noffset
20810	AGA-8 – Flow Temperature is High	9952 + Noffset
20811	AGA-8 – Flow Pressure is Low	9953 + Noffset
20812	AGA-8 –Flow Press is High	9954 + Noffset
20814	AGA-8 - Not configured	9955 + Noffset
20819	AGA-8 - No gas components	9956 + Noffset

NX-19 Errors

These errors are generated by the NX-19 calculation.

Realflo Number	Description	PEMEX Item
21913	NX-19 – Flow Temperature is Low	9981 + Noffset
21914	NX-19 – Flow Pressure is Low	9982 + Noffset
21915	NX-19 –Flow Press is High	9983 + Noffset
21916	NX-19 - Configuration flag not set	9984 + Noffset
21917	NX-19 - Gas ratios were not available	9985 + Noffset
21921	NX-19 – Flow Temperature is High	9986 + Noffset

Retrieval and Acknowledgment of Events and Alarms

The field device is capable of storing 256 events or alarms.

Events and alarms can be retrieved using Modbus function code 3, to read register 32 (20 hex). The number of records in the host poll (request) will be ignored by the field device. The field device will return up to 12 alarms or events for each poll (alarm/event size is 20 bytes, the maximum Modbus message size is 156 bytes).

Alarm or Event Record Format

The format of the 20-byte record is as follows:

Byte	Contents	Format
1 – 2	Status bits	See below
3 – 4	Event record number	16-bit integer
5 – 8	Time of event/alarm	HHMMSS.0 (32-bit float)
9 – 12	Date of event/alarm	MMDDYY.0 (32-bit float)
13 – 16	Previous value	32-bit float
17 – 20	Current value	32-bit float

If bit 9 of the status bits field is 1, then the record is an event. If bit 9 of the status bits field is 0, then the record is an alarm.

Event Status Bits

The status bits for events are as follows.

Bit		Description
0	Byte 2, Bit 0	Fixed value
1	Byte 2, Bit 1	Zero scale
2	Byte 2, Bit 2	Full scale
3	Byte 2, Bit 3	Operator value
4	Byte 2, Bit 4	Fixed Bit
5	Byte 2, Bit 5	Fixed/Variable flag
6	Byte 2, Bit 6	Change to table entry
7	Byte 2, Bit 7	Change to command system
8	Byte 1, Bit 0	Unused
9	Byte 1, Bit 1	Always 1 (event)
10	Byte 1, Bit 2	Low low limit
11	Byte 1, Bit 3	Low limit
12	Byte 1, Bit 4	High limit
13	Byte 1, Bit 5	High high limit
14	Byte 1, Bit 6	Rate of change limit
15	Byte 1, Bit 7	Unused

Alarm Status Bits

The status bits for alarms are as follows.

Bit		Description
0	Byte 2, Bit 0	Unused (0)
1	Byte 2, Bit 1	Unused (0)
2	Byte 2, Bit 2	Unused (0)
3	Byte 2, Bit 3	Unused (0)
4	Byte 2, Bit 4	Unused (0)

Bit		Description
5	Byte 2, Bit 5	Unused (0)
6	Byte 2, Bit 6	Unused (0)
7	Byte 2, Bit 7	Unused (0)
8	Byte 1, Bit 0	Unused (0)
9	Byte 1, Bit 1	0 (alarm)
10	Byte 1, Bit 2	Low low limit
11	Byte 1, Bit 3	Low limit
12	Byte 1, Bit 4	High limit
13	Byte 1, Bit 5	High high limit
14	Byte 1, Bit 6	Unused (0)
15	Byte 1, Bit 7	1 if the variable entered the alarm state. 0 if the variable returned to normal (in this case, the bits are set to 0)

Alarm Acknowledgement

To acknowledge alarms/events, the server will use Modbus function code 5 to “write” to register 32 (hex 20). The data in the message should be 1.

When the field device receives this request, only records that have been transmitted to the server will be deleted. Alarms/events that were not retrieved or occurred after the alarm/event retrieval will not be deleted.

Measurement Units

Realflo supports twelve different systems of measurement. The tables below show the measurement units for each type of parameter. The *Units* column shows the measurement units. The *Realflo Display* column shows how these units are displayed on the screen and in printed reports.

Definitions

The following are standard units used in the United States unit sets. The prefix M in units stands for thousands. The prefix MM in units stands for millions.

- MCF is thousands of cubic feet (i.e. 10^3 ft^3).
- MMCF is millions of cubic feet (i.e. 10^6 ft^3).
- MBTU is thousands of BTU (i.e. 10^3 BTU).
- MMBTU is millions of BTU (i.e. 10^6 BTU).

M in metric and SI unit sets stands for 10^6 (i.e. millions).

US1 Units

Parameters and Values	**Units**	**Realflo Display**
Pipe and Orifice Diameters	inches	inches
Static, Base and Atmospheric Pressure	psi	psi
Differential Pressure	psi	psi
Flowing and Base Temperature	°F	F
Viscosity	centipoise	cP
Density	lbm/ft^3	lbm/ft3
Mass	lbm	lbm
Mass Flow Rate	lbm/hr	lbm/hr
Volume	ft^3	ft3
Volume Flow Rate	ft^3/hr	ft3/hr
Heating Value	$BTU(60)/ft^3$	BTU/ft3
Energy	BTU(60)	BTU
Energy Flow Rate	BTU(60)/hr	BTU/hr
Flow Extension	kg/m^3s	kg/m3s
Turbine Rate	$pulses/ft^3$	pulses/ft3
Altitude	feet	feet

US2 Units

Parameters and Values	**Units**	**Realflo Display**
Pipe and Orifice Diameters	inches	inches
Static, Base and Atmospheric Pressure	psi	psi
Differential Pressure	inches H_2O at 60 °F	in H2O at 60F
Flowing and Base Temperature	°F	F

Parameters and Values	Units	Realflo Display
Viscosity	centipoise	cP
Density	lbm/ft^3	lbm/ft3
Mass	lbm	lbm
Mass Flow Rate	lbm/hr	lbm/hr
Volume	MMCF	MMCF
Volume Flow Rate	MMCF/day	MMCF/day
Heating Value	BTU(60)/ft^3	BTU/ft3
Energy	MMBTU(60)	MMBTU
Energy Flow Rate	MMBTU(60)/ day	MMBTU/day
Flow Extension	kg/m^{3}s	kg/m3s
Turbine Rate	pulses/ft^3	pulses/ft3
Altitude	feet	feet

US3 Units

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	inches	inches
Static, Base and Atmospheric Pressure	psi	psi
Differential Pressure	inches H_2O at 68 °F	in H2O at 68F
Flowing and Base Temperature	°F	F
Viscosity	centipoise	cP
Density	lbm/ft^3	lbm/ft3
Mass	lbm	lbm
Mass Flow Rate	lbm/hr	lbm/hr
Volume	MMCF	MMCF
Volume Flow Rate	MMCF/day	MMCF/day
Heating Value	BTU(60)/ft^3	BTU/ft3
Energy	MMBTU(60)	MMBTU
Energy Flow Rate	MMBTU(60)/ day	MMBTU/day
Flow Extension	kg/m^{3}s	kg/m3s
Turbine Rate	pulses/ft^3	pulses/ft3
Altitude	feet	feet

US4 Units

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	inches	inches
Static, Base and Atmospheric Pressure	psi	psi
Differential Pressure	inches H_2O at 60 °F	in H2O at 60F
Flowing and Base Temperature	°F	F
Viscosity	centipoise	cP
Density	lbm/ft^3	lbm/ft3
Mass	lbm	lbm
Mass Flow Rate	lbm/hr	lbm/hr
Volume	MCF	MCF

Parameters and Values	Units	Realflo Display
Volume Flow Rate	MCF/hr	MCF/hr
Heating Value	BTU(60)/ft^3	BTU/ft3
Energy	MBTU(60)	MBTU
Energy Flow Rate	MBTU(60)/hr	MBTU/hr
Flow Extension	kg/m^3s	kg/m3s
Turbine Rate	pulses/ft^3	pulses/ft3
Altitude	feet	feet

US5 Units

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	inches	inches
Static, Base and Atmospheric Pressure	psi	psi
Differential Pressure	inches H_2O at 60 °F	in H2O at 60F
Flowing and Base Temperature	°F	F
Viscosity	centipoise	cP
Density	lbm/ft^3	lbm/ft3
Mass	lbm	lbm
Mass Flow Rate	lbm/day	lbm/day
Volume	MCF	MCF
Volume Flow Rate	MCF/day	MCF/day
Heating Value	BTU(60)/ft^3	BTU/ft3
Energy	MBTU(60)	MBTU
Energy Flow Rate	MBTU(60)/day	MBTU/day
Flow Extension	kg/m^3s	kg/m3s
Turbine Rate	pulses/ft^3	pulses/ft3
Altitude	feet	feet

US6 Units

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	inches	inches
Static, Base and Atmospheric Pressure	psi	psi
Differential Pressure	inches H_2O at 60 °F	in H2O at 60F
Flowing and Base Temperature	°F	F
Viscosity	centipoise	cP
Density	lbm/ft^3	lbm/ft3
Mass	lbm	lbm
Mass Flow Rate	lbm/hr	lbm/hr
Volume	MMCF	MMCF
Volume Flow Rate	MMCF/hr	MMCF/hr
Heating Value	BTU(60)/ft^3	BTU/ft3
Energy	MMBTU(60)	MMBTU
Energy Flow Rate	MMBTU(60)/hr	MMBTU/hr
Flow Extension	kg/m^3s	kg/m3s

Parameters and Values	Units	Realflo Display
Turbine Rate	pulses/ft^3	pulses/ft3
Altitude	feet	feet

US7 Units

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	inches	inches
Static, Base and Atmospheric Pressure	psi	psi
Differential Pressure	inches H_2O at 60 °F	in H2O at 60F
Flowing and Base Temperature	°F	F
Viscosity	centipoise	cP
Density	lbm/ft^3	lbm/ft3
Mass	lbm	lbm
Mass Flow Rate	lbm/day	lbm/day
Volume	MMCF	MMCF
Volume Flow Rate	MMCF/day	MMCF/day
Heating Value	BTU(60)/ft^3	BTU/ft3
Energy	MMBTU(60)	MMBTU
Energy Flow Rate	MMBTU(60)/ day	MMBTU/day
Flow Extension	kg/m^3s	kg/m3s
Turbine Rate	pulses/ft^3	pulses/ft3
Altitude	feet	feet

US8 Units

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	inches	inches
Static, Base and Atmospheric Pressure	psi	psi
Differential Pressure	inches H_2O at 60 °F	in H2O at 60F
Flowing and Base Temperature	°F	F
Viscosity	centipoise	cP
Density	lbm/ft^3	lbm/ft3
Mass	lbm	lbm
Mass Flow Rate	lbm/hr	lbm/hr
Volume	MCF	MCF
Volume Flow Rate	MCF/day	MCF/day
Heating Value	BTU(60)/ft^3	BTU/ft3
Energy	MMBTU(60)	MMBTU
Energy Flow Rate	MMBTU(60)/ day	MMBTU/day
Flow Extension	kg/m3s	kg/m3s
Turbine Rate	pulses/ft^3	pulses/ft3
Altitude	feet	feet

PEMEX Units

Parameters and Values	Units	Realflo Display

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	inches	inches
Static, Base and Atmospheric Pressure	psi	psi
Differential Pressure	inches H2O at 60°F	in H2O at 60F
Flowing and Base Temperature	°F	F
Viscosity	centipoise	CP
Density	lbm/ft3	lbm/ft3
Mass	lbm	lbm
Mass Flow Rate	lbm/hr	lbm/hr
Volume (standard and secondary conditions)	MMCF	MMCF
Volume Flow Rate (standard and secondary conditions)	MMCF/day	MMCF/day
Heating Value	BTU(60)/ft3	BTU/ft3
Energy	Giga calories	Giga calories
Energy Flow Rate	Giga calories/day	Giga calories/day
Flow Extension	kg/m3s	kg/m3s
Turbine Rate	pulses/ft3	pulses/ft3
Altitude	feet	feet

IP Units

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	feet	ft
Static, Base and Atmospheric Pressure	lbf/ft^2	lbf/ft2
Differential Pressure	lbf/ft^2	lbf/ft2
Flowing and Base Temperature	°F	F
Viscosity	lbm/ft-s	lbm/ft-s
Density	lbm/ft^3	lbm/ft3
Mass	lbm	lbm
Mass Flow Rate	lbm/hr	lbm/hr
Volume	ft^3	ft3
Volume Flow Rate	ft^3/hr	ft3/hr
Heating Value	BTU(60)/ft^3	BTU/ft3
Energy	BTU(60)	BTU
Energy Flow Rate	BTU(60)/hr	BTU/hr
Flow Extension	kg/m^{3}s	kg/m3s
Turbine Rate	pulses/ft^3	pulses/ft3
Altitude	feet	feet

Metric1 Units

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	Mm	mm
Static, Base and Atmospheric Pressure	kPa	kPa
Differential Pressure	kPa	kPa
Flowing and Base Temperature	°C	C
Viscosity	centipoise	cP

Parameters and Values	Units	Realflo Display
Density	kg/m^3	kg/m3
Mass	kg	kg
Mass Flow Rate	kg/s	kg/s
Volume	10^3m^3	E3m3
Volume Flow Rate	10^3m^3/day	E3m3/day
Heating Value	MJ/m^3	MJ/m3
Energy	GJ	GJ
Energy Flow Rate	GJ/day	GJ/day
Flow Extension	kg/m^3s	kg/m3s
Turbine Rate	pulses/m^3	pulses/m3
Altitude	meters	m

Metric2 Units

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	mm	mm
Static, Base and Atmospheric Pressure	bar	bar
Differential Pressure	millibar	millibar
Flowing and Base Temperature	°C	C
Viscosity	centipoise	cP
Density	kg/m^3	kg/m3
Mass	kg	kg
Mass Flow Rate	kg/hr	kg/hr
Volume	m^3	M3
Volume Flow Rate	m^3/hr	M3/hr
Heating Value	MJ/m^3	MJ/m3
Energy	MJ	MJ
Energy Flow Rate	MJ/hour	MJ/hour
Flow Extension	kg/m^3s	kg/m3s
Turbine Rate	pulses/m^3	pulses/m3
Altitude	meters	m

Metric3 Units

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	mm	mm
Static, Base and Atmospheric Pressure	MPa	MPa
Differential Pressure	kPa	kPa
Flowing and Base Temperature	°C	C
Viscosity	centipoise	cP
Density	kg/m^3	kg/m3
Mass	kg	kg
Mass Flow Rate	kg/s	kg/s
Volume	10^3m^3	E3m3
Volume Flow Rate	10^3m^3/day	E3m3/day
Heating Value	MJ/m^3	MJ/m3
Energy	GJ	GJ
Energy Flow Rate	GJ/day	GJ/day
Flow Extension	kg/m^3s	kg/m3s
Turbine Rate	pulses/m^3	pulses/m3
Altitude	meters	m

SI Units

Parameters and Values	Units	Realflo Display
Pipe and Orifice Diameters	m	m
Static, Base and Atmospheric Pressure	Pa	Pa
Differential Pressure	Pa	Pa
Flowing and Base Temperature	°K	K
Viscosity	Pa-s	Pa-s
Density	kg/m^3	kg/m3
Mass	kg	kg
Mass Flow Rate	kg/s	kg/s
Volume	m^3	m3
Volume Flow Rate	m^3/s	m3/s
Heating Value	J/m^3	J/m3
Energy	J	J
Energy Flow Rate	W	W
Flow Extension	kg/m^3s	kg/m3s
Turbine Rate	pulses/m^3	pulses/m3
Altitude	meters	m

Input Averaging

Realflo averages differential pressure, static pressure, and temperature using time-weighted or flow-weighted methods. The method is configured by the user. These methods comply with API 21.1.

Flow-Dependent Time Weighted Linear Average

Time weighted averaging can be selected for differential pressure, static pressure, and temperature inputs.

Each sample is a product of the input value (or rate) and the time interval. Each input accumulation is the sum of the samples in the time period (an hour or less). The flow duration is the sum of the time intervals in the period. The time weighted linear average is the accumulation divided by the flow duration.

The average for the period will be for all of the time intervals with flow or all of the intervals when there is no flow.

$$\bar{p}_f = \frac{1}{t_f}\sum_{i=1}^{k} p_i t_i F_i$$

$$t_f = \sum_{i=1}^{k} t_i F_i$$

Where

p_f is the average input variable during periods of flow.

t_i is the time interval for sampling i.

t_f is the total time with flow.

F_i is the flow dependency factor. Zero if no flow at sample period i, and one if flow at sample period i.

Flow Weighted Linear Average

Flow weighted averaging can be selected for differential pressure, static pressure, and temperature inputs.

Each sample is a product of the input value (or rate), the time interval and the flow weighting. Each input accumulation is the sum of the samples in the time period (an hour or less). The flow duration factor for the period is the sum of the product of the time intervals and the flow weighting. The flow weighted linear average is the accumulation divided by the flow duration factor.

The average for the period will be for all of the time intervals with flow or all of the intervals when there is no flow.

For differential pressure meters the flow weighting is the square root of the differential pressure.

For turbine meters, the flow weighting is one (i.e. there is no weighting) as the flow is linearly related to the pulse rate.

$$\bar{p}_f = \frac{1}{t_z}\sum_{i=1}^{k} p_i t_i W_i$$

$$t_z = \sum_{i=1}^{k} t_i W_i$$

Where

p_f is the average input variable during periods of flow.

t_i is the time interval for sampling i.

t_z is the total time with weighting.

W_i is the flow weighting factor. This would typically be the square root of the differential pressure for an orifice meter.

No Flow Linear Average

If there is no flow for an entire period, then a linear average of the differential pressure, static pressure, and temperature inputs is used for the entire period.

Each sample is a product of the input value (or rate) and the time interval. Each input accumulation is the sum of the samples in the time period (an hour or less). The duration factor for the period is the sum of the time intervals.

$$\bar{p}_n = \frac{1}{t_k}\sum_{i=1}^{k} p_i t_i$$

$$t_k = \sum_{i=1}^{k} t_i$$

Where

p_n is the average input variable during periods of no flow.

t_i is the time interval for sampling i.

t_k is the total time with no flow.

Creating Custom Realflo Applications

The flow computer program was developed using the C Tools for both Telepace and ISaGRAF firmware in SCADAPack controllers and C++ Tools for SCADAPack 32 controllers. User written code can be added to the Flow computer program. An object library and a source file are provided for this purpose.

The size of the custom application is limited to the application memory space available in the controller being used. The amount of memory available will depend on the controller type, SCADAPack or SCADAPack 32, the flow computer type and the run configuration. The application memory space available typically ranges from 2KB to 80KB.

If you are considering creating a custom Realflo application consult the factory for advice on the application memory available for your controller and run configuration combination.

SCADAPack Controllers

The Telepace C Tools, version 2.13 or newer, are required to modify the flow computer for Telepace firmware. The ISaGRAF C Tools, version 2.13 or newer, are required to modify the flow computer for ISaGRAF firmware.

The following files are found in the Custom Applications folder.

gasmain.c	is source code for the flow calculation main loop. Users add their source code to this file.
appstart.c	is the application program start-up routine. Refer to the C Tools manual for a complete description of this file.

Telepace Files:

Realflot.lib	is the object library for the flow calculation on Telepace standard firmware. This library is linked with the compiled gasmain.c to form a gas calculation application.
Realflot.cmd	is a linker command file for creation of executable code for Telepace standard firmware.
rfenront.lib	is the object library for the flow calculation on Telepace Enron Modbus firmware. This library is linked with the compiled gasmain.c to form a gas calculation application.
rfenront.cmd	is a linker command file for creation of executable code for Telepace Enron Modbus firmware.

ISaGRAF Files:

Realfloi.lib	is the object library for the flow calculation on ISaGRAF standard firmware. This library is linked with the compiled gasmain.c to form a gas calculation application.
Realfloi.cmd	is a linker command file for creation of executable code for ISaGRAF standard firmware.

rfenroni.lib	is the object library for the flow calculation on ISaGRAF Enron Modbus firmware. This library is linked with the compiled gasmain.c to form a gas calculation application.
rfenroni.cmd	is a linker command file for creation of executable code for ISaGRAF Enron Modbus firmware

Modifying the Application

The file gasmain.c contains the main function of the C program. The function is listed below.

```
void main(void)
        {
        TASKINFO taskStatus;

        /* create gas flow computer tasks */
        create_task(gasTaskScheduler, 4, APPLICATION,
2);
        create_task(gasFlowTask, 2, APPLICATION, 8);

        /* add user application code here */

        /* end execution of this task */
        taskStatus = getTaskInfo(0);
        end_task(taskStatus.taskID);
        }
```

The function creates two tasks for the flow computer. Do not modify the following lines. Doing so may interfere with the proper operation of the flow computer.

```
        create_task(gasTaskScheduler, 4, APPLICATION,
2);
        create_task(gasFlowTask, 2, APPLICATION, 8);
```

User code may be added at the point indicated by the comment:

```
        /* add user application code here */
```

User code normally takes the form of an infinite loop that performs the required functions. It is important that the user's code properly uses the IO_SYSTEM resource and that it releases the processor. The code fragment below shows the typical form of the loop.

```
while (TRUE)
 {
 /* code placed here does not use the I/O system*/

/* obtain exclusive use of the I/O system */
 request_resource(IO_SYSTEM);

/* code placed here uses the I/O system */

 /* allow other tasks to use the I/O system */
 release_resource(IO_SYSTEM);
```

```
/* allow other priority 1 tasks to execute */
release_processor();
}
```

If the code is not an infinite loop, it is executed once only. This form can be used for initialization or for creation of other tasks. Once the one-time code is executed, the lines below end the main task.

```
/* end execution of this task */
taskStatus = getTaskInfo(0);
end_task(taskStatus.taskID);
```

Refer to the C Tools User Manual for a description of rules and guidelines for C programs.

Building the Application for Telepace Firmware

Execute the following commands to build the flow computer program. The first two lines compile the standard files for the Realflo Flow Computer application. The next line links the object files with the rest of the Realflo application. The executable file will be named Realflot.abs.

For standard Telepace:

```
mccm77 -v -nQ -Ml -g -c -Ic:\Telepace\ctools\520x appstart.c
mccm77 -v -nQ -Ml -g -c -Ic:\Telepace\ctools\520x gasmain.c
lnkm77 -M -c Realflot.cmd
```

For Enron Modbus Telepace:

```
mccm77 -v -nQ -Ml -g -c -Ic:\Telepace\ctools\520x appstart.c
mccm77 -v -nQ -Ml -g -c -Ic:\Telepace\ctools\520x gasmain.c
lnkm77 -M -c rfenront.cmd
```

You can write a batch file to execute the commands or use a make utility to control the compilation of the program.

If you add additional files compile them in the manner shown above. Add the files to the linker command file Realflot.cmd. Refer to the Telepace C Tools User Manual for details.

Building the Application for ISaGRAF Firmware

Execute the following commands to build the flow computer program. The first two lines compile the standard files for the Realflo Flow Computer application. The next line links the object files with the rest of the Realflo application. The executable file will be named Realfloi.abs.

For standard ISaGRAF:

```
mccm77 -v -nQ -Ml -g -c -Ic:\Telepace\ctools\isagraf appstart.c
mccm77 -v -nQ -Ml -g -c -Ic:\Telepace\ctools\isagraf gasmain.c
lnkm77 -M -c Realfloi.cmd
```

For Enron Modbus ISaGRAF:

```
mccm77 -v -nQ -Ml -g -c -Ic:\Telepace\ctools\isagraf appstart.c
mccm77 -v -nQ -Ml -g -c -Ic:\Telepace\ctools\isagraf gasmain.c
lnkm77 -M -c rfenroni.cmd
```

You can write a batch file to execute the commands or use a make utility to control the compilation of the program. If you add additional files compile them in the manner shown above. Add the files to the linker command file Realfloi.cmd. Refer to the ISaGRAF C Tools User Manual for details.

SCADAPack 314/330/334 and SCADAPack 350 Controllers

The SCADAPack 314/330/334 and SCADAPack 350 controllers support multiple C/C++ programs running in the controller.

See the SCADAPack 350 C/C++ Tools User manual for complete information.

SCADAPack 32 Controllers

The following files and folders are found in the SCADAPack 32 Flow Computer folder.

SCADAPack32FlowComputer.hws	The Hitachi Workspace file. Refer to the SCADAPack 32 C++ Tools manual for a complete description of this file.
SCADAPack32FlowComputer.hww	The Hitachi Workspace Session file. Refer to the Hitachi Help in the Hitachi Embedded Workshop.

Realfloi Files

appsettings.src	is the application program start-up settings. Refer to the SCADAPack 32 C++ Tools manual for a complete description of this file.
appstart.cpp	is the application program start-up routine. Refer to the SCADAPack 32 C++ Tools manual for a complete description of this file.
gasmain.cpp	is source code for the flow calculation main loop. Users add their source code to this file.
Realfloi.hwp	is the Workspace project file.
ISaGRAF_Realflo.lib	is the object library for the flow calculation on ISaGRAF firmware. This library is linked with the compiled gasmain.c to form a gas calculation application.
Debug Application.hdc	is the Hitachi debugger file.

Realflot Files

appsettings.src	is the application program start-up settings. Refer to the SCADAPack 32 C++ Tools manual for a complete description of this file.
appstart.cpp	is the application program start-up routine. Refer to the SCADAPack 32 C++ Tools manual for a complete description of this file.
gasmain.cpp	is source code for the flow calculation main loop. Users add their source code to this file.
Realflot.hwp	is the Workspace project file.

Telepace_Realflo.lib	is the object library for the flow calculation on Telepace firmware. This library is linked with the compiled gasmain.c to form a gas calculation application.
Debug Application.hdc	is the Hitachi debugger file.

Modifying the Application

The file gasmain.cpp contains the main function of the C++ program. The function is listed below.

```
/* ------------------------------------------------------------------
   gasmain.cpp
   Gas Flow Computer Start-Up Routine
   Copyright 1997-2001, Control Microsystems Inc

   copied from newApp.cpp
   SCADAPack 32 C++ Application Main Program
   Copyright 2001, Control Microsystems Inc.
   ------------------------------------------------------------- */
#include <ctools.h>

/* ------------------------------------------------------------------
   Function Prototypes
   ------------------------------------------------------------- */
#ifdef __cplusplus
extern "C"
{
#endif

extern void main(void);

extern void gasTaskScheduler(void);
extern void gasFlowTask(void);

#ifdef __cplusplus
}
#endif

/* -------------------------------------------------------------------
   main

   This routine is the main application loop.
   ------------------------------------------------------------- */
void main(void)
{
      TASKINFO taskStatus;

      /* create gas flow computer tasks */
      create_task(gasTaskScheduler, 4, APPLICATION, 2);
      create_task(gasFlowTask, 2, APPLICATION, 6);

      /* add user application code here */

      /* end execution of this task */
      getTaskInfo(0, &taskStatus);
      end_task(taskStatus.taskID);
```

```
}
```

The function creates two tasks for the flow computer. Do not modify the following lines. Doing so may interfere with the proper operation of the flow computer.

```
create_task(gasTaskScheduler, 4, APPLICATION, 2);
create_task(gasFlowTask, 2, APPLICATION, 8);
```

User code may be added at the point indicated by the comment:

```
/* add user application code here */
```

User code normally takes the form of an infinite loop that performs the required functions. If the code is not an infinite loop, it is executed once only. This form can be used for initialization or for creation of other tasks. Once the one-time code is executed, the lines below end the main task.

```
/* end execution of this task */
taskStatus = getTaskInfo(0);
end_task(taskStatus.taskID);
```

Refer to the SCADAPack 32 C++ Tools User Manual for a description of rules and guidelines for C++ programs.

Building the Application

Once the editing of the project is completed the application needs to be compiled and linked. This process results in an executable file that can be loaded into the SCADAPack 32 controller.

To compile and link the project:

- Select **Build All** from the HEW **Build** menu.
- The HEW Output window will show the progress of the compiling and linking process.

The application is successfully built if there are no Errors or Warnings displayed in the Output window. The following should appear in the Output window when the application is build successfully:

```
Build Finished
0 Errors, 0 Warnings
```

Measurement Canada Approved Version

Customers with measurement sites that require Measurement Canada custody transfer approval for natural gas flow measurement, can take advantage of the cost effective and flexible SCADAPack solution. The Measurement Canada version utilizes the same flow calculations as other Realflo related installations, but comes with the specific software and hardware required to meet the Measurement Canada requirements for sealing and inspection by Measurement Canada. The approved flow computers may be used with AGA-3 (orifice plate flow measurement), AGA-7 (turbine flow measurement), or Vcone flow elements.

Three standard enclosure configurations are available for Measurement Canada approved versions. Selection of enclosure size can be made based on the equipment required within the approved cabinet. Each cabinet meets NEMA4X specifications and includes a windowed door for controller diagnostic LED viewing.

Measurement Canada approval depends on meeting requirements for locking out program changes and firmware changes. This is accomplished by disabling certain commands in the flow computer.

Flow Computer Disabled Commands

The Realflo commands listed in the table below are disabled when the lockout device is installed. Error code 30064 is returned when these commands are attempted when the lockout device is installed.

Command Number	***Command Description***
3	Set input configuration
6	Set Real Time Clock
9	Adjust Real Time Clock
15	Set contract configuration
16	Set number of runs
17	Set Flow Computer ID
19	Set Run ID
21	Set Long Run ID
30	Start Temperature Calibration: Force current temperature
31	Start Temperature Calibration: Force fixed temperature
32	End Temperature Calibration
34	Start Static Pressure Calibration: Force current static pressure
35	Start Static Pressure Calibration: Force fixed static pressure
37	End Static Pressure Calibration
38	Start Differential Pressure Calibration: Force current differential pressure
40	Start plate change: force current temperature
41	Start plate change: force fixed temperature
42	End plate change: temperature
43	Start plate change: force current static pressure
44	Start plate change: force fixed static pressure

Command Number	Command Description
45	End plate change: static pressure
46	Start plate change: force current differential pressure
47	Start plate change: force fixed differential pressure
48	End plate change: differential pressure
75	Start Pulse Count Calibration: Force current pulse count rate
76	Start Pulse Count Calibration: Force fixed pulse count rate
77	End Pulse Count Calibration
78	Force current temperature
79	Force fixed temperature
80	Remove forced temperature
81	Force current static pressure
82	Force fixed static pressure
83	Remove forced static pressure
84	Force current differential pressure
85	Force fixed differential pressure
86	Remove forced differential pressure
87	Force current pulse count rate
88	Force fixed pulse count rate
89	Remove forced pulse count rate
102	Delete account
103	Update account
130	Search for MVT sensor
131	Change address of MVT sensor
133	Set MVT configuration
135	Calibrate MVT sensor
138	Set Display Control Configuration
139	Set Sensor Mode
151	Set Custom Display Configuration
303	Set AGA-3 (1992) configuration
353	Set AGA-3 (1985) configuration
703	Set AGA-7 configuration
803	Set AGA-8 gas ratios
804	Set AGA-8 Hexanes+ Gas Ratios
1903	Set NX19 gas ratios
2203	Set V-Cone Configuration

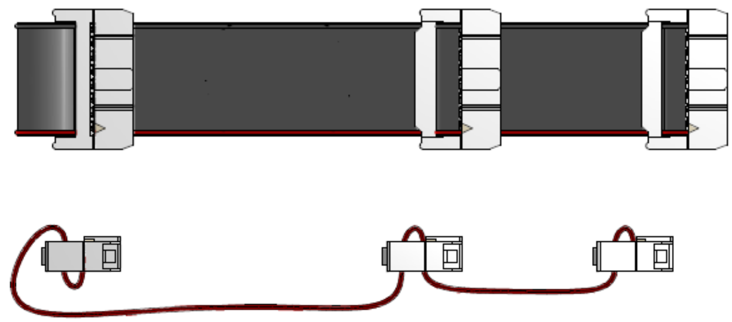
Enron Protocol Disabled Commands

The Enron Protocol commands listed in the table below are disabled when the lockout device is installed. The flow computer will return an exception response, with exception code 1, when these commands are attempted when the lockout device is installed.

Command Number	Command Description
5	Force Boolean state
6	Force numeric register
15	Load multiple states
16	Load multiple registers

Measurement Canada Lockout Cable

The Measurement Canada lockout cable is use with SCADAPack, SCADAPack LP, SCADAPack 32 and SCADAPack 314/330/334 flow computers. The cable is a standard IMC cable with a jumper between the /SELECT line and ground on the cable. The cable can be inserted anywhere on the I^2C bus. The cable and side view are shown below.



Measurement Canada Approved Flow Computers

In order for a flow computer to be Measurement Canada approved it needs to meet measurement accuracy and performance standards. The approved flow computers require that a specific firmware version and flow computer version be used. In addition the flow computer requires a lockout device so that changes cannot be made to the firmware or meter run configuration. The requirements for each approved flow computer type is described below.

SCADAPack 32

The lockout device is a special cable attached to the I^2C bus. The cable pulls the /SELECT line low. If the flow computer option is enabled and the select line is low the commands listed in the ***Flow Computer Disabled Commands*** section are disabled.

- SCADAPack 32 firmware version 2.16 (Telepace or ISaGRAF) is required for Measurement Canada operation.
- Flow computer version 6.74 is is required for Measurement Canada operation.

SCADAPack 314

The lockout device is a special cable attached to the I^2C bus. The cable pulls the /SELECT line low. If the flow computer option is enabled and the select line is low the commands listed in the ***Flow Computer Disabled Commands*** section are disabled.

- SCADAPack 314 firmware version 1.51 (Telepace or ISaGRAF) is required for Measurement Canada operation.
- Flow computer version 6.74 is is required for Measurement Canada operation.

SCADAPack 330/334

The lockout device is a special cable attached to the I^2C bus. The cable pulls the /SELECT line low. If the flow computer option is enabled and the select line is low the commands listed in the ***Flow Computer Disabled Commands*** section are disabled.

- SCADAPack 330/334 firmware version 1.51 (Telepace or ISaGRAF) is required for Measurement Canada operation.
- Flow computer version 6.74 is is required for Measurement Canada operation.

SCADAPack and SCADAPack LP

The lockout device is a special cable attached to the I^2C bus. The cable pulls the /SELECT line low. If the flow computer option is enabled and the select line is low the commands listed in the ***Flow Computer Disabled Commands*** section are disabled.

- SCADAPack firmware version 2.30 (Telepace or ISaGRAF) is required for Measurement Canada operation.
- Flow computer version 6.10 is is required for Measurement Canada operation.

SolarPack 410

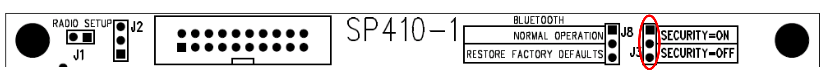
The SolarPack 410 security jumper is used to enable or disable programming commands and firmware uploads.

When in the **SECURITY ON** position:

- Realflo cannot make changes to the SolarPack 410 flow computer configuration. The commands listed in the ***Flow Computer Disabled Commands*** section are disabled.
- Host and HMI systems cannot make changes to the SolarPack 410 flow computer configuration using the TeleBUS Command sequence.
- New firmware cannot be loaded into the SolarPack 410

When in the **SECURITY OFF** position security is effectively disabled. Realflo and HMI commands are processed by the SolarPack 410. New firmware can be loaded into the SolarPack 410.

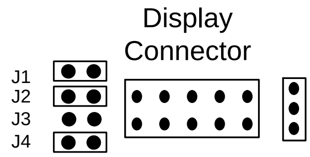
Refer to the figure below for the position of the header and jumper link labeled J3.



- SolarPack firmware version 1.51 (Telepace or ISaGRAF) is required for Measurement Canada operation.
- Flow computer version 6.74 is is required for Measurement Canada operation.

SCADAPack 4203 DR

The SCADAPack 4203DR controller does not have an I^2C bus. Jumper J4 at the left side of the Display connector on the 4203 is used to enable or disable the Measurement Canada lock out. If the flow computer option is enabled and jumper J1 is removed the commands listed in the ***Flow Computer Disabled Commands*** section are disabled.

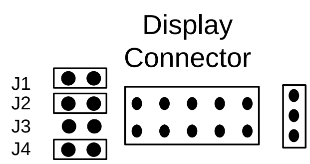


J1 - System Jumper, Required
J2 - System Jumper, Required
J3 - Not Used
J4 - Remove for Measurement Canada

- SCADAPack firmware version 1.51 (Telepace or ISaGRAF) is required for Measurement Canada operation.
- Flow computer version 6.74 is is required for Measurement Canada operation.

SCADAPack 4203 DS

The SCADAPack 4203DS controller does not have an I^2C bus. Jumper J4 at the left side of the Display connector on the 4203 is used to enable or disable the Measurement Canada lock out. If the flow computer option is enabled and jumper J1 is removed the commands listed in the ***Flow Computer Disabled Commands*** section are disabled.



J1 - System Jumper, Required
J2 - System Jumper, Required
J3 - Not Used
J4 - Remove for Measurement Canada

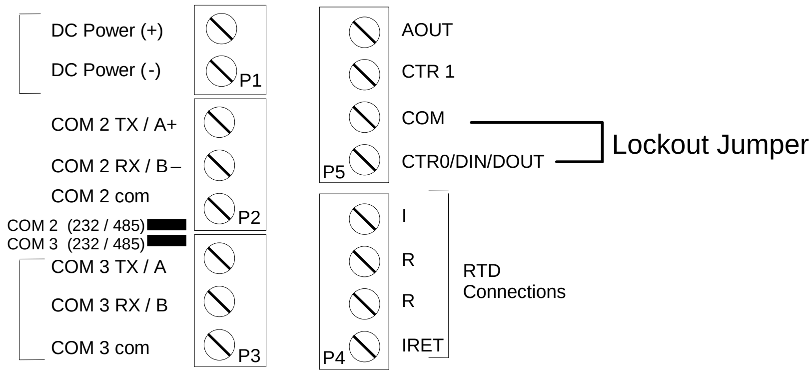
- SCADAPack firmware version 1.51 (Telepace or ISaGRAF) is required for Measurement Canada operation.
- Flow computer version 6.74 is is required for Measurement Canada operation.

SCADAPack 4202 DR

The SCADAPack 4202DR controller does not have an I^2C bus. The lockout is implemented using digital input 0. To allow this input to be used to lock out the programming features custom firmware is required. This firmware is installed only for Measurement Canada flow computer installations. Digital input 0 will not be available for other uses when the custom firmware is installed.

If digital input 0 is connected to ground (COM) and the flow computer option is enabled the command are disabled.

- SCADAPack firmware version 2.30 (Telepace or ISaGRAF) is required for Measurement Canada operation.
- Flow computer version 6.10 is is required for Measurement Canada operation.

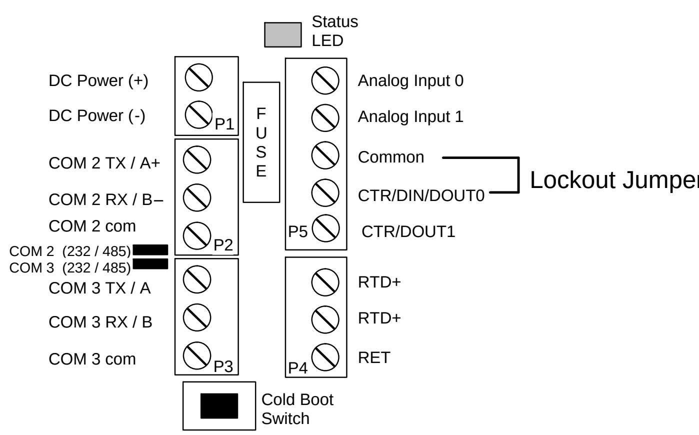


SCADAPack 4202 DS

The SCADAPack 4202DS controller does not have an I²C bus. The lockout is implemented using digital input 0. To allow this input to be used to lock out the programming features custom firmware is required. This firmware is installed only for Measurement Canada flow computer installations. Digital input 0 will not be available for other uses when the custom firmware is installed.

If digital input 0 is connected to ground (COM) and the flow computer option is enabled the command are disabled.

- SCADAPack firmware version 2.30 (Telepace or ISaGRAF) is required for Measurement Canada operation.
- Flow computer version 6.10 is is required for Measurement Canada operation.



DNP3 Protocol User Manual

DNP, the Distributed Network Protocol, is a standards-based communications protocol developed to achieve interoperability among systems in the electric utility, oil & gas, water/waste water and security industries. This robust, flexible non-proprietary protocol is based on existing open standards to work within a variety of networks.

DNP offers flexibility and functionality that go far beyond conventional communications protocols. Among its robust and flexible features DNP 3.0 includes:

- Multiple data types (Data Objects) may be included in both request and response messages.
- Multiple master stations are supported for outstations.
- Unsolicited responses[1] may be initiated from outstations to master stations.
- Data types (Objects) may be assigned priorities (Class) and be requested based on the priority.
- Addressing for over 65,000 devices on a single link.
- Time synchronization and time-stamped events.
- Broadcast messages.
- Data link and application layer confirmation
- Internal indications that report the health of a device and results of last request.
- Select-Before-Operate which is the ability to choose extra reliability when operating outputs.

DNP Overview

DNP Architecture

DNP is a layered protocol that is based on the Open System Connection (OSI) 7-layer protocol. DNP supports the physical, data link and application layers only and terms this the Enhanced Performance Architecture (EPA). In addition to these three layers an additional layer, the pseudo-transport layer, is added to allow for larger application layer messages to be broken down into smaller frames for the data link layer to transmit.

Object Library The data objects (Binary Inputs, Binary Outputs, and Analog Inputs etc.) that reside in the master or outstation.

Application Layer Application tasks for sending of solicited requests (master messages) to outstations or sending of unsolicited responses from outstations. These request and response messages are referred to as fragments in DNP.

[1] Unsolicited responses are also known as unsolicited messages

Pseudo-Transport Layer	Breaks the application layer messages into smaller packets that can be handled by the data link layer. These packets are referred to as frames in DNP.
Data Link Layer	Handles the transmission and reception of data frames across the physical layer.
Physical Layer	This is the physical media, such as serial or Ethernet, which DNP communicates.

These layers are described in the following sections of this manual.

Object Library

The data types that are used in DNP are broadly grouped together into Object Groups such as Binary Input Objects and Analog Input Objects etc. Individual data points, or objects within each group, are further defined using Object Variations such as Binary Input Change with Time and 16-Bit Analog Inputs for example.

In general there are two categories of data within each data type, static objects and event objects. Static objects contain the current value of the field point or software point. Event objects are generated as a result of the data changing.

In addition to the object group and variation data objects can be assigned to classes. In DNP there are four object classes, Class 0, Class 1, Class 2 and Class 3. Class 0 contains static data. Classes 1, 2 and 3 provide a method to assign priority to event objects. While there is no fixed rule for assigning classes to data objects typically class 1 is assigned to the highest priority data and class 3 is assigned to the lowest priority data.

This object library structure enables the efficient transfer of data between master stations and outstations. The master station can poll for high priority data (class 1) more often than it polls for low priority data (class 3). As the data objects assigned to classes is event data when the master polls for a class only the changed, or event data, is returned by the outstation. For data in an outstation that is not assigned a class the master uses a class 0 poll to retrieve static data from the outstation.

DNP allows outstations to report data to one or more master stations using unsolicited responses (report by exception) for event data objects. The outstation reports data based on the assigned class of the data. For example the outstation can be configured to only report high priority class 1 data.

Internal Indication (IIN) Flags

The Internal Indication (IIN) flags are set by a slave station to indicate internal states and diagnostic results. The following tables show the IIN flags supported by SCADAPack controllers. Bits except *Device Restarted* and *Time Synchronization required* are cleared when the slave station receives any poll or read data command.

The IIN is set as a 16 bit word divided into two octets of 8 bits. The order of the two octets is:

First Octet	Second Octet

IIN First Octet

7	6	5	4	3	2	1	0	Bit Number

First Octet Bit	Description
0	last received message was a broadcast message
1	Class 1 data available
2	Class 2 data available
3	Class 3 data available
4	Time Synchronization required
5	not used (returns 0)
6	Device trouble • Indicates memory allocation error in the slave, or • For master in mimic mode indicates communication failure with the slave device.
7	Device restarted (set on a power cycle)

IIN Second Octet

7	6	5	4	3	2	1	0	Bit Number

Second Octet Bit	Description
0	Function Code not implemented
1	Requested object unknown or there were errors in the application data
2	Parameters out of range
3	Event buffer overflowed Indicates event buffer overflow in the slave or master. The slave will set this bit if the event buffer in the slave is overflowed. The master will set this bit if the event buffer in the master has overflowed with events read from the slave. Confirm the event buffer size, in the master and slave, is set to a value that will not cause the buffer to overflow and avoid that events are lost.
4	not used (returns 0)
5	not used (returns 0)
6	not used (returns 0)
7	not used (returns 0)

Application Layer

The application layer in DNP is responsible for the processing of complete messages for requesting, or responding to requests, for data.

The following shows the sequence of Application Layer messages between one master and one outstation.

```
Master                                    Outstation
         Send Request ------------> Accept request and process
                      <------------ Optional Application Confirmation

         Accept response   <------------- Send Response
         Optional Application
         Confirmation      ------------->
```

Change detected

```
         Accept response <-------------- Send Unsolicited Response
         Optional Application
         Confirmation    -------------->
```

The complete messages are received from and passed to the pseudo-transport layer. Application layer messages are broken into fragments with each fragment size usually a maximum of 2048 bytes. An application layer message may be one or more fragments in size and it is the responsibility of the application layer to keep the fragments are properly sequenced.

Application layer fragments are sent with or without a confirmation request. When a confirmation is requested the receiving device replies with a confirmation indicating the message was received and parsed without any errors.

Pseudo-Transport Layer

The pseudo-transport layer formats the larger application layer messages into smaller packets that can be handled by the data link layer. These packets are referred to as frames in DNP. The pseudo-transport layer inserts a single byte of information in the message header of each frame. This byte contains information such as whether the frame is the first or last frame of a message as well as a sequence number for the frame.

Data Link Layer

The data link layer handles the transmission and reception of data frames across the physical layer. Each data link frame contains a source and destination address so the receiving device knows where to send the response. For data integrity data link layer frames contain two CRC bytes every 16 bytes.

Data link layer frames are sent with or without a confirmation request. When a confirmation is requested the receiving device replies with a confirmation indicating the message was received and the CRC checks passed.

Physical Layer

The physical layer handles the physical media, such as serial or Ethernet, which DNP communicates.

Modbus Database Mapping

In SCADAPack controllers static DNP objects such as binary input, analog input, binary counter and analog output are associated with Modbus registers. Whenever a DNP object is created an associated Modbus register(s) is also assigned. Application programs executing in the SCADAPack controller, C or logic, are able to assign physical I/O to Modbus registers using the Telepace Register Assignment or the ISaGRAF I/O Connection and these physical I/O points can then be assigned to DNP objects. User application data such as runtimes, flow totals and others can also be assigned to DNP objects.

This architecture enables DNP master stations and outstations to pass not only physical data points between them but also to monitor and control user applications executing in the SCADAPack controller. For example a master station can monitor a level in an outstation and then, based on the application program, send a setpoint value to another outstation to control the level.

SCADAPack DNP Operation Modes

Within a DNP network, a SCADAPack controller can operate as a:

- DNP Outstation (Slave)
- DNP Master or Mimic Master or
- DNP Router

DNP Master Mimic and DNP Router are incompatible and mutually-exclusive modes of operation.

A DNP outstation forms the basic class of any DNP node in a network. Other operational modes derive from a DNP Outstation. A DNP outstation responds to requests from one or more DNP master stations on a network. Also, a DNP Outstation is able to initiate unsolicited responses (messages) based on event data to a master station.

A DNP Master is capable of polling for data, accepting and processing unsolicited messages, and sending control commands to an outstation. Note that a DNP Master can also act perform the duties of a DNP Outstation.

A SCADAPack controller acting as a DNP Router is simply acting a pass through, basically redirecting messages from one DNP node to another. Similarly to a DNP Master, a DNP Router can also perform all the duties of a DNP Outstation.

DNP Network topologies comprise several combinations of DNP Masters, DNP Routers, and DNP Outstations. Typical configurations possible with SCADAPack controllers are:

- DNP Master and single DNP Outstation
- DNP Master and multi-dropped DNP Outstations
- DNP SCADA Host, Data Concentrator (Mimic Master) and multi-dropped DNP Outstations
- DNP SCADA Host, DNP Router and multi-dropped DNP Outstations

Major SCADAPack DNP operation modes are covered in the next chapters.

SCADAPack DNP Outstation

A DNP3 Outstation can be considered the base class of terminal nodes on a DNP network. Other DNP3 configuration modes, such as Master, Mimic Master or Router, as implemented by the Control Microsystems DNP driver, inherit their properties from the outstation base class. In other words, a

SCADAPack controller can simultaneously take on any other operation mode, in addition to being a DNP outstation.

When configured as a DNP outstation a SCADAPack controller is able to:

- Map physical I/O data to DNP points.
- Define DNP points as Class 0 (Static or None), Class 1, Class 2 or Class 3 data types.
- Respond to requests from one or more master stations such as a SCADA hosts or other SCADAPack controllers capable of operating as DNP Masters.
- Initiate unsolicited responses to one or more master stations.

‘Unsolicited responses’ are also known as ‘unsolicited messages’. ‘Unsolicited messages’ will be used predominantly in this document.

One distinguishing feature of a DNP outstation is this ability to trigger unsolicited messages to a master, upon event accumulation. Events are accumulated when the state of a DNP point changes or an analog values exceeds a threshold. Dead bands can be used to filter out noise from being reported as event data.

After accumulating a certain number of DNP events, or if a certain time period has expired, a DNP outstation will trigger an unsolicited message to its configured master DNP stations, reporting event data. As defined by the DNP specification, an outstation that triggers an unsolicited message expects a confirmation from the targeted masters (or peers). If an acknowledgement is not received with a configured **Application Layer** timeout, the outstation will retransmit the initial unsolicited message. If no response is received within the Application Layer timeout, the outstation will retransmit again. This process continues until the outstation has retransmitted the message a number of times as configured by its **Application Layer Retries** parameter.

If retry attempts are not sucessful, this message is discarded from the transmit buffer. As of this writing, re-transmission of the message will only resume after a new event occurs within the appropriate buffer. Future releases of the SCADAPack DNP driver will re-attempt a DNP transaction after a random period of time has expired. Retransmissions will be attempted until the messages are eventually received by the master.

Application Layer messages that are larger than **249 bytes** are broken down into Data Link frames. The DNP protocol allows one to configure acknowledgements of individual Data Link frames, this enhancing network robustness, especially under noisy environments. When the underlying network structure is noise free (wired or networks for instance), enabling Application and Data Link confirmations are not necessary.

How to Configure SCADAPack DNP Outstation

In this exercise, we will configure a DNP outstation with address 10. We will also configure the station with digital input points associated with Class 1 and Class 2 events. The station will be configured to trigger unsolicited messages to Master station 200, when Class 1 and Class 2 events occur on these digital inputs.

After this exercise, you should be able to:

- Enable the DNP protocol on a serial port.

- Configure the DNP Application and Data Link Layers
- Configure Class Events Generation and Transmission
- Configure a DNP Routing table
- Configure DNP points.

We will map two digital inputs mapped to Modbus registers 10001 and 10002 to DNP Addresses 1 and 2.

Tasks to Complete

- Enable DNP Protocol on communication interface.
- Configure a DNP Outstation with station address.
- Configure DNP points and assign them to Class objects.
- Configure outstation to be able to trigger unsolicited messages.

Enable DNP on Communication Interface

The first step recommended in configuration the DNP driver on a SCADAPack controller is to enable DNP on the communication interface. To enable the DNP protocol on com2,

- From the Controller menu in either Telepace or ISaGRAF, select Serial Ports.
- Select COM2 from the Port dropdown list.
- Set the Protocol type to DNP.
- Click on OK.
- If using an Ethernet equipped controller, enable DNP in TCP or DNP in UDP from the Controller IP configuration dialog.

Configure DNP Outstation

From the **Controller** Menu in either Telepace or ISaGRAF, select **DNP Configuration** to launch the DNP Configuration dialog.

The **Application Layer** configuration panel is displayed by default.

- Under the Communication group box, change the **Retries** parameter to 2.
- Leave other parameters under the Communication group box at default values.

> TIP: It is not necessary to enable the Application Layer confirmation as unsolicited events, by their nature, request for an Application Layer confirmation.

- **Set** Time Synchronization **to** None**.**

> TIP: It is recommended that a DNP3 master initiate time synchronization.

- Enable Unsolicited Class 1 events.
- For Class 1 Events, set a **Hold Time** of 5 seconds and a **Hold Count** of 100.

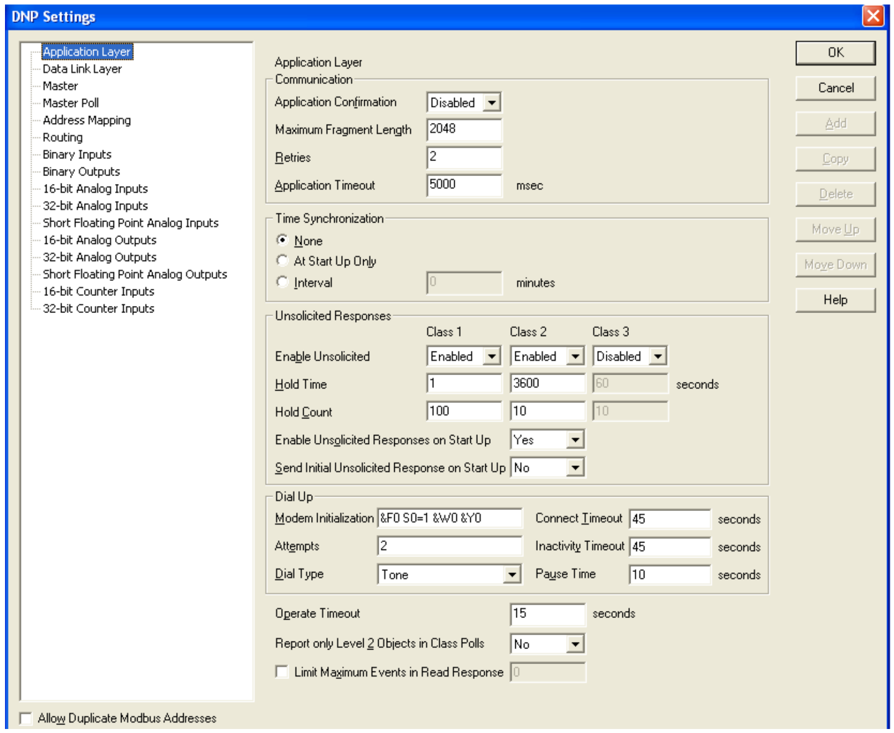
> TIP: On systems with multiple outstations that could potentially transmit unsolicited messages to a master at the same time, it is recommended to

use a combination of the Hold Time and Hold Count parameters to avoid multiple stations from transmitting at the same time.

- Enable Unsolicited Class 2 events.
- For Class 2 Events, set a Hold Time of **3600** seconds and a Hold Count of **10.**

TIP: Class 2 events are typically of less importance than Class 1 events and may not need to be reported immediately to the master

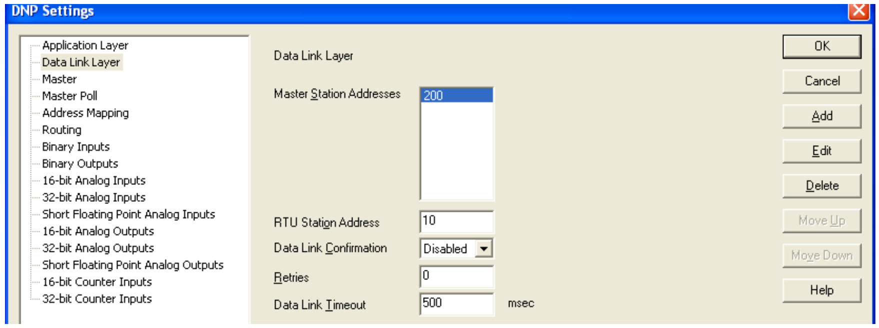
- Other parameters can be left at their default values. The completed Application Layer Configuration panel should look like this:



Clicking on OK closes the DNP Configuration dialog. Click on OK only after you have completed the DNP configuration.

From the **DNP Configuration** panel, select the **Data Link Layer** tree node.

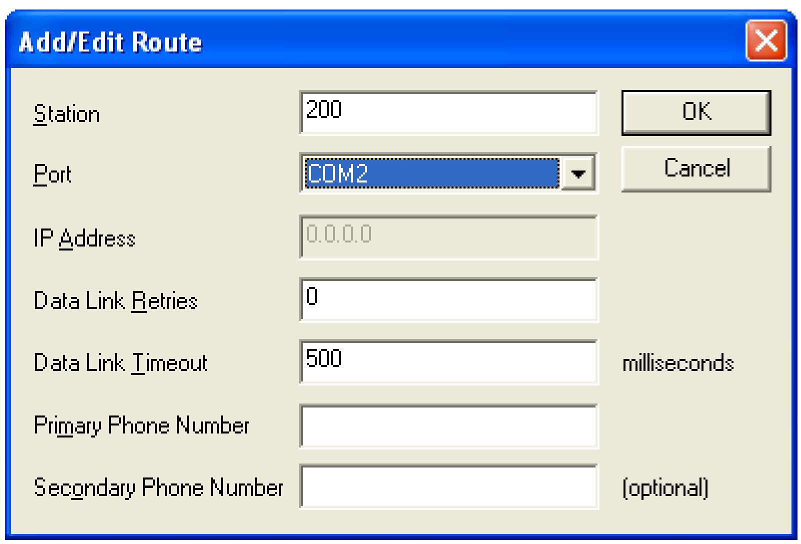
- Click on the **Edit** button and change the Master **Station Address** to 200.
- Change the **RTU Station Address** to 10.
- Leave other parameters at their default values. The completed dialog should look like this:



TIP: It may be necessary to enable the Data Link confirmation on noisy networks. However, if the Maximum Application Fragment Length is reduced to 249 bytes, it is not necessary to enable the Data Link confirmation, as each data link packet is in essence an Application Layer fragment.

From the **DNP Configuration** panel, select the **Routing** tree node**.**

- Click on the **Add** button to begin a new routing table entry.
- From the Add/Edit Route dialog,
    - Enter 200 for the destination **Station**.
    - Set the **Port** to COM2.
    - Leave default values for other parameters.
    - The completed dialog should look like this:

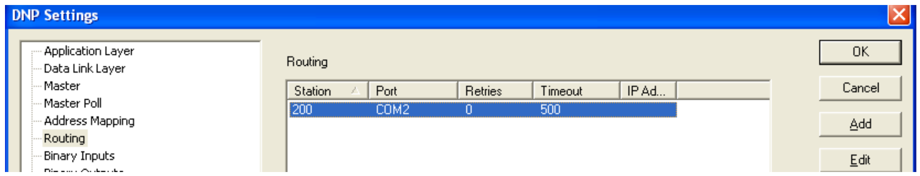


The Data Link Timeout in this dialog takes precedence over the Data Link Timeout in the Data Link Layer configuration panel.

TIP: Even though a SCADAPack outstation will respond successfully to master request, without is routing entry to the master, it is a good practice to define such a routing entry from an outstation to its master. Moreover, without a routing entry defined to the master, the outstation will not know which port to send out unsolicited messages, if configured, to the master.

- Click on **OK** to add this entry to the routing table and return to the Routing dialog.

The completed routing table should look like this:



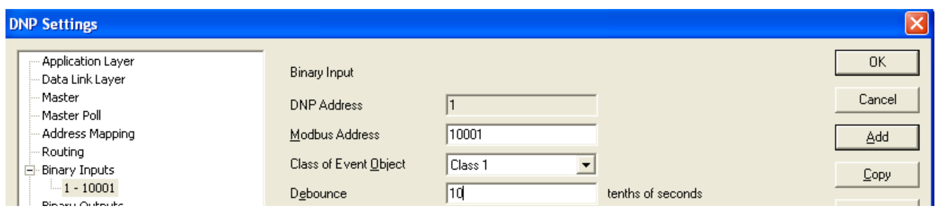
This next step assumes you have digital inputs mapped to Modbus registers 10001 and 10002.

From the **DNP Configuration Panel,** click on the **Binary** Inputs tree node**.**

- Set the Starting DNP Address to 1.
- Set the Event Report Method to Log All Events.

If you want to log all events and not only the most recent, you need to set the Event Reporting Method to Log all Events.

- Set the Event Buffer Size to 100. The completed panel should look like this:



- Click on **Add** to create a new DNP3 binary input point. Observe that a new binary input point is now visible under the Binary Input tree node with DNP Address 1 (Starting Address)
- Leave the default associating **Modbus Address** as 10001.
- Leave the default **Event Object** as Class 1.
- Set the **Debounce** property to 10.

TIP: It is a good idea to set a non- zero Debounce on unfiltered inputs, to avoid noise being collected as Class events. The same applies for analog inputs. A non-zero Deadband will keep noise from being collected as Class events.

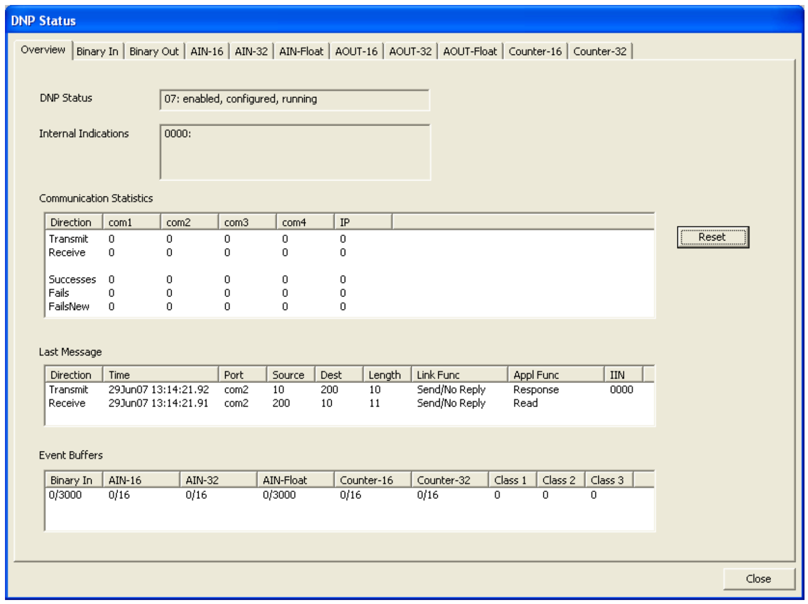
- Set the **Debounce** property to 10.
- Click on **Add** to submit this point to the database and start configuration for the next point. A new point has been added under the Binary Inputs tree node in the DNP Configuration panel.
- Change the associating **Modbus Address** to 10002.
- Change the **Event Object** to Class 2.
- Set the **Debounce** appropriately.

- Click on **Add** to submit this point to the database and start configuration for the next point.
- Repeat the previous two steps to add more points if desired.
- Follow a similar procedure to configure other types of DNP3 objects.

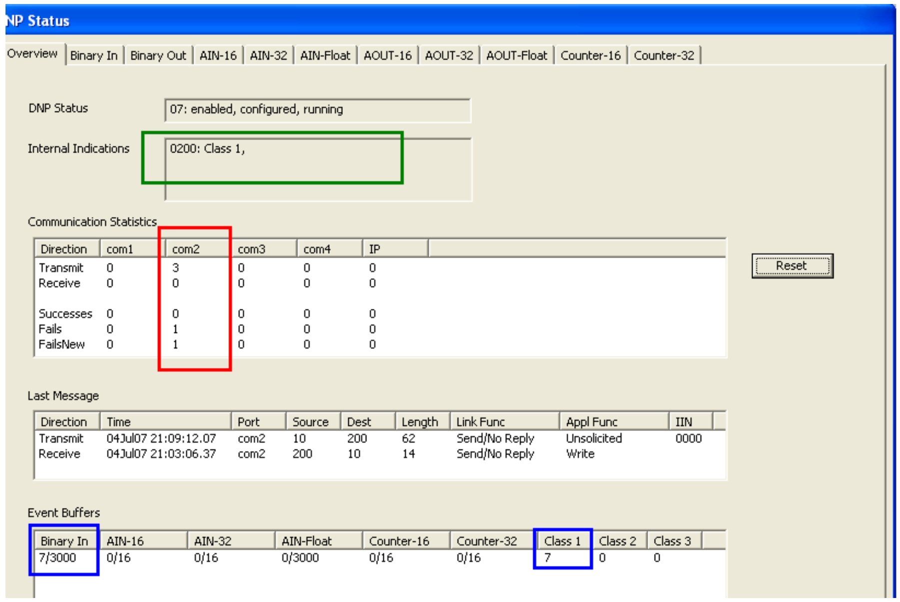
Confirm Successful Configuration

To confirm that the DNP driver has been properly configured,

From the **Controller** menu, select **DNP Status**. You will be presented with the following dialog.



- Check that the DNP Status field within this dialog displays 07: enabled, configured, running
- You can also monitor the current state of the defined DNP binary input points from the Binary-In tab.
- Toggle the state of digital input 1 configured earlier in this exercise and observe the event buffer for Binary Inputs increment on each change of state. After 5 seconds has elapsed, an unsolicited DNP message is triggered to master station 200. Given that DNP master station 200 is not yet configured and connected, a response to the unsolicited message will not be received and the 5000ms Application layer timeout period will expire. The unsolicited message transmission will subsequently retransmitted and will be aborted after 3 retry attempts have been made. This confirms that your outstation is properly setup and unsolicited messages are being generated and sent. At the time of this implementation, the events will be re-attempted only after a new event occurs.
- Also observe the Internal Indications show that Class 1 events are available as indicated in the figure below.



For additional information on the any of the dialogs referenced in the above exercise, refer to the ***DNP Configuration Menu Reference*** towards the end this booklet.

SCADAPack DNP Master

DNP master modes currently apply only to the SCADAPack 32, SCADAPack 314/330/334, SCADAPack 350 and SCADAPack 4203 controllers.

As a master, a SCADAPack controller can be a regular Master or Mimic master.

SCADAPack DNP Master Concepts

A DNP Master station inherits the characteristics of a DNP Outstation. In addition, a DNP Master station is able to:

- Poll DNP outstations for static (Class 0) data and Class 1, 2 and 3 event data.
- Accept and process unsolicited response messages from polled outstations.

This configuration of a DNP Master (Client) and DNP Outstation (Server) forms the basis of a DNP3 Network. The SCADAPack DNP Master may be configured to periodically poll a SCADAPack DNP Outstation for Class 0, 1, 2, and 3 data objects and receive unsolicited responses from the outstation. The outstation may be configured to report change event data to the master station using unsolicited responses.

The arrowed line between the master and outstation in the diagram below represents a communication path connecting the two stations. This communication medium may be any type that is supported by both controllers, such as direct serial, leased line modem, dial-up modem and radio for example.

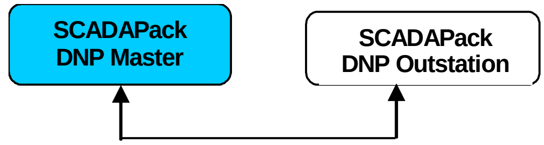


Figure 0-1: Simple SCADAPack Master-Outstation DNP Network

An extension of a simple DNP Master and single outstation network, involves a SCADAPack DNP Master connected to a number of outstations over a multi-drop communication channel. The DNP Master may be configured to periodically poll each SCADAPack DNP Outstation for Class 0, 1, 2, and 3 data objects and receive unsolicited responses from the outstations. The outstations may be configured to report change event data to the master station using unsolicited responses.

The arrowed line between the master and outstations, in the diagram below, represents the communication path connecting the stations. This communication path may be any multi-dropped type that is supported by the controllers, such as leased line modem, dial-up modem and radio for example.

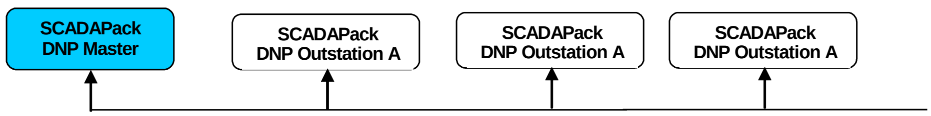


Figure 0-2: SCADAPack DNP Master and multi-dropped DNP Outstations

The DNP Master feature is limited to a SCADAPack32, SCADAPack 314/330/334, SCADAPack 350 and SCADAPack 4203

SCADAPack DNP Mimic Master

In a typical DNP network a SCADA Host master communicates with a number of outstations. The SCADA Host will poll each outstation for data and may receive change event data in the form of unsolicited responses from the outstations. This type of DNP network is shown in the following diagram.

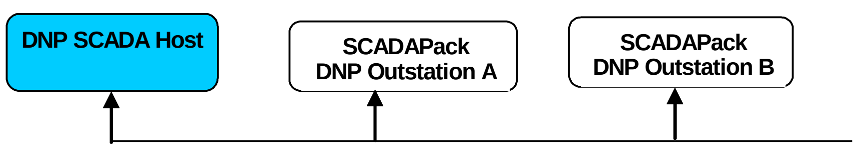


Figure 0-3: DNP SCADA Host and multi-dropped DNP Outstations

In the above configuration the SCADA Host manages the communication path with each outstation. When the communication path is slow, such as with dial-up communication, or subject to high error rates, such as with some radio communication, the data update rate at the SCADA host can become very slow.

Adding a SCADAPack controller configured for Master Mimic Mode, allows for the SCADA Host to poll the SCADAPack (Mimic Master) for outstation data instead. In essence, the SCADAPack Mimic Master is acting as a Data Concentrator, reporting on behalf of the outstations currently configured in its routing table. The following diagram shows the addition of the SCADAPack Mimic Master.

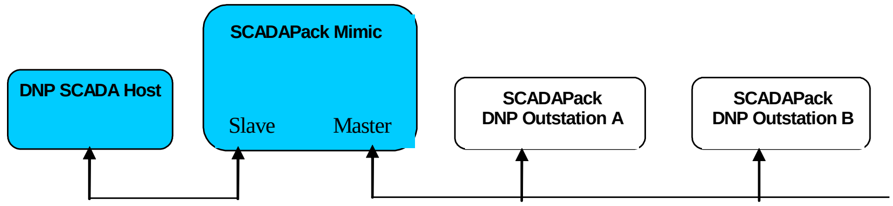


Figure 0-4: SCADAPack Mimic Master and multi-dropped DNP Outstations

In this configuration the outstation side of the network has been decoupled from the host side of the network, as the SCADAPack mimic master now manages the communication with the outstations.

The SCADA Host and outstations will typically be connected to different communication ports of the SCADAPack Mimic Master. The mimic will respond to the following DNP messages on behalf of the targeted station:

- Read messages (this includes class polls as well as individual point reads) from SCADA Host
- Write messages from SCADA Host
- Unsolicited messages from an outstation
- Direct operate messages from SCADA Host

The following DNP messages cannot be mimicked (Mimic does not respond on behalf of target DNP station), and are routed directly to the target outstation by the Mimic:

- Select and Operate messages
- Data Link Layer messages (e.g. get link status, reset link status, etc)
- Enable/Disable Unsolicited Message commands (FC 20 and 21)
- Other control messages

Routing for those messages that cannot be mimicked is subjected to the following rule:

```
if (a message is received which needs to be
retransmitted to someone else)
    if (the message target is configured in our routing
table)
        if (the destination port is different from the
incoming port)
        or (routing is enabled on the incoming port)
        then retransmit the message
```

In order to provide current outstation data to the SCADA Host, the SCADAPack mimicking master independently communicates with each outstation to update a local copy of its database with data from the outstations. This communication may be initiated by the SCADAPack mimicking master, either by polling each outstation in turn using solicited messages; or the outstations could initiate unsolicited messages back to the mimicking master. There could also be a combination of solicited and unsolicited messages between the mimicking master and the outstations.

In the Mimic mode diagram above the SCADAPack mimic master polls each outstation, A and B, for data and holds images of this data in its memory. When the SCADA Host poll outstations A and B for data, the mimic master replies from its own images of the outstations. The SCADA Host can also poll the SCADAPack master for its own local data.

Typically the messaging strategy chosen will depend on the relative importance of the data, and the required maximum end-to-end delays for data being transferred through the network. If the requirement is for a reasonably short end-to-end delay for data points, a round-robin polling scheme is optimum, without any unsolicited messages. If there are some data points, which are higher priority and need to be transferred as fast as possible, unsolicited messages should be used.

The advantage of having the SCADA system communicating with the SCADAPack 32 mimic, instead of direct communication to the outstations is that communication delays and high error rates are effectively removed. The physical connection between the SCADA system and mimic master SCADAPack is typically a direct high-speed connection and message transactions are fast. Outstations may often be connected via slow PSTN or radio links, and therefore message transactions are subject to substantial delays. They may also be unreliable communication links subject to high error rates.

By having a multiple-level network the communication between the SCADAPack master and outstations is separated from communication between SCADA system and the SCADAPack master. The delays and error rates, which may be inherent in the outstation communication paths, can be isolated from communications with the SCADA system, thereby increasing overall system performance.

One particular advantage of Mimic Mode is that the master SCADAPack does not need to know, or be configured with, any details of the DNP points configured in the outstations. This makes it relatively simple to insert such a SCADAPack master into any existing DNP network. The SCADAPack master in Mimic Mode behaves transparently to the higher-level SCADA system, and can easily be configured with communication paths and polling instructions for each connected outstation.

This feature is limited to the SCADAPack 32, 350 and SCADAPack 4203 controllers.

SCADAPack DNP Address Mapping

Address mapping provides a direct link between an outstation’s DNP points and local Modbus registers within the SCADAPack DNP master. These remote DNP points are now mapped into specific regions of the DNP master’s Modbus database.

When DNP data points are received from an outstation, a cross reference to the address mapping table is made, and if a match is found, the DNP data will be written to the corresponding local Modbus register. 'Input' DNP object types from the outstation are mapped to the master’s local input Modbus register space 1xxxx or 3xxxx. These local Modbus registers are updated after the corresponding DNP point gets updated; usually by a class poll to the outstation, or if the outstation issues an unsolicited response based on a change of value or state on these points.

‘Output' DNP object types from the outstation are mapped to the master’s local output Modbus register space 0xxxx or 4xxxx. Changes made to the local Modbus register will trigger a DNP Write message, with the current point value, to the outstation. DNP Write implemented in SCADAPack controllers requires an Application Layer confirmation from the target outstation.

By configuring the Address Mapping table, outstation DNP points are therefore mapped to local Modbus registers. As mapped local Modbus points, the data is available for use in application programs such as Telepace and ISaGRAF. In addition a Modbus SCADA Host can poll the SCADAPack master for these points.

The following diagram shows a simple DNP Address Mapping network.

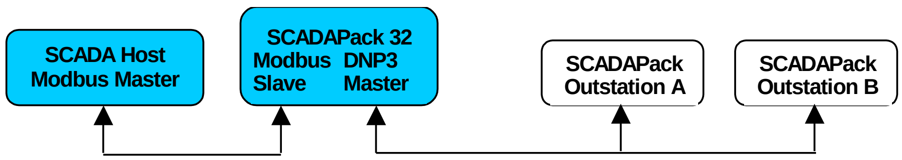


Figure 0-5: SCADAPack Address Mapping

In this network the SCADAPack master updates is local database with mapped outstation data. The manner and frequency with which the SCADAPack master updates the local Modbus registers, depends on the number and type of I/O object types the registers are mapped to.

This feature is limited to the SCADAPack 32, 350 and SCADAPack 4203 controllers.

Mapping numerous local Modbus output registers (0xxxx and 4xxxx), to a remote DNP device may cause frequent communications between the master and the slave, if the associated registers are being changed frequently in the master. On limited bandwidth or radio networks network capacity needs to handle the traffic that will be generated from these local changes.

How to Configure SCADAPack DNP Master

In this exercise, we will configure a SCADAPack DNP Master to poll a DNP outstation with address 10. The DNP master will be communicating to the outstation by requesting for Class event data and acknowledging receipt of unsolicited responses through com1.

After this exercise, you should be able to:

- Configure a DNP Master to poll for Static (Class 0) and Class 1 event data.
- Configure a DNP Master to accept and respond to unsolicited messages

Tasks to Complete

- Enable DNP communication on com1 of the SCADAPack controller.
- Configure a DNP Master with station address of 200, for example.
- Configure the DNP master to issue class polls to the outstation created in the previous exercise.
- Map outstation DNP points to local DNP points.

Configuration Steps

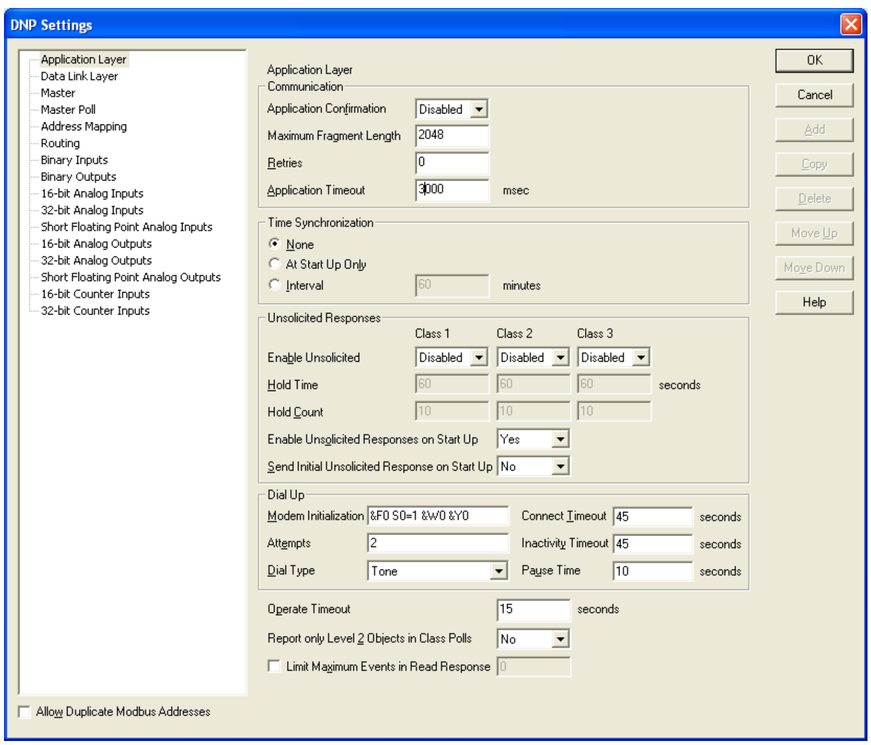
- Use the same procedure of the previous exercise to enable the DNP protocol on com1.
- From the **Controller** menu, launch the **DNP Configuration** panel.
- From the **Application Layer** configuration panel,
    - Check that the Application Layer Confirmation is Disabled.

TIP: A master should not have to request for an Application Layer Confirmation, as an Application Layer response is implied in master requests.

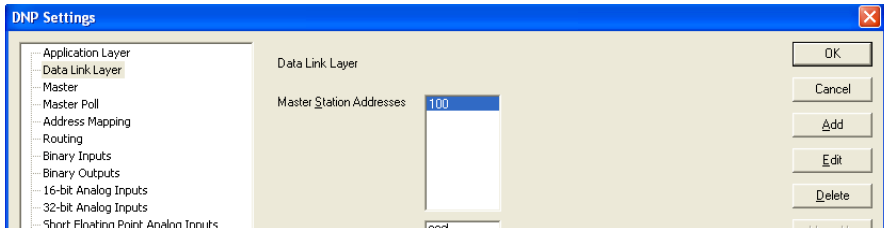
- Set the Application Timeout to 3000 seconds.
- Set Time Synchronization to none.

TIP: Master time synchronization to an outstation is configured in the Add/Edit Master Poll dialog.

- Other parameters can be left at their default values. The completed Application Layer Configuration panel should look like this:



- From the **DNP Configuration** dialog, click on the **Data Link Layer** tree node.
    - Leave the **Master Station Address** at the default value of 100.
    - Change the **RTU Station Address** to 200.



- Click on the Master tree node from the **DNP Settings** dialog.
  - Set the Base Poll Interval to 1s.
  - Check that Mimic Mode is Disabled.

TIP: A small Base Poll interval provides better granularity.

- Click on the Master Poll tree node from the DNP Configuration panel.
  - Set the Base Poll Interval to 1s.
  - Ensure Mimic Mode is Disabled.
  - Click on the Add button within the Master Poll panel to create a new master poll schedule.
  - In the Add/Edit Master Poll dialog, do the following:
    - Set **Station** to 10
    - Under **Class 0 Polling** group box, set the **Interval** to 3600 base poll intervals (1 hour).
    - Leave the **Poll Offset** at the default of 0 base poll intervals.

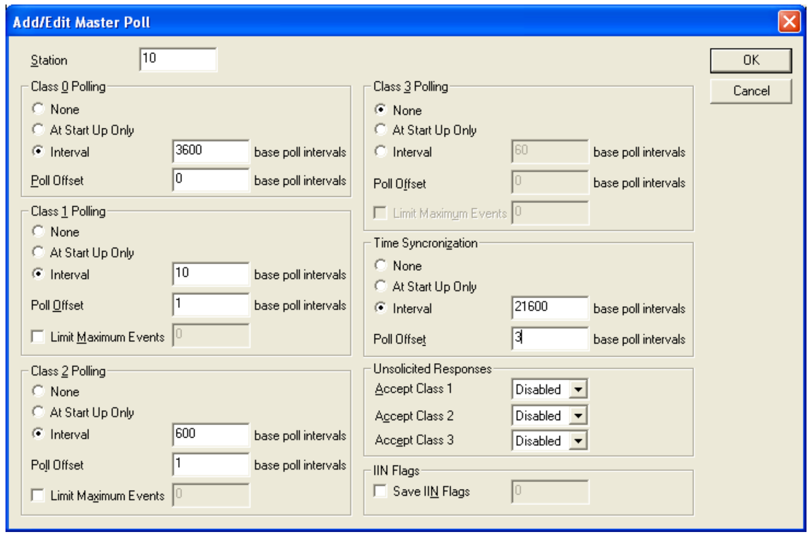
TIP: Static (Class 0) comprise current values of DNP3 points in the I/O database. Due to the sheer size of this data, it is recommended to reduce the frequency of static polls. Urgent data will be updated at the master via Class polls or unsolicited messages.

- Under **Class 1 Polling** group box, set the **Interval** to 10 base poll intervals (10 seconds).
- Set the P**oll Offset** to 1 base poll intervals.
- Leave the **Limit Maximum Events** checkbox unchecked.
- Under **Class 2 Polling** group box, set the **Interval** to 600 base poll intervals (10 minutes).
- Set the P**oll Offset** to 2 base poll intervals.
- Leave the **Limit Maximum Events** checkbox unchecked.
- Under the **Time Synchronization** group box, set the **Interval** to 21600 base poll intervals (6 hours).
- Set the P**oll Offset** to 3 base poll intervals.

TIP: Polling intervals on Master request for time synchronization are configured in this dialog. If possible, set this to a daily frequency.

A small base poll interval limits that maximum poll interval to 32767 seconds. Daily polls (every 86400 seconds) are, therefore, not possible when the base poll interval is set for 1 second.

- Under **Unsolicited Response** group box, leave fields at default. The completed dialog should look like this:

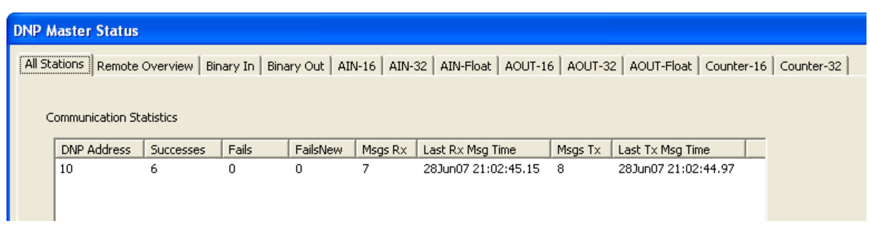


- From the **DNP Configuration** panel, select the **Routing** tree node.
  - Click on the **Add** button to begin a new routing table entry.
  - From the Add/Edit Route dialog,
    - Enter 10 for the destination **Station**.
    - Set the **Port** to COM1.
    - Leave default values for other parameters.

Confirm Successful DNP Master Configuration

With this configuration and a valid communication link between com1 of the DNP Master and com2 of the DNP outstation, you can use the DNP Master Status dialog to see communication activity between the two devices.

Confirm that you have communication activity between the master and outstation as indicated in the screen capture below.



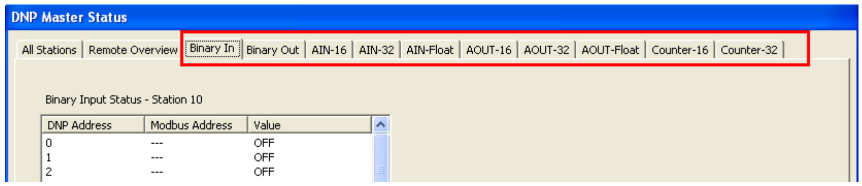
If the All Stations tab indicates successful message transmission between the Master and Outstation, congratulate yourself on completing the exercise.

For additional information on the aforementioned configuration parameters, referenced in the previous two exercises, refer to Chapter ***0*** in this manual.

How to Configure SCADAPack Address Mapping

At this stage in your configuration, the DNP master is able to poll for outstation points. After a successful poll, you can verify the status of current value of outstation DNP points from the various data point type tabs available across the DNP Status Window.

The figure below shows the status of DNP digital input points 0, 1 and 2 on outstation 10.



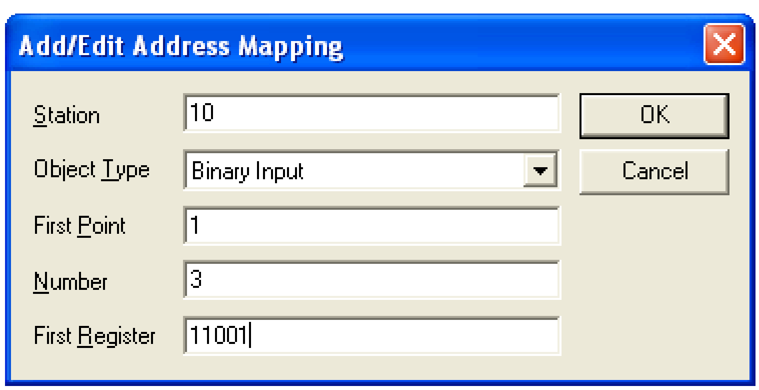
The Modbus Address column is blank as these remote DNP points have not been mapped to any local Modbus registers.

While this data is available in the DNP Address space of the master, it is not available for use within a local program. To render DNP data available to a local program, you would have to perform an Address Map. To map DNP binary input data from outstation 10 to this master's local DNP database, do the following:

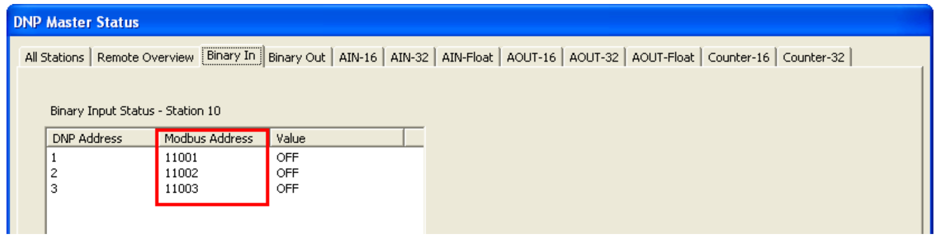
From the **Controller** menu, select **DNP Configuration**

- Click on the **Address Map** tree node.
- From the Address Mapping configuration panel
    - Click on the **Add** button to launch the **Add/Edit Address Mapping** dialog.
    - Enter **10** for **Station**.
    - Select **Binary Input** for Object Type.
    - Enter a value of 1 for First Point. This is the DNP Address of the first Binary Input point in Station 10.
    - Enter 3 for Number of points to map.
    - Enter 11001 for First Register (First Modbus Register) address. Modbus address 11000 needs to exist the in your controller database.

The completed dialog should look like this:



- Click on **OK** to add this entry to the Address Mapping table.
- Use the **DNP Master Statu**s dialog, to confirm that remote points are being mapped to local Modbus registers as shown below:



You can also confirm that remote points are being mapped to Modbus registers by monitoring the status of Modbus registers 11001, 11002 and 11003.

How to Configure SCADAPack DNP Mimic Master

In addition to the configuration procedures for a DNP Master, following the steps below to enable the DNP Mimic master.

From the Controller **menu, select** DNP Configuration

- Follow the steps in the ***Section 0*** to configure the DNP master.
- Click on the **Master** tree node.
- Enable **Mimic Mode.**

SCADAPack DNP Router

SCADAPack controllers can be configured as a DNP Router. A unique characteristic of a SCADAPack DNP router is the ability to:

- Route (or forward) DNP messages not destined to this station, using rules defined within a routing table.

Otherwise, a SCADAPack controller not configured for DNP routing will simply discard a message whose DNP destination address does not match that of the controller.

A DNP router is typically used when a direct communication link between the DNP master and outstation cannot be established, typically due to different physical layers on the two network segments. For instance, the physical network between the DNP SCADA Host and the router could be an Ethernet connection, while the physical layer between the router and outstations could be a multi-drop serial RS-485 or even an RS-232 radio connection. Given that messages are routed directly from the DNP SCADA Host to the outstations, bandwidth limitations are dictated by the speed of the serial multi-drop connection. On the contrary, there is no bandwidth limitation within a DNP Mimic architecture, as the Mimic Master immediately responds to the DNP SCADA Host on behalf of the targeted outstation. Of course, the side effect of the DNP Mimic architecture is that polled data obtained by the DNP SCADA Host may not be very current. In either case, careful design considerations based on these tradeoffs should be exercised.

As mentioned above, the SCADA Host has only one connection to a SCADAPack DNP Router. Target outstations of the SCADA Host are connected downstream of the DNP Router as illustrated in the figure below.

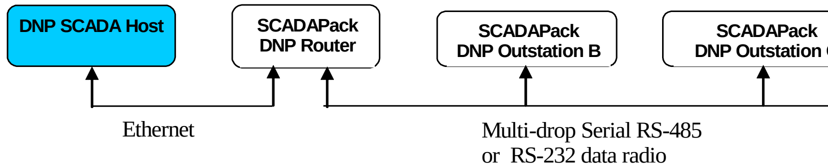


Figure 0-6: SCADAPack DNP Router and multi-dropped DNP Outstations

In the above configuration the SCADAPack DNP Router (Outstation A above) manages the communication with the outstations. The SCADAPack DNP router receives messages from the SCADA Host for each outstation and ***route*** or forwards the messages to the outstations, based on routing rules established with the DNP Routing table.

DNP Messages are routed based on the following logic:

```
if (a message is received which needs to be
retransmitted to someone else)

    if (the message target is configured in our routing
table)

        if (the destination port is different from the
incoming port)

        or (routing is enabled on the incoming port)

        then retransmit the message
```

Change event data in the form of unsolicited responses from the outstations are routed directly to the DNP SCADA Host, by the SCADAPack DNP router.

A DNP Router is different from a Mimic in that a router forwards messages directly to the outstations, whereas the mimic responds to some messages on behalf of the outstations. Therefore, both operation modes have the advantage of delegating the task of DNP Routing of multiple outstations to this intermediate unit. The SCADAPack DNP router handles communications paths to outstations, including such tasks as dial-up radio communication. In contrast to Mimic mode, however, the SCADA Host system still has to handle the long delays and high error rates that may be present on the communications links to the outstations.

Mimic Master and Routing are incompatible modes that should not be used together.

How to Configure a SCADAPack DNP Router

In this exercise, we will configure a SCADAPack 32 controller to route DNP messages received from DNP Master 32001 on its Ethernet port, out through com2. This message is destined for outstation 20. .This exercise assumes a valid Ethernet connection between your PC or laptop and the SCADAPack 32.

After this exercise, you should be able to:

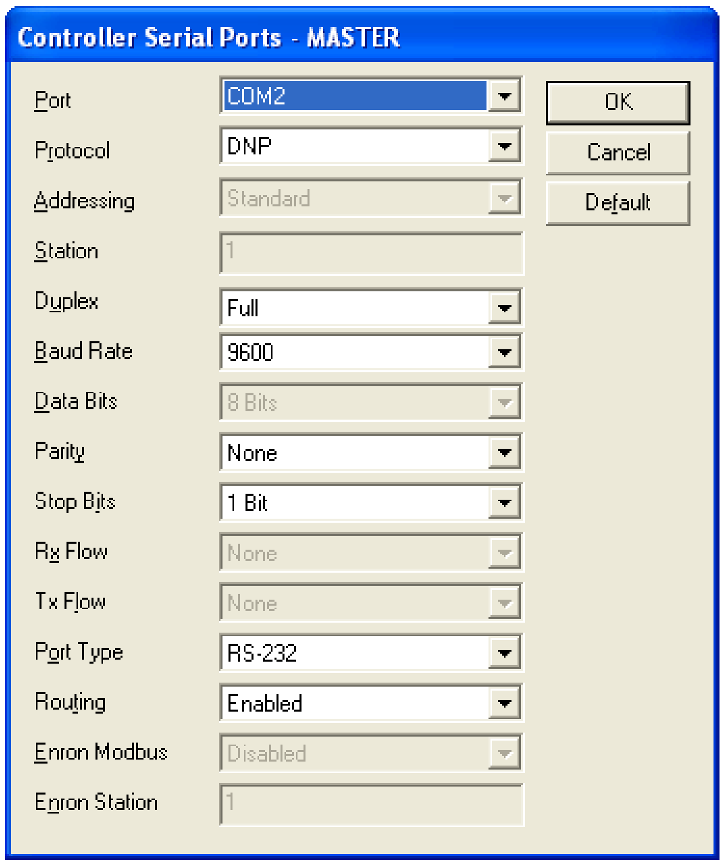
- Configure DNP/TCP on an Ethernet port
- Configure a SCADAPack DNP Router to route messages from a SCADA DNP Host to an outstation.

Tasks to Complete

- Enable the DNP protocol communication on the communication interfaces involved in routing.
- Enable routing on the communication interface.
- Setup the forward and return entries in the DNP routing table.

Configuration Steps

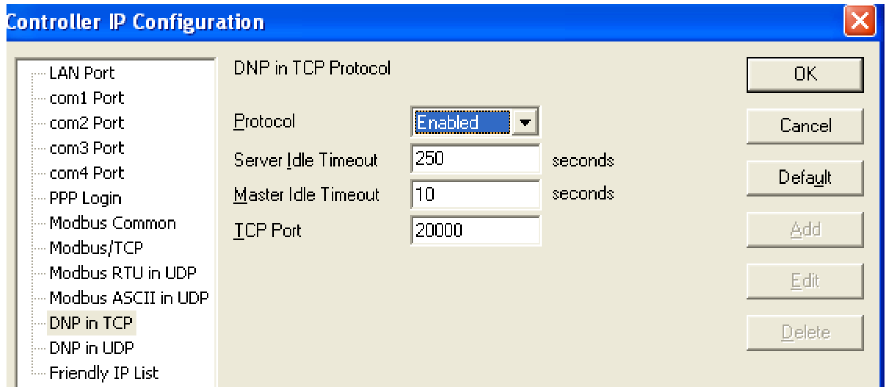
- From the Controller menu, click on Serial Ports.
- In the Controller Serial Ports dialog, set the Protocol on COM2 to DNP.
- In the Controller Serial Ports dialog, Enable Routing.
- The completed dialog should look like this:



- Click on **OK** to close this dialog and save your settings.
- From the **Controller** menu, click on **IP Configuration**.
- Select the DNP/TCP tree node from the Controller IP Configuration dialog.
- Enable the protocol and leave other settings at default values.

This exercise assumes that you have a valid IP Address, Subnet Mask and Default Gateway properly configured.

- The completed dialog would look like this:



TIP: In this configuration, the SCADAPack DNP Router is acting as a DNP Server on the Ethernet port. The **Server Idle Timeout** parameter will be used to determine how long this connection will be kept open from time of last communication activity. For a **Server Idle Timeout** default value of 4 minutes, and an **Application Layer Timeout** default value of 5 minutes, there is the possibility that the IP port will be closed, if the router is experiencing communication difficulties with the outstations. In this case, it is a good idea to increase the Server Idle Timeout to at least 2x the DNP configuration Application Layer Timeout. Or, simply reduce the Application Layer timeout to a value less than 2x the Server Idle Timeout.

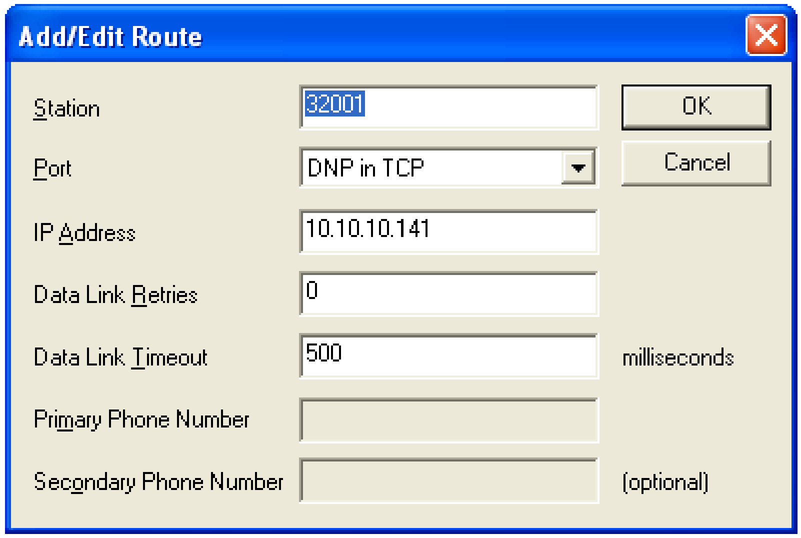
- From the DNP Configuration panel, select the Routing tree node.
    - Click on the Add button to begin a new routing table entry.
    - From the Add/Edit Route dialog,

Add the route to Station 20:

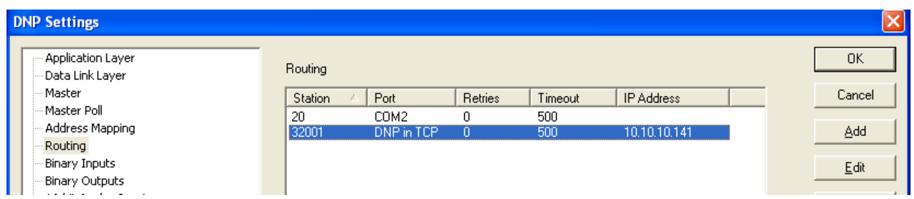
- Enter 20 for the **Station**.
- Set the **Port** to COM2.
- Leave default values for other parameters.
- Click on **OK** to add this entry to the routing table and return to the Routing dialog.

Add the **Return** route from Station 20:

- Enter 32001 for the **Station**.
- Set the **Port** to DNP in TCP.
- Enter the IP Address of your DNP Master. In this case, the IP Address of my PC running a DNP SCADA Host software is 10.10.10.141.
- Leave default values for other parameters.
- The completed dialog should look like this:



- Click on **OK** to add this entry to the routing table and return to the Routing dialog.
- The completed routing table should look like this:



For proper operation of the router, there needs to be two routing entries in the routing table for each outstation; An entry specifying how the communication path from this router to the outstation and another communication path from the router to the SCADA DNP Master.

Design Considerations

The strength of DNP lies in its ability to offer time-stamped data, scheduled polling of data from multiple outstations and time synchronization, event data buffering and reporting by exception.

DNP was originally design to be used over a serial point-to-point (RS-232) link. As such, the protocol implements certain measures against data corruption and missing data in its Application and Data Link layers. Such measures include timeouts, retries, and checksums.

These data recovery mechanisms provided by the protocol, can be counterproductive when not properly configured over an underlying communication medium, such as Ethernet, that already provides robust measures. In such cases, the recovery mechanisms offered by DNP need to be turned off. Such considerations together with good engineering judgment, therefore, need to be practiced before one embarks on the design of a large DNP network.

This chapter outlines special considerations of the DNP protocol and implications within the SCADAPack DNP driver that should be considered when designing large networks. We also list common malpractices and a list of Frequently Asked Questions (FAQs) that arise during the course of network design.

Considerations of DNP3 Protocol and SCADAPack DNP Driver

To allow consistent network performance, even under worse case scenarios, the following DNP specification rules should be considered when designing a DNP network using SCADAPack as the main nodes.

Unsolicited Messages always request for a Confirmation

An outstation will request for an Application Layer confirmation when it sends an unsolicited message, even if the Application Layer confirmation field is not enabled. If no response is received within an Application Layer timeout, the outstation will retry the message a number of times as determined by the Application Layer Retry parameter.

Master shall never request for Application Layer Confirmation

A Master request is accompanied by a response message from an outstation. Hence, the Application Layer confirmation on the master RTU should not be enabled.

DNP Write Messages always request for a Confirmation

As implemented in the SCADAPack DNP driver, a DNP Write request (FC 02) requires an Application Layer response from the outstation. If an acknowledgement is not received within the configured Application Layer timeout interval, the message is retried a number of times as determined by the Application Layer retry parameter.

Only one DNP3 transaction can be pending at a time

A SCADAPack DNP station will not initiate or process another DNP transaction, as long as one is outstanding. Thus, once a SCADAPack has initiated a DNP transaction, subsequent DNP3 messages received but not related to the original transaction are buffered.

SCADAPack controllers buffer 3 DNP messages

A SCADAPack serial port receive buffer can hold a maximum of 3 DNP messages or Data Link frames. If an additional DNP message is received when the buffer is full, the oldest message in the buffer is replaced with the newest one.

Output points in DNP Address Mapping issue DNP Write

Digital and analog output points contained within the DNP Address Mapping of a SCADAPack controller automatically issue DNP Write messages when their value or state changes.

Typical Configuration Malpractices and Recommendations

DNP is a capable protocol that effectively transfers some of the system engineering effort from designing a sophisticated logic program, to configuring and tuning the system using parameters. However, DNP does not remove the need to properly evaluate and engineer the communication media to support the performance expectations of the system, especially under worse case scenarios.

DNP networks can be designed around polling or report-by-exception. In a polling environment, each master request can be viewed as an invitation for an outstation device to transmit data on the shared communications medium. The master controls which device can transmit, thereby keeping collisions from occurring, as the timing of responses is predictable. In addition, masters can ask again if a response is not received, thus providing an opportunity for the outstation to re-send lost data. Using this strategy, a master effectively manages media access thereby stopping contention with those outstations unexpectedly transmitting on their own.

DNP networks can also be designed around unsolicited communications. In this case, the outstations transmit events to the master as they occur. When using this strategy, the communications media needs to be evaluated carefully in regards to the need for collision detection and prevention, if consistent network performance is to be expected.

Given that typical systems are designed using a combination of both strategies, is a good idea to start by configuring the network for poll mode, as it can be easily tuned to cater for unsolicited messaging, when system characteristics under worst case conditions become known. Below are several requirements of DNP system architecture that require careful engineering judgment.

- Multiple high priority unsolicited messages configured in outstation.
- System with multiple outstations, each containing numerous Class 1 events, configured with a Class 1 Hold Count of 1.
- Relying on unsolicited messaging to get event data to master. System not designed around master polling for events.
- Multiple masters with poor communication link.
- Insufficient use of Deadband and debounce to curb event generation.
- Master RTU has Application Layer confirmation enabled.
- Enabling both the Application and Data Link Layer confirmations.
- Setting very high Application Layer timeout values over high speed networks.
- DNP Address mapping contains multiple analog and digital output points that change rapidly.

The aforementioned statements and recommendations are provided below. These recommendations are for consistent performance under worse case situations, and are based on the special considerations provided in the previous section.

Multiple High Priority Unsolicited Messages

A common configuration malpractice is to enable numerous high priority events objects within an outstation, and configure the outstation to trigger an unsolicited message to the master each time a new event occurs. In a SCADAPack controller, this is accomplished by configuring numerous Class 1 event objects, and enabling Class 1 Unsolicited Responses (Messaging) with a Hold Count or Hold Time of 1.

A Hold Count of 1 and Hold Time of 60 seconds specified for Class 1 events, imply that the controller will immediately trigger an unsolicited event as one occurs. If this outstation and others have a multitude of Class 1 event objects, visualize the worst-case scenario as a burst of messages being transmitted to the master at the same time. Given that a SCADAPack serial port buffer can only handle three DNP Data Link frames at any given time, some messages might get lost, especially if the master is required to immediately retransmit this message to some other node in return.

Such a system is designed around unsolicited messaging and is, therefore, far more susceptible to network collisions if proper management of bandwidth it not exercised. Given that a SCADAPack controller can only process one DNP transaction at a time, there is also a good chance that the serial port receive buffer will overflow, adding to the cost of lost messages.

Recommendations:

In general, bandwidth is used more efficiently in a large DNP system if the master is designed to poll for event data more frequently and static data less regularly.

Recommended practice is also to reserve unsolicited messaging for a small number of data. If possible no more than 3 messages are sent to the master at exactly the same time, under the worst-case scenario, as some event data may be lost if the master is currently busy processing another transaction, unless random retry intervals are put in place.

If unsolicited messaging is the predominant data transfer method, an approach to manage network usage, could be to configure a group of three or less outstations with a Hold Time that is unique within the group.

The table below shows an example configuration for Hold Time and Hold Counts for Class 1 events across six outstations.

Table 0-1: Hold Time and Hold Count Setup in for Six DNP Outstations

DNP Outstation Address	Hold Time (seconds)	Hold Count
11	1	100
12	1	100
13	1	100
14	2	100
15	2	100
16	2	100

Master not polling frequently causing event buffer overflows

An outstation does not discard the events within its buffer until all its configured masters have acknowledged receipt of these events. This means that an outstation event buffer may eventually fill up and overflow leading to missing events. Buffer overflows typically indicate a poorly configured system.

When the system is designed around unsolicited messaging, there is a good likelihood of media contention causing buffer overflows. On the contrary, if the system is designed around frequent master poll for event data, there will be fewer chances of buffers overflowing causing missing event data.

As stated earlier, immediate reporting of events using unsolicited messaging should be reserved for those absolutely rare occurring events. This is because unsoliciting these messages back to the master will be reliable only if there is a substantial amount of unused bandwidth on the communication media. A good rule of thumb is to have 50% or more of unused bandwidth available, evenly distributed over a time frame.

Recommendation: Design the system around frequent master poll of class events and less regular integrity polls. Reserve unsolicited messaging for infrequent high priority events. If network traffic is predominated by unsolicited messaging, allocate 50% or more unused bandwidth as quiet time.

Outstation reports to Multiple Masters with Poor Communications Link

A poor communications link to one of an outstation's multiple masters will keep the outstation's event buffer from being emptied, as events cannot be reported to the master. This could lead to buffer overflow situations and loss of event data.

Recommendation: Check that the communication path to masters of an outstation is robust.

Insufficient Use of Input Deadband or Debounce

Event generation on a DNP analog input is controlled by a Deadband parameter. On a digital input, event generation is controlled by a debounce parameter. Default settings of zero for these parameters are typically overly aggressive and may lead to events being generated due to noise.

Recommendation: Set the analog Deadband and debounce parameters appropriately to non-zero values.

Master Confirmation and Retries

Application or Data Link Layer confirmations should never be enabled on a master as:

- Master requests typically will fit within a single Application Layer fragment hence there is need for Data Link Layer confirmations.
- Master request typically require a response, hence no need for Application Layer confirmations.

Thus, enabling the Application Layer Confirmation on a DNP master is obsolete practice and may instead reduce system performance.

Recommendation: Disable the Application Layer Confirmation in a master SCADAPack controller. Typical retry values for Application Layer retries lie between 1 and 3. Lengthy retries may instead burden the communication medium

Outstation Confirmations and Retries

Confirmations on an outstation serve two useful purposes:

- Check that a master received unsolicited responses from the outstation.
- To confirm that a master correctly received responses to its request

Unsolicited messages will request for an Application Layer confirmation, whether or not the Application Layer Confirmation is enabled on the outstation. If network traffic is predominantly unsolicited messaging, the Application Layer confirmation does not need to be enabled.

When the master is configured, as recommended, to frequently poll the outstation for event data using ***read request,*** while imposing a limit on the number of events the outstation should include in its response***,*** the outstation still needs to know if the master received its replies so that it can:

- Remove these events from its buffer
- Know what to transmit next.

To cater for confirmations to read responses, Application Layer Confirmation in the outstation typically needs to be enabled.

The Data Link Layer breaks down Application Layer fragments into smaller frames. Smaller packet sizes reduce bit error in noisy environments. While it is better to accept the overhead of confirming each Data Link Layer frame of a multi-frame message, and re-transmit corrupted frames, than to re-send an entire Application Layer fragment, a viable alternative is to reduce the Application Layer fragment size and use only Application Layer confirmations. When fragments are reduced to the size of a Data Link Layer frame, the overhead of Application Layer confirmations, and the probability of noise corrupting those confirmation messages, is nearly the same as for Data Link Layer confirmations.

Enabling the Data Link layer confirmation on the outstation, therefore, is not required when the communication medium is not robust. For example, certain data radios, e.g., FreeWave 9000 MHz spread spectrum radios, implement a robust mechanism to ensure that a data packet make it to their desired destination; TCP/IP incorporates robust mechanisms to stop missing data; a local serial link between stations is also very robust. In these cases, it is not necessary to enable the Data Link Layer confirmations.

If, however, physical medium quality if below par, such as in the case of noisy radio networks, or a shaky PSTN connections, then one should enable the Data Link Layer confirmation only, or as mentioned earlier, reduce the Application Layer maximum fragment length below 249 bytes.

If either the Application or Data Link Layer Confirmation is enabled, retries should be configured to a low non-zero value. Typical retry values lie between 1 and 3. Lengthy retries may instead burden the communication medium

Recommendation:

Application and Data Link Layer confirmations in an outstation can be set according to the following table:		Communication Medium Reliability	
		High	Low
Data Acquisition Configuration	master polls outstation frequently for event data (also limits number of events in read response)	**Enable** Application Layer Confirmation **Disable** Data Link Layer Confirmation	**Disable** Application Layer Confirmation **Enable** Data Link Layer Confirmation
	master	**Enable** Application	**Disable**

	does not poll frequently enough and outstation generates lot of unsolicited messages	Layer Confirmation **Disable** Data Link Layer Confirmation	Application Layer Confirmation **Enable** Data Link Layer Confirmation
	Regardless of the data acquisition strategy, if the Max Application Layer fragment is set to a values less than 249	**Enable** Application Layer Confirmation **Disable** Data Link Layer Confirmation	**Enable** Application Layer Confirmation **Disable** Data Link Layer Confirmation

It is not required to enable BOTH the Application and Data Link Layer Confirmations.

Setting relatively large Application Layer timeouts

On a high speed link, such as Ethernet, configuring a high Application Layer timeout does not increase network reliability. Instead this reduces system performance, as there will be a significant portion of time within the timeout period, after which the IP transaction may have been terminated.

Typically, an Ethernet transaction is completed in the order of a millisecond and a DNP master SCADAPack controller, by default, closes its DNP TCP port within 10 seconds of no activity. A DNP SCADAPack controller acting as an outstation closes its port by default in about 4 minutes.

Under these default conditions, if the application layer timeout on a SCADAPack DNP master is set for 15 seconds, for instance, the port may have closed 10 seconds after last activity, but the application may still be waiting for a timeout.

If a message is somehow lost, and the timeout is set for 5 seconds, for instance, the application will still be waiting for a response even though the IP transaction has terminated. This results to wasted bandwidth.

Recommendation: When operating over high speed links, make Application Layer timeouts as small as possible.

DNP Address mapping contains multiple output points

The DNP Address Mapping table allows local Modbus registers in the SCADAPack DNP master to be mapped to DNP points in an outstation.

Each time an output register defined within the DNP Address Mapping table changes, a DNP Write message (FC 2) is immediately issued to update the corresponding DNP point in the outstation.

If numerous output registers that change frequently, are listed in the Address Mapping table, the network will be overburdened with a multitude of DNP Write messages.

Recommendation: Reserve Address Mapping only for mapping of outstation DNP data that needs to be used by the master Modbus database, or to segregate points from different outstations in the master. If numerous points are being mapped from the outstation to the master, the system is not designed properly. In this case, it may be worthwhile to consider transferring application logic from the master to the outstation.

Configuration FAQ

Complimentary commonly asked questions and answers are given below.

When configuring a routing entry in the DNP Routing table of a SCADAPack, one has to specify the Data Link Layer Timeout and Retries. Do these fields take precedence over the same fields found under the Data Link Layer configuration panel?

Yes.

In a master-outstation architecture, how do you recommend we setup time synchronization?

Recommended practice is to configure the master to initiate time synchronization to the outstations.

DNP3 provides 4 data classes; Class 0 (Static or None), Class 1, Class 2 and Class 3. How does I decide which class to assign any given I/O point?

In a SCADAPack controller, configured DNP points by nature, are members of the Class 0 type. Class 0 data is the current value or state of a DNP point. So, when a master does a Class 0 poll to an outstation, the current value or state of DNP points within the database are returned.

Value or state changes on a point are captured as Class 1, Class 2 or Class 3 event data. Typically, highest priority events are assigned to Class 1 and the lowest priority event to Class 3.

What does Class of ‘None’ mean?

Class None is Class 0 or Static.

Why does this setting do: Enable Unsolicited Responses On Startup?

This setting enables unsolicited response (or unsolicited message) transmission, when power to an RTU is cycled or when its configuration is changed. In this case, the RTU does not have to wait for Function Code 20 or 0x14 (Enable Unsolicited Responses) from the master before is starts sending any collected events.

This field should be set to No, to allow a master control when an outstation is able to send unsolicited messages. Recommended practice is to allow a master to enable unsolicited message transmission on outstations.

Why would I ever need to change the Application Layer Maximum Fragment Length?

The Application Layer Maximum Fragment Length determines the maximum amount of memory that is reserved for each application layer fragment. The default is 2048 bytes on SCADAPack controllers although outstations need to be prepared to receive fragments sizes of at least 249 bytes. When communicating with those devices with insufficient memory it is necessary to limit the maximum application layer fragment length to what the outstation can handle. In addition, limiting the application layer fragment size beyond 249 also reduces the maximum Data Link layer frame length.

Certain data radios may give better efficiency when transmitting data packets less than the maximum data link fragment size of 249 bytes. With these radios, it is necessary to reduce the application layer's maximum fragment size below 249 bytes as required by the radio.

Other types of data radios, such as FreeWave's 900 MHz Spread Spectrum radios, provide configuration options to optimize efficiency by changing the maximum packet size. In this case, it is not necessary to reduce the application layer maximum fragment size.

In addition, when the communication medium is noisy, it is typically more efficient to transmit smaller packets than larger packets. In this case, setting small Application Layer fragments would force smaller data link frames, which is a better strategy in a noisy environment.

Limiting the application layer fragment size reduces the rate at which event data is retrieved from the buffers, thus increasing the possibility of event buffer overflows, if the event data is not being retrieved in a timely fashion. Reducing the maximum application layer fragment size, increases network traffic and also reduced data throughput as an Application Layer Confirmation is required for each fragment of a multi-fragment message.

Why would I ever want to 'Limit that maximum number of events in a read response?"

This is another strategy that can be used to limit the Application Layer fragment of an outstations' response message. This strategy could be used under noisy environments.

Also, this could be used to keep an outstation with a large collection of event data from holding the communication media captive while transmitting all its events.

What behavior should we expect from a SCADAPack when the event logs are full?

When a new event is collected and the SCADAPack DNP event buffer is full, the oldest event is deleted and the newest event added into the buffer.

What is the main difference between SCADAPack DNP driver configuration modes?

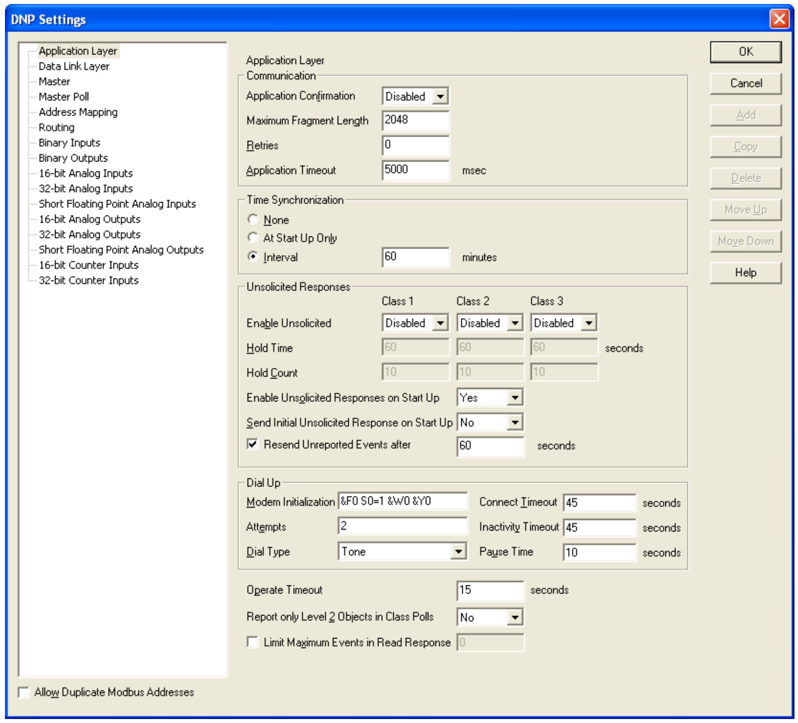
	DNP Master	**DNP Mimic Master**	**Address Mapping**	**Router**	**Outstation**
Define DNP I/O points	Not necessary	Not necessary	Not necessary	Not necessary	Yes
Enable Application Layer Confirmation	No	No	No	No.	Not necessary.
Should I Initiate Time synchronization?	Yes	No.	No.	No.	No.

Poll for Class DNP static and Class data?	Yes	Yes	Yes	No.	No
Initiates Unsolicited messages?	No	No	No	No	Yes
Router Messages not destined to this station?	No	Some	No	Yes	No
When to use	Master in a Point to Multipoint network	Data Concentrator with many outstations that will take a while to configure. When outstation data does not need to be available to logic in this node.	When remote DNP data is needed by local program	Strictly Repeater	Forms basic node in DNP network.

DNP Configuration Menu Reference

This section of the manual details the SCADAPack DNP3 driver configuration parameters. The DNP Configuration panel is accessed from the **Controller | DNP Configuration** menu from either Telepace or ISaGRAF. Browse through this chapter to familiarize yourself with some key DNP3 concepts and their implementation in a SCADAPack controller.

When selected the DNP Settings window is opened, as shown below.



The DNP Settings window has a tree control on the left side of the window. The tree control appears differently depending on the controller type selected. The SCADAPack 314/330/334, SCADAPack 350, SCADAPack 32 and SCADAPack 32P controllers support DNP master and include the bolded items in the following list. SCADAPack controllers not supporting DNP master the bolded items are not included. This tree control contains headings for:

- Application Layer
- Data Link Layer
- **Master**
- **Master Poll**
- **Address Mapping**
- Routing
- Binary Inputs
- Binary Outputs
- 16-Bit Analog Inputs
- 32-Bit Analog Inputs

- Short Floating Point Analog Inputs
- 16-Bit Analog Outputs
- 32-Bit Analog Outputs
- Short Floating Point Analog Outputs
- 16-Bit Counter Inputs
- 32-Bit Counter Inputs

When a tree control is selected by clicking the mouse on a heading a property page is opened for the header selected. From the property page the DNP configuration parameters for the selected header is displayed.

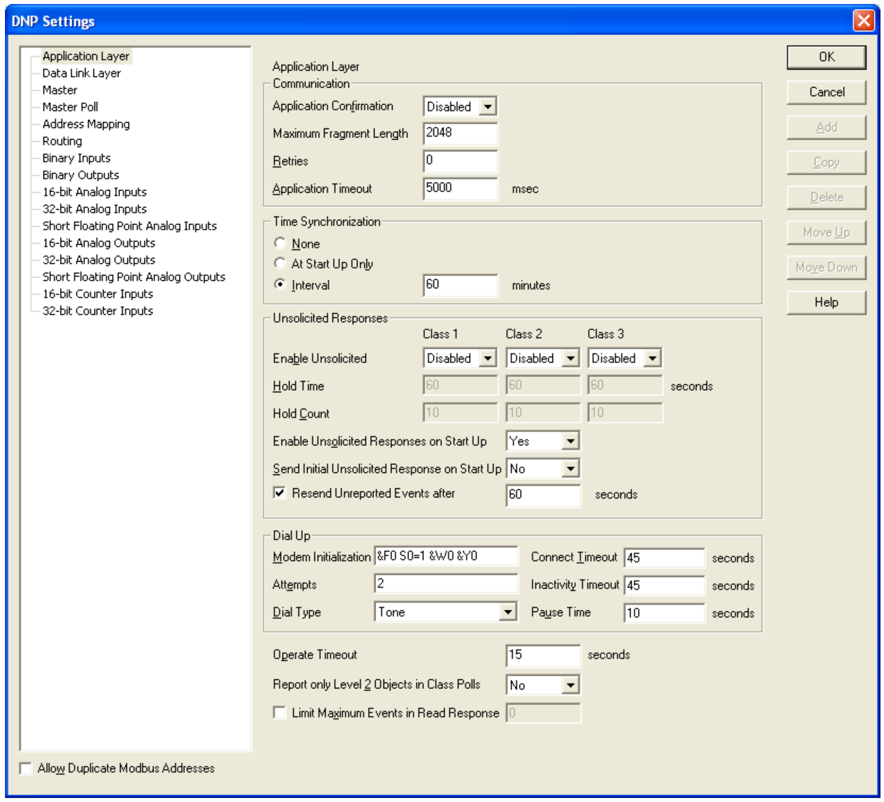
As DNP objects are defined they are added as leaves to the object branch of the tree control. When an object is defined the object branch will display a collapse / expand control to the left of the branch.

The **Allow Duplicate Modbus Addresses** checkbox (in the bottom left corner) determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Uncheck the box if you want to be notified about duplicate addresses. If an attempt is made to use a Modbus address that has already been used for another DNP point the following message is displayed.

Application Layer Configuration

The Application Layer property page is selected for editing by clicking Application Layer in the tree control section of the DNP Settings window. When selected the Application Link Layer property page is active.



Application Layer parameters are set in this property page. Each parameter is described in the following paragraphs.

The **Communication** section of the dialog contains the configurable application layer communication parameters.

When the **Application Confirmation** feature is enabled, the SCADAPack controller requests a confirmation from the master station for any data transmitted. When it is disabled, the controller does not request a confirmation from the master station and assumes that the master receives the data it sends successfully. However if the data includes event data (including unsolicited messages), the controller requests a confirmation from the master regardless of whether this feature is enabled or disabled. Valid selections for this parameter are:

- Enabled
- Disabled

The **Maximum Fragment Length** is maximum size of a single response fragment that the RTU will send. If the complete response message is too large to fit within a single fragment, then the SCADAPack controller will send the response in multiple fragments. Valid values are between 100 and 2048 bytes.

This parameter is adjustable to allow for interoperability with simple DNP3 devices that require smaller application layer fragments. Devices with limited memory may restrict the application layer fragment size to as low as 249 bytes.

The Maximum Fragment Length parameter applies to responses from read commands only. It does not affect unsolicited responses.

The **Retries** entry maximum number of times the application layer will retry sending a response or an unsolicited response to the master station. This does not include any retries performed by the data link layer. Valid values are between 0 and 255.

Using application layer Confirmation and Retries is inherently more efficient than using data link layer Confirmation and Retries. Each fragment sent by the Application layer may require as many as 10 data link layer frames to be sent, each with its own confirmation message. The application layer is typically preferred for message confirmation for this reason.

The **Application Timeout** is the expected time duration (in milliseconds) that the master station's application layer requires to process and respond to a response from the SCADAPack controller. This SCADAPack controller uses this value in setting its time-out interval for master station responses. This value should be large enough to avoid response time-outs. The value needs to be kept small enough so as not to slow system throughput. The value of this element is dependent on the master station. Valid values are between 100 and 60000 milliseconds.

The **Time Synchronization** section of the dialog defines when and how often the SCADAPack outstation prompts the master station to synchronize the SCADAPack controller time. Messages need to be sent between the Master and Remote stations for Time Synchronization to work. Valid selections for this parameter are:

- The **None** selection will cause the SCADAPack controller to not request Time Synchronization.
- The **At Start Up Only** selection will cause the SCADAPack controller to request Time Synchronization at startup only.
- **The Interval** selection will cause the SCADAPack controller to request Time Synchronization at startup and then every **Interval** minutes after receiving a time synchronization from the master. Valid entries for Interval are between 1 and 32767 minutes. The default value is 60 minutes.

Time Synchronization may instead be initiated by the Master for each Outstation. This may be selected in the Add/Edit Master Poll dialog. It is not required to enable Time Synchronization at both the Master and the Outstation.

The Un**solicited Response** section of the dialog defines which **class** objects are enabled or disabled from generating report by exception responses. Unsolicited responses are individually configured for Class 1, Class 2, and Class 3 data.

The **Enable Unsolicited** controls enables or disables the generation of unsolicited events for Class 1, Class 2 or Class 3 data. If unsolicited responses are disabled for a Class the controller will not generate unsolicited events for that Class. If unsolicited responses are enabled the controller generates unsolicited events for that Class if its value or state exceeds a defined threshold. Valid selections are:

- Enabled
- Disabled

The controller does not transmit collected unsolicited messages (or responses) to a master, even after the Hold Time or Hold Count conditions have been met, unless its 'Enable Unsolicited Responses on Start Up' field is set to `'Yes'` or the master triggers this transmission.

To configure a master to control unsolicited message transmission from a remote, see the **Master Poll** configuration panel.

The **Hold Time** parameter is used only when unsolicited responses are enabled for a Class. This parameter defines the maximum period (in seconds) the RTU will be allowed to hold its events before reporting them to the DNP master station. When the hold time has elapsed since the first event occurred, the RTU will report to the DNP master station events accumulated up to then. This parameter is used in conjunction with the **Hold Count** parameter in customizing the unsolicited event reporting characteristics. The value used for the Hold Time depends on the frequency of event generation, topology and performance characteristics of the system. The valid values for this parameter are 0 - 65535. The default value is 60 seconds.

The **Hold Count** parameter is used only when unsolicited responses are enabled for a Class. This parameter defines the maximum number of events the RTU will be allowed to hold before reporting them to the DNP master station. When the hold count threshold is reached, the RTU will report to the master, events accumulated up to that point. This parameter is used in conjunction with the **Hold Time** in customizing the unsolicited event reporting characteristics. So that an unsolicited response is sent as soon as an event occurs, set the Hold Count parameter to 1. The valid values for this parameter are 1 - 65535. The default value is 10.

The **Enable Unsolicited Responses on Start Up** parameter enables or disables unsolicited responses on startup. This affects the default controller behaviour after a start-up or restart. Some hosts require devices to start up with unsolicited responses enabled. It should be noted this is non-conforming behaviour according to the DNP standard. Valid selections are:

- Yes
- No

The default selection is **Yes**.

The **Send Initial Unsolicited Response on Startup** parameter enables or disables Send Initial unsolicited responses on startup. This parameter controls whether an initial unsolicited response with null data is sent after a start-up or restart. Valid selections are:

- Yes
- No

The default selection is **No**.

The **Resend unreported events after** parameter enables or disables the retransmission of events after every attempt to report the events have not succeeded.

Many communications networks experience occasional communications failures. In such networks, even when message retries are used, there is a chance that some messages will not be sucessful – meaning there is a chance some unsolicited messages will be unsuccessful and change events will not be reported to the master station. The events remain in the outstation buffers until polled or additional events are generated.

To address this the **Resend unreported events after** parameter is added to the DNP configuration. This parameter controls a timer for retrying the transmission of unsolicited messages.

Whenever a DNP unsolicited message is unsucessful, including its retries, then instead of just retiring the message, an unsolicited resend timer is initiated. After the configured time delay has passed, the unsolicited message will be sent again, including the configured retries. This process will be repeated continuously until the unsolicited message is successfully sent and acknowledged. In the case of multiple masters the unsolicited resend timer is uninitiated after the retries are expired for the last master in the polling list.

SCADAPack firmware 2.44 (and later), SCADAPack 32 Firmware 1.92 (and later), SCADAPack 314/330/334, SCADAPack 350/SCADAPack firmware 1.25 (and later) and SolarPack 410 firmware 1.32 (and Later) support this feature.

Valid values are 1 to 65535 seconds. The default value is 0 seconds. The control is unselected by default.

If **Resend unreported events** is not selected, the controller will not resend unreported events after attempts are unsucessful, until polled or until additional events are generated and their reporting threshold is reached.

The **Resend unreported events** control can be selected even when no classes are enabled. This allows the feature to be used in a mimic controller that is being used to pass outstations events to a host.

The **Dial Up** section of the dialog defines modem parameters used when a dial up modem is used to communicate with stations that use dial up communication. The phone numbers for the stations are defined in the Routing table.

The **Modem Initialization** is the string that will be sent to the modem prior to each call. This is an ASCII null-terminated string. The maximum length of the string is 64 characters, including the null terminator.

The **Attempts** controls the maximum number of dial attempts that will be made to establish a Dial Up connection. The valid values for this parameter are 1 – 10. The default value is 2.

The **Dial Type** parameter controls whether tone or pulse dialing will be used for the call. Valid values are Tone dialing or Pulse dialing. The default value is Tone dialing.

The **Connect Timeout** controls the maximum time (in seconds) after initiating a dial sequence that the firmware will wait for a carrier signal before hanging up. The valid values for this parameter are 1 – 65535. The default value is 45.

The **Inactivity Timeout** controls the maximum time after message activity that a connection will be left open before hanging up. The valid values for this parameter are 1 – 65535 seconds. The default value is 45 seconds.

The **Pause Time** controls the delay time (in seconds) between dial events, to allow time for incoming calls. The valid values for this parameter are 1 – 65535. The default value is 10.

The **Operate Timeout** parameter specifies the timeout interval between a Select and Operate request from the Master. If after receiving a valid ***Select*** control output request from the master, the RTU does not receive the corresponding ***Operate*** request within this time-out interval, the control output request is unsucessful. The value of this parameter, expressed in seconds, is dependent on the master station, the data link and physical layer. Valid values are 1 to 6500 seconds. The default value is 15 seconds. The Master needs to have the Select/Operate functionally in order to use this feature.

The **Report only Level 2 Compliant Objects in Class Polls** parameter affects how Short Float Analog Input, Short Float Analog Output, and 32-bit Analog Output objects are reported. These objects are converted to 32-bit Analog Input and 16-bit Analog Output objects when this parameter is selected. Valid selections are:

- Yes
- No

The default selection is No.

The **Limit Maximum Events in Read Response** parameter allows limiting the number of events in a read response. Select the checkbox to enable the limit. Valid values are 1 to 65535. The default value is disabled.

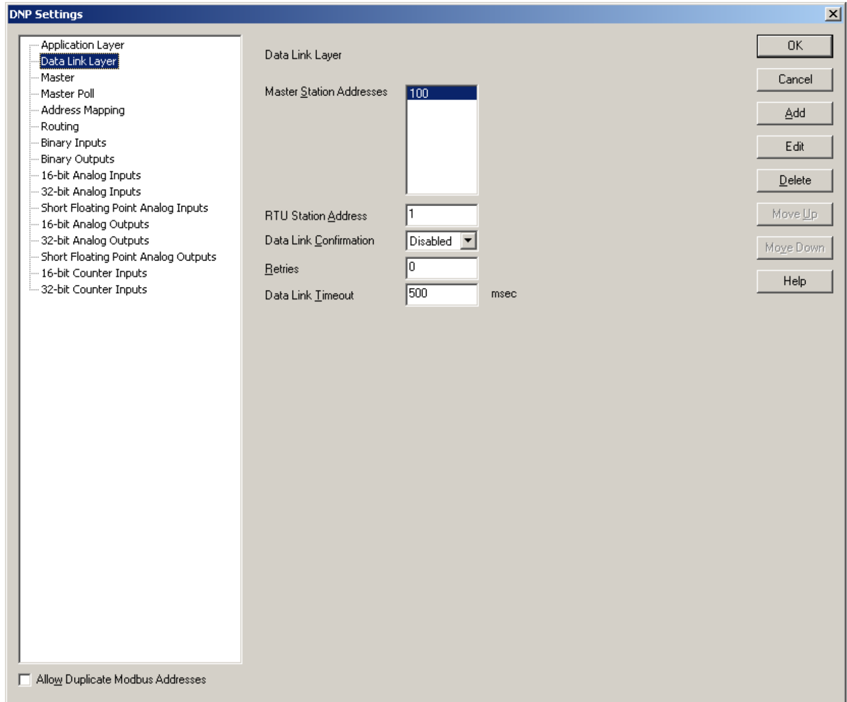
The Maximum Events parameter applies to responses from read commands only. It does not affect unsolicited responses.

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

- Click the **OK** button to accept the configuration changes and close the DNP Settings dialog.
- Click the **Cancel** button to close the dialog without saving any changes.

Data Link Layer Configuration

The Data Link Layer property page is selected for editing by clicking Data Link Layer in the tree control section of the DNP Settings window. When selected the Data Link Layer property page is active.



Data Link Layer parameters are set in this property page. Each parameter is described in the following paragraphs.

The **Master Station Addresses** list box contains a list of Master station addresses that the SCADAPack controller will respond to. The default list contains one master address of 100. This address may be edited, or changed, and up to 8 master stations may be added to the list. Valid entries for Master Station Addresses are 0 to 65519.

- When a master station polls for event data, the controller will respond with any events that have not yet been reported to that master station.
- When an unsolicited response becomes due, it will be sent to each configured master station in turn. A complete unsolicited response message transaction, including retries, will be sent to the first configured master station. When this transaction has finished, a complete unsolicited response message transaction including retries will be sent to the next configured master station, and so on for the configured master stations.
- Change events will be retained in the event buffer until they have been successfully reported to configured master stations.

Select the **Add** button to enter a new address to the Master Station Address list. Selecting the Add button opens the **Add Master Station Address** dialog. Up to 8 entries can be added to the table. An error message is displayed if the table is full.

Select the **Edit** button to edit address in the Master Station Address list. Selecting the Edit button opens the **Edit Master Station Address** dialog. The button is disabled if there are no entries in the list.

The **Master Station Address** edit box specifies the Master Station Address. Enter any valid Station address from 0 to 65519.

- The **OK** button adds the Master Station Address to the list and closes the dialog. An error is displayed if the Master Station Address is invalid, if the address is already in the list, or if the address conflicts with the RTU station address.
- The **Cancel** button closes the dialog without making any changes.

The **RTU Station Address** parameter specifies the address of this RTU. It is the source address used by this DNP driver when communicating with a master station. Each DNP station in a network needs to have a unique address, including the Master station. Valid entries for RTU Station Address are 0 to 65519.

The **Data Link Confirmation** parameter specifies whether or not the RTU requests the underlying data link transmitting its response to use a high quality service, which generally means that the data link requires the receiving data link to confirm receipt of messages.

The **Retries** parameter specifies the maximum number of times the data link layer will retry sending a message to the master station. This parameter is only used when responding to a request from a Master station, when there is no corresponding entry in the Routing dialog for that station. This is independent of the application layer retries. The valid values for this parameter are 0 - 255. Setting the value to 0 disables sending retries.

Using data link layer Confirmation and Retries is inherently less efficient than application layer Confirmation and Retries. Each fragment sent by the Application layer may require as many as 10 data link layer frames to be sent, each with its own confirmation message. The data link layer is typically not used for message confirmation for this reason.

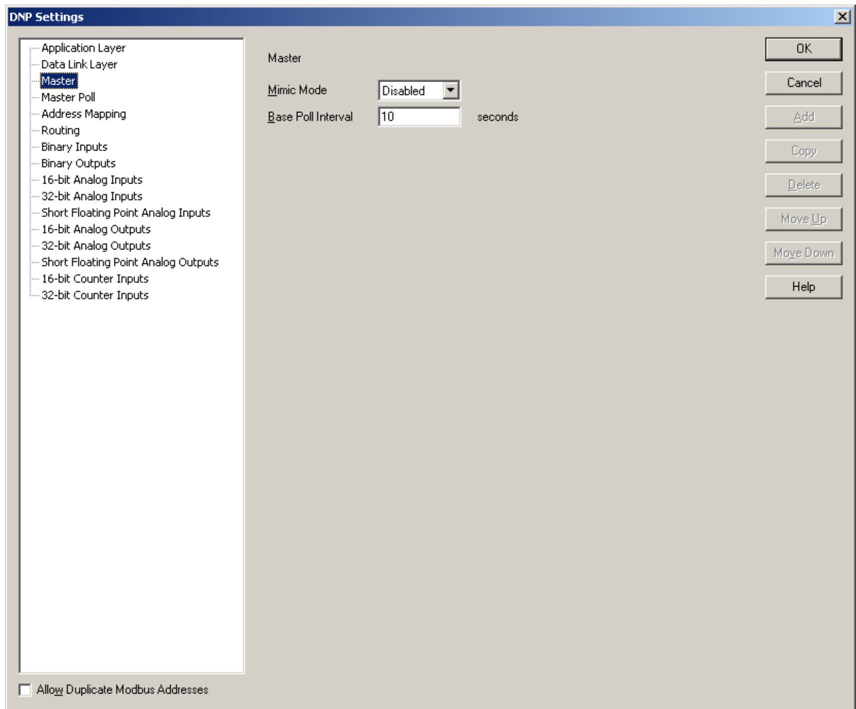
The **Data Link Timeout** parameter specifies the expected time duration that the master station's data link layer requires to process and respond to a message from the RTUs data link layer. It is used by the RTU in setting its time-out interval for master station responses. This value should be large enough to avoid response time-outs. The value needs to be kept small enough so as not to slow system throughput. The value of this element is dependent on the master station. It is expressed in milliseconds. Valid values are 10 to 60000 milliseconds. The default value is 500 milliseconds.

- Click the **OK** button to accept the configuration changes and close the DNP Settings dialog.
- Click the **Cancel** button to close the dialog without saving any changes.
- Click the **Delete** button to remove the selected rows from the list. This button is disabled if there are no entries in the list.

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points needs to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Master

The Master property page is selected for editing by clicking Master in the tree control section of the DNP Settings window. This selection is only visible if the controller type is SCADAPack 314/330/334, SCADAPack 350, SCADAPack 32 or SCADAPack 32P. These controllers support DNP Master. When selected the Master Application Link Layer property page is active.



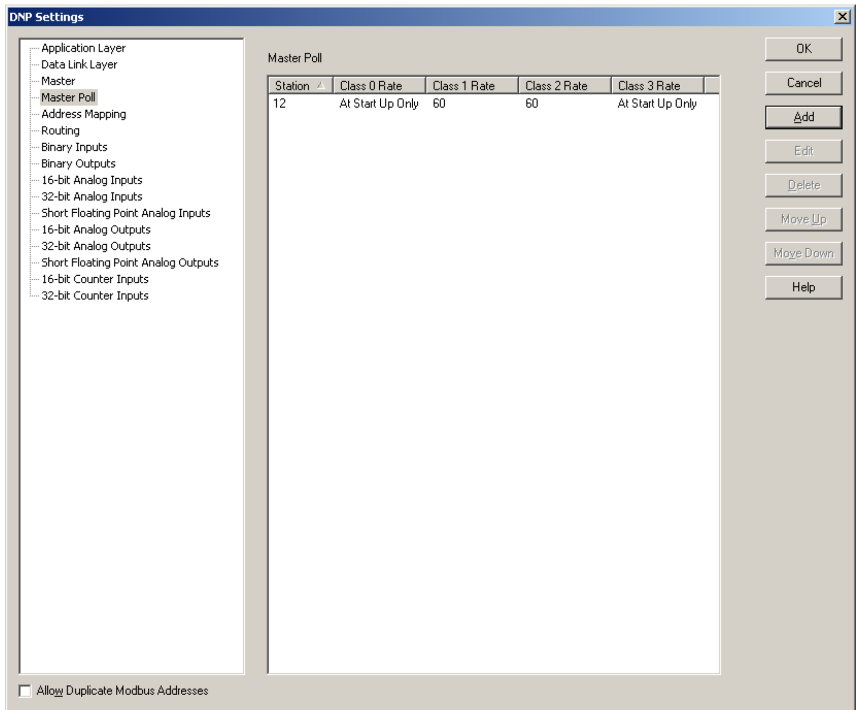
Master parameters are set in this property page. Each parameter is described in the following paragraphs.

The **Mimic Mode** parameter specifies the DNP Mimic Mode. The valid selections are Enable or Disable. When DNP Mimic Mode is enabled the controller will intercept DNP messages destined for a remote DNP station address, and will respond directly, as though the controller were the designated target. For read commands, the controller will respond with data from its Remote DNP Objects corresponding with the target address. For write commands, the controller will write data into its Remote DNP Objects, and issue a direct response to acknowledge the command. It will then issue a new command to write the data to the designated target. The default selection is Disabled.

The **Base Poll Interval** parameter is the base interval (in seconds) for polling slave devices. The poll rates and issuing time synchronisation will be configured in multiples of the base poll interval. The slave devices with the same poll rates will be polled in the order they appear in the poll table. The valid values for this parameter are 1 to 65535. The default value is 10 seconds.

Master Poll

The Master Poll property page is selected for editing by clicking Master Poll in the tree control section of the DNP Settings window. This selection is only visible if the controller type is a SCADAPack 314/330/334, SCADAPack 350, SCADAPack 32 or SCADAPack 32P. These controllers support DNP Master. When selected the Master Poll property page is active and button Copy is renamed to Edit.



The Master Poll displays slave devices to be polled by this master station as a row, with column headings, in the table. The table may have up to 1000 entries. A vertical scroll bar is used if the list exceeds the window size.

Slave devices in the Master Poll table need to be added to the Routing table.

The **Station** column displays the address of the DNP slave device to be polled. Each entry in the table should have unique DNP Station Address.

The **Class 0 Rate** column displays the rate of polling for Class 0 data, as a multiple of the base poll interval.

The **Class 1 Rate** column displays the rate of polling for Class 1 data, as a multiple of the base poll interval.

The **Class 2 Rate** column displays the rate of polling for Class 2 data, as a multiple of the base poll interval.

The **Class 3 Rate** column displays the rate of polling for Class 3 data, as a multiple of the base poll interval.

- The **OK** button saves the table data and closes the DNP Settings dialog.
- The **Cancel** button closes the dialog without saving changes.

Select the **Add** button to enter a new row in the Master Poll. Selecting the Add button opens the **Add/Edit Master Poll** dialog.

Select the **Edit** button to modify the selected row in the Master Poll. Selecting the Edit button opens the **Add/Edit Master Poll** dialog containing the data from the selected row. This button is disabled if more than one row is selected or if there are no entries in the table.

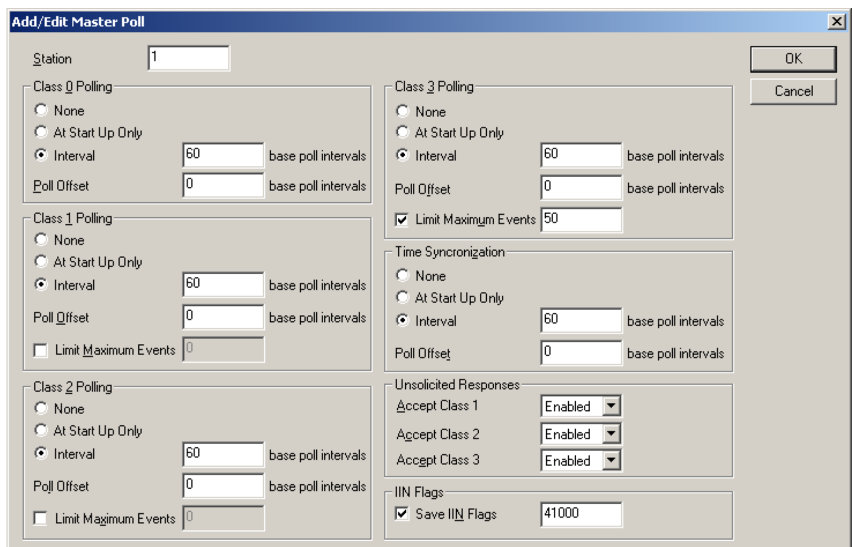
The **Delete** button removes the selected rows from the table. This button is disabled if there are no entries in the table.

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click on the column headings to sort the data. Clicking once sorts the data in ascending order. Clicking again sorts the data in descending order.

Add/Edit Master Poll Dialog

This dialog is used to edit an entry or add a new entry in the Master Poll.



The **Station** edit control displays the address of the DNP slave device to be polled. Valid values are 0 to 65519.

The **Class 0 Polling** section of the dialog specifies the type and rate of polling for Class 0 data.

- The **None** selection disables class 0 polling for the slave station. This is the default selection.
- The **At Start Up Only** selection will cause the master to poll the slave station at startup only.
- The **Interval** selection will cause the master to poll the slave station at startup and then every **Interval** of the base poll interval. For example if the base poll interval is 60 seconds and the Interval parameter is set to 60 then the master will poll the slave station every hour. Valid values are 1 to 32767. The default value is 60.
- The **Poll Offset** parameter is used to distribute the load on the communication network. The Poll Offset is entered in multiples of the base poll interval. Valid values for this parameter are 0 to the Poll Interval value minus 1. Any non-zero value delays the start of polling for

the specified objects by that amount. The default value is 0. This control is disabled when None is selected, and enabled otherwise. For an example of using the Poll Offset parameter see the ***Poll Offset Example*** at the end of this section.

The **Class 1 Polling** section of the dialog specifies the type and rate of polling for Class 1 data.

- The **None** selection disables class 1 polling for the slave station. This is the default selection.
- The **At Start Up Only** selection will cause the master to poll the slave station at startup only.
- The **Interval** selection will cause the master to poll the slave station at startup and then every **Interval** of the base poll interval. For example if the base poll interval is 60 seconds and the Interval parameter is set to 60 then the master will poll the slave station every hour. Valid values are 1 to 32767. The default value is 60.
- The **Poll Offset** parameter is used to distribute the load on the communication network. The Poll Offset is entered in multiples of the base poll interval. Valid values for this parameter are 0 to the Poll Interval value minus 1. Any non-zero value delays the start of polling for the specified objects by that amount. The default value is 0. This control is disabled when None is selected, and enabled otherwise. For an example of using the Poll Offset parameter see the ***Poll Offset Example*** at the end of this section.
- **Limit Maximum Events** allows limiting the number of events in poll responses for Class 1/2/3 data. The checkbox is not checked by default, meaning there is no limit on the number of events. Select the checkbox to specify a limit. The valid values for this parameter are 1 to 65535. The default value is 65535. This control is disabled when None is selected, and enabled otherwise.

  The Maximum Events parameter can be used to manage communication load on a system.

  Consider the example of a master polling some data logging remotes, and the case where one of the remotes has been offline for a long time. The remote will have built up a large number of buffered events. If the master polled it for every event, the reply might take a long time, and cause an unwanted delay in the master's polling cycle. However if the master limits the number of events returned, the reply message duration will be more deterministic and the master can keep its poll loop timing maintained. In this case, the event retrieval from the data logger will be distributed over a number of poll cycles.

The **Class 2 Polling** section of the dialog specifies the type and rate of polling for Class 2 data.

- The **None** selection disables class 1 polling for the slave station. This is the default selection.
- The **At Start Up Only** selection will cause the master to poll the slave station at startup only.
- The **Interval** selection will cause the master to poll the slave station at startup and then every **Interval** of the base poll interval. For example if the base poll interval is 60 seconds and the Interval parameter is set to

60 then the master will poll the slave station every hour. Valid values are 1 to 32767. The default value is 60.

The **Poll Offset** parameter is used to distribute the load on the communication network. The Poll Offset is entered in multiples of the base poll interval. Valid values for this parameter are 0 to the Poll Interval value minus 1. Any non-zero value delays the start of polling for the specified objects by that amount. The default value is 0. This control is disabled when None is selected, and enabled otherwise. For an example of using the Poll Offset parameter see the ***Poll Offset Example*** at the end of this section.

Limit Maximum Events allows limiting the number of events in poll responses for Class 1/2/3 data. The checkbox is not checked by default, meaning there is no limit on the number of events. Select the checkbox to specify a limit. The valid values for this parameter are 1 to 65535. The default value is 65535. This control is disabled when None is selected, and enabled otherwise.

The Maximum Events parameter can be used to manage communication load on a system. Consider the example of a master polling some data logging remotes, and the case where one of the remotes has been offline for a long time. The remote will have built up a large number of buffered events. If the master polled it for every event, the reply might take a long time, and cause an unwanted delay in the master's polling cycle. However if the master limits the number of events returned, the reply message duration will be more deterministic and the master can keep its poll loop timing maintained. In this case, the event retrieval from the data logger will be distributed over a number of poll cycles.

The **Class 3 Polling** section of the dialog specifies the type and rate of polling for Class 3 data.

- The **None** selection disables class 1 polling for the slave station. This is the default selection.
- The **At Start Up Only** selection will cause the master to poll the slave station at startup only.
- The **Interval** selection will cause the master to poll the slave station at startup and then every **Interval** of the base poll interval. For example if the base poll interval is 60 seconds and the Interval parameter is set to 60 then the master will poll the slave station every hour. Valid values are 1 to 32767. The default value is 60.
- The **Poll Offset** parameter is used to distribute the load on the communication network. The Poll Offset is entered in multiples of the base poll interval. Valid values for this parameter are 0 to the Poll Interval value minus 1. Any non-zero value delays the start of polling for the specified objects by that amount. The default value is 0. This control is disabled when None is selected, and enabled otherwise. For an example of using the Poll Offset parameter see the ***Poll Offset Example*** at the end of this section.

Limit Maximum Events allows limiting the number of events in poll responses for Class 1/2/3 data. The checkbox is not checked by default, meaning there is no limit on the number of events. Select the checkbox to specify a limit. The valid values for this parameter are 1 to 65535. The default value is 65535. This control is disabled when None is selected, and enabled otherwise.

The Maximum Events parameter can be used to manage communication load on a system. Consider the example of a master polling some data logging remotes, and the case where one of the remotes has been offline for a long time. The remote will have built up a large number of buffered events. If the master polled it for every event, the reply might take a long time, and cause an unwanted delay in the master's polling cycle. However if the master limits the number of events returned, the reply message duration will be more deterministic and the master can maintain its poll loop timing maintained. In this case, the event retrieval from the data logger will be distributed over a number of poll cycles.

The **Time Synchronization Rate** section of the dialog specifies the rate of issuing a time synchronization to this device, as a multiple of the base poll interval. Valid selections for this parameter are:

- The **None** selection will disable issuing a time sync to this device. This is the default selection.
- The **At Start Up Only** selection will cause issuing a time synchronization at startup only.
- The **Interval** selection will cause the RTU to issue a time synchronization at startup and then every **Interval** of the base poll interval seconds. Valid entries for **Interval** are between 1 and 32767 the base poll interval seconds. The default value is 60.

The **Unsolicited Responses** section is used in conjunction with the Enable Unsolicited Responses on Start Up parameter on the Application Layer page. Certain non-SCADAPack slave devices are designed to start with their Enable Unsolicited Responses on Start Up parameter set to No. Selecting Enabled for any class causes the master to (after it detects the slave come online) send a command allowing the slave to begin sending Unsolicited Responses of that class.

With SCADAPack slaves the Enable Unsolicited Responses on Start Up parameter may be set to Yes, and the Accept Class parameters may be left at Disabled.

- The **Accept Class 1** selection displays the enable/disable status of unsolicited responses from the slave device for Class 1 events. The default selection is disabled.
- The **Accept Class 2** selection displays the enable/disable status of unsolicited responses from the slave device for Class 1 events. The default selection is disabled.
- The **Accept Class 3** selection displays the enable/disable status of unsolicited responses from the slave device for Class 1 events. The default selection is disabled.

The **Save IIN Flags** checkbox enables storing the IIN (Internal Indications) flags from the slave station in a Modbus database register. When this parameter is checked the IIN flags are saved to the entered Modbus register address. Valid entries are Modbus register addresses 30001 to 39999 and 40001 to 49999. The default value is 0.

The IIN flags are set by the slave to indicate the events in the following table. The events are bit mapped to the Modbus register. Bits except *Device Restarted* and *Time Synchronization required* are cleared when the slave station receives any poll or read data command. The master will write to bits 5 and 11 depending on the local conditions in the master.

Bit	Description
0	last received message was a broadcast message
1	Class 1 data available
2	Class 2 data available
3	Class 3 data available
4	Time Synchronization required
5	not used (returns 0)
6	Device trouble Indicates memory allocation error in the slave, or For master in mimic mode indicates communication failure with the slave device.
7	Device restarted (set on a power cycle)
8	Function Code not implemented
9	Requested object unknown or there were errors in the application data
10	Parameters out of range
11	Event buffer overflowed Indicates event buffer overflow in the slave or master. The slave will set this bit if the event buffer in the slave is overflowed. The master will set this bit if the event buffer in the master has overflowed with events read from the slave. Check that the event buffer size, in the master and slave, is set to a value that will keep the buffer from overflowing and losing events.
12	not used (returns 0)
13	not used (returns 0)
14	not used (returns 0)
15	not used (returns 0)

The **OK** button checks the data for this table entry. If the data is valid the dialog is closed. If the table data entered is invalid, an error message is displayed and the dialog remains open. The table entry is invalid if any of the fields is out of range. The data is also invalid if it conflicts with another entry in the table. Such conflict occurs when the station number is not unique.

The **Cancel** button closes the dialog without saving changes.

Poll Offset Example

The Poll Offset parameter enhances the control over timing of master poll messages, by allowing master poll messages to be staggered.

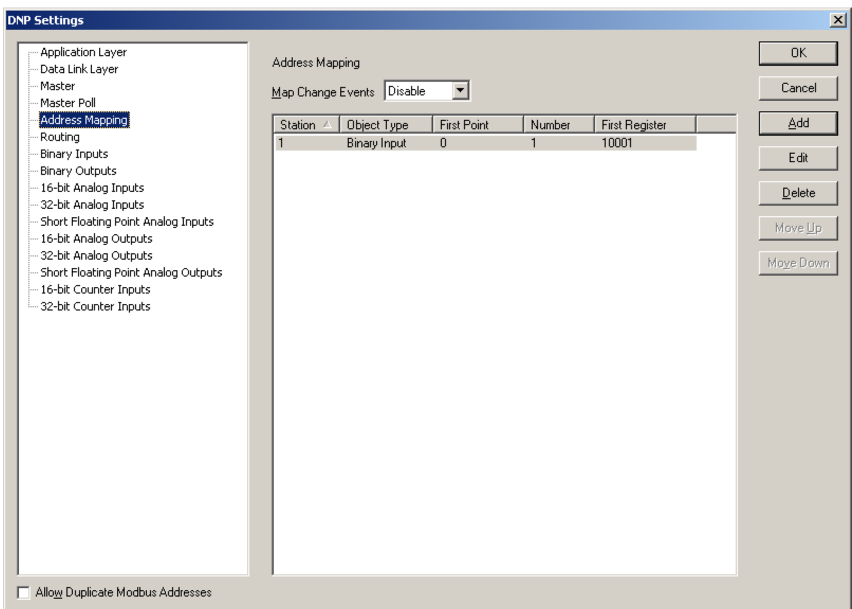
For example, a master station may have 10 slaves to poll, and needs to poll them every hour. If these are included in the poll table without any poll offset, they will be polled in quick succession on the hour – resulting in a large burst of communication activity once per hour. On some types of communications networks (particularly radio) it is desirable to distribute communication load more evenly, to minimize the chance of collisions and to avoid the possibility of consuming bandwidth continuously for an extended period of time.

The poll offset parameter enables you to distribute the communication load evenly. In the above example, it is possible to stagger the master polls so slave stations are polled at 6-minute intervals. To do this, set the base poll interval to 10 seconds, and for each slave station set the poll rate and poll offset parameters as follows:

Base Poll (seconds)	Poll Rate (seconds)	Poll Offset (seconds)
10	360	0
10	360	36
10	360	72
10	360	108
10	360	144
10	360	180
10	360	216
10	360	252
10	360	288
10	360	324

Address Mapping

The Address Mapping property page is selected for editing by clicking Address Mapping in the tree control section of the DNP Settings window. This selection is only visible if the controller type is a SCADAPack 314/330/334, SCADAPack 350, SCADAPack 32 or SCADAPack 32P. These controllers support DNP Master.



The Address Mapping contains a set of mapping rules, which will allow the Remote DNP Objects to be mapped into local Modbus registers. This makes the data accessible locally, to be read and/or written locally in logic. It is also possible to perform data concentration – to map the remote DNP Objects into the local DNP address space – by defining local DNP objects and then mapping the remote DNP objects to the same Modbus registers. Change events can also be mapped in the same way - there is a configuration option to allow mapping of change events from a remote DNP slave into the local DNP change event buffer. The table may have up to 1000 entries. A vertical scroll bar is used if the list exceeds the window size.

The **Station** column displays the address of the remote DNP station.

The **Object Type** column displays the DNP data object type.

The **First Point** column displays the starting address of the remote DNP data points.

The **Number** column displays the number of remote points to be mapped.

The **First Register** column displays the starting address of local Modbus register where the remote data points are to be mapped.

The **Map Change Events** combo box enables or disables mapping of change events from a remote DNP slave into the local DNP change event buffer. Mapped change events may trigger an Unsolicited message to be sent, after the Hold Count or Hold Time is reached. It may be desired instead to map only static (live) values into local Modbus registers. The default selection is Disabled.

The default selection is Disabled.

The **OK** button saves the table data. No error checking is done on the table data.

The **Cancel** button closes the dialog without saving changes.

Select the **Add** button to enter a new row in the Address Mapping. Selecting the Add button opens the **Add/Edit Address Mapping** dialog.

Select the **Edit** button to modify the selected row in the Address Mapping. Selecting the Edit button opens the **Add/Edit Address Mapping** dialog containing the data from the selected row. This button is disabled if more than one row is selected. This button is disabled if there are no entries in the table.

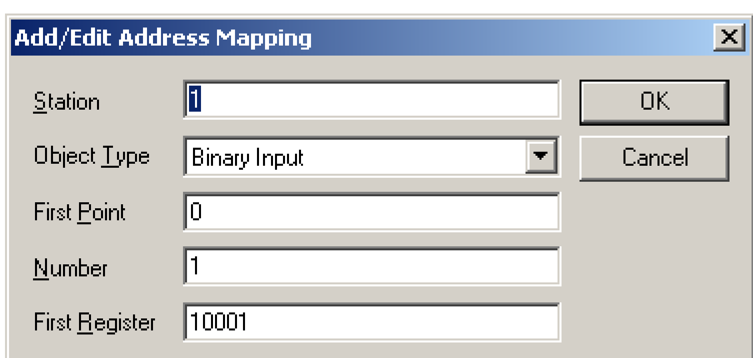
The **Delete** button removes the selected rows from the table. This button is disabled if there are no entries in the table.

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click on the column headings to sort the data. Clicking once sorts the data in ascending order. Clicking again sorts the data in descending order.

Add/Edit Address Mapping Dialog

This dialog is used to edit an entry or add a new entry in the Address Mapping.



The **Station** edit control displays the address of the remote DNP station. Valid values for this field are from 0 to 65519.

The **Object Type** combo box displays the DNP data Object Type. The list of available types includes: Binary Input, Binary Output, 16-bit Analog Input, 32-bit Analog Input, Short Floating Point Analog Input, 16-bit Analog Output, 32-bit Analog Output, Short Floating Point Analog Output, 16-bit Counter Input, 32-bit Counter Input. The Default selection is Binary Input.

The **First Point** edit control displays the starting address of the remote DNP data points. Valid values are from 0 to 65519.

The **Number** edit control displays the number of remote points to be mapped. Valid values for this field are from 1 to 9999.

The **First Register** edit control displays the starting address of local Modbus register where the remote data points are to be mapped. Valid values depend on the selection of DNP Object Type and are as follows:

For Binary Inputs valid range is from 10001 to 14096.

For Binary Outputs valid range is from 00001 to 04096.

For Analog Inputs and Counter Inputs valid range is from 30001 to 39999.

For Analog Outputs valid range is from 40001 to 49999.

The **OK** button checks the data for this table entry. If the data is valid the dialog is closed. If the table data entered is invalid, an error message is displayed and the dialog remains open. The table entry is invalid if any of the fields is out of range. The data is also invalid if it conflicts with another entry in the table. Such conflict occurs when the combination of station number, object type, and object address is not unique.

The **Cancel** button closes the dialog without saving changes.

Routing

In a typical application the SCADAPack controller, configured for DNP, will act as a DNP slave station in a network. The SCADA system will communicate directly with the DNP slave stations in the SCADA system.

DNP routing is a method for routing, or forwarding, of messages received from the SCADA system, through the SCADAPack controller, to a remote DNP slave station. The SCADAPack DNP slave station will respond to messages sent to it from the SCADA system, as well as broadcast messages. When it receives a message that is not sent to it the message is sent on the serial port defined in the routing table.

The advantage of this routing ability is that the SCADA system can communicate directly with the SCADAPack controller and the SCADAPack controller can handle the communication to remote DNP slave stations.

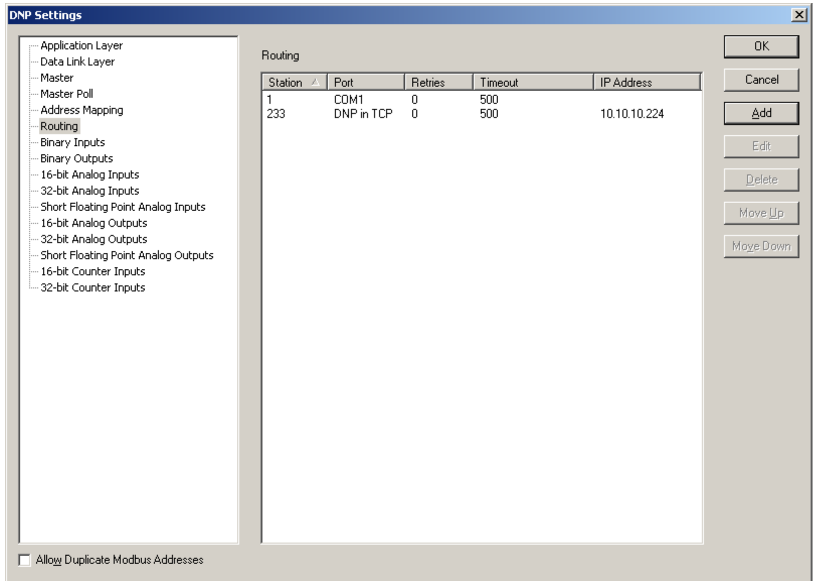
The DNP Routing table displays each routing translation as a row, with column headings, in the table. Entries may be added, edited or deleted using the button selections on the table. The table will hold a maximum of 128 entries.

The DNP Routing property page is selected for editing by clicking DNP Routing in the tree control section of the DNP Settings window. When selected the DNP Routing property page is displayed.

Notes:

- Routing needs to be enabled for the controller serial port in order to enable DNP routing.

- Telepace version 2.63 cannot open files created with version 2.64, unless the Routing table is empty.
- Telepace version 2.64 cannot open files created with version 2.65, unless the Routing table is empty.



The **Station** column displays the address of the remote DNP station.

The **Port** column displays the serial communications port, which should be used to communicate with this DNP station.

The **Retries** column displays the maximum number of Data Link retries, which should be used for this DNP station in the case of communication errors.

The **Timeout** column displays the maximum time (in milliseconds) to wait for a Data Link response before retrying the message.

The **IP Address** column displays the IP address of the remote DNP station.

The **OK** button saves the table data. No error checking is done on the table data.

The **Cancel** button closes the dialog without saving changes.

Select the **Add** button to enter a new row in the DNP Routing table. Selecting the Add button opens the **Add/Edit DNP Route** dialog.

Select the **Edit** button to modify the selected row in the DNP Routing table. Selecting the Edit button opens the **Add/Edit DNP Route** dialog containing the data from the selected row. This button is disabled if more than one row is selected. This button is disabled if there are no entries in the table.

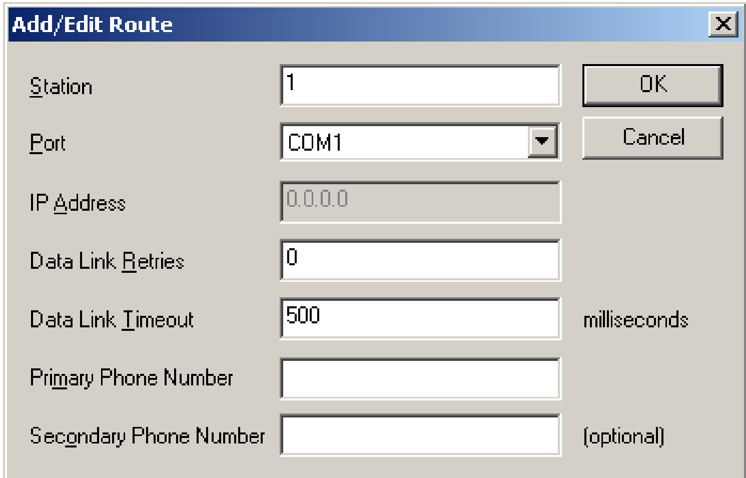
The **Delete** button removes the selected rows from the table. This button is disabled if there are no entries in the table.

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click on the column headings to sort the data. Clicking once sorts the data in ascending order. Clicking again sorts the data in descending order.

Add/Edit DNP Route Dialog

This dialog is used to edit an entry or add a new entry in the DNP Routing table.



The **Station** edit control displays the address of the remote DNP station. Valid values for this field are from 0 to 65519.

The **Port** combo box displays the communications port, which should be used to communicate with the remote DNP station. This combo box contains list of the valid communications ports, which will depend on the type of controller. For SCADAPack 330/334, SCADAPack 350, SCADAPack 32 and SCADAPack 32P controllers the list will contain DNP in TCP and DNP in UDP in addition to the serial port designations, COM1, COM2 etc.

The **IP Address** edit control is only enabled if the controller type is a SCADAPack 330/334, SCADAPack 350, SCADAPack 32 or SCADAPack 32P. Enter the IP address of the remote DNP station.

The **Data Link Retries** edit control displays the maximum number of Data Link retries which should be used for this DNP station in the case of communication errors. This field overrides the Data Link Retries field in the global DNP parameters set in the Data Link Layer configuration. Valid values for this field are 0 to 255.

The **Data Link Timeout** edit control displays the maximum time (in milliseconds) to wait for a Data Link response before retrying the message. This field overrides the Data Link Timeout field in the global DNP parameters in the Data Link Layer configuration. Valid values for this field are 100 to 60000, in multiples of 100.

The phone number parameters allow automatic dialing for stations that use dial-up ports. The Phone Number parameters are enabled only when the Port selected is a serial port.

The **Primary Phone Number** is the dialing string that will be used for the primary connection to the station. The controller will make 1 or more attempts, as configured in the Application layer, to connect using this number. If this connection does not work then the Secondary Phone Number will be dialed, if it is entered.

Valid values are any ASCII string. The maximum length is 32 characters. Leave this blank if you are not using a dial-up connection. The default value is blank. The serial port type needs to be set to RS-232 Modem for dial-up operation.

The **Secondary Phone Number** is the dialing string that will be used for the secondary connection to the station. The controller will make 1 or more attempts, as configured in the Application layer, to connect using this number. This number is used after the primary connection does not work.

Valid values are any ASCII string. The maximum length is 32 characters. Leave this blank if you are not using a dial-up connection. The default value is blank. The serial port type needs to be set to RS-232 Modem for dial-up operation.

The **OK** button checks the data for this table entry. If the data is valid the dialog is closed. If the table data entered is invalid, an error message is displayed and the dialog remains open. The table entry is invalid if any of the fields is out of range. The data is also invalid if it conflicts with another entry in the table.

The **Cancel** button closes the dialog without saving changes.

Dynamic Routing

In addition to the configured routing table, there is an internal *dynamic* routing entry. This entry is not shown in the routing table. The dynamic routing entry listens to incoming messages and learns the address of the remote station and the communication port used for communicating with it.

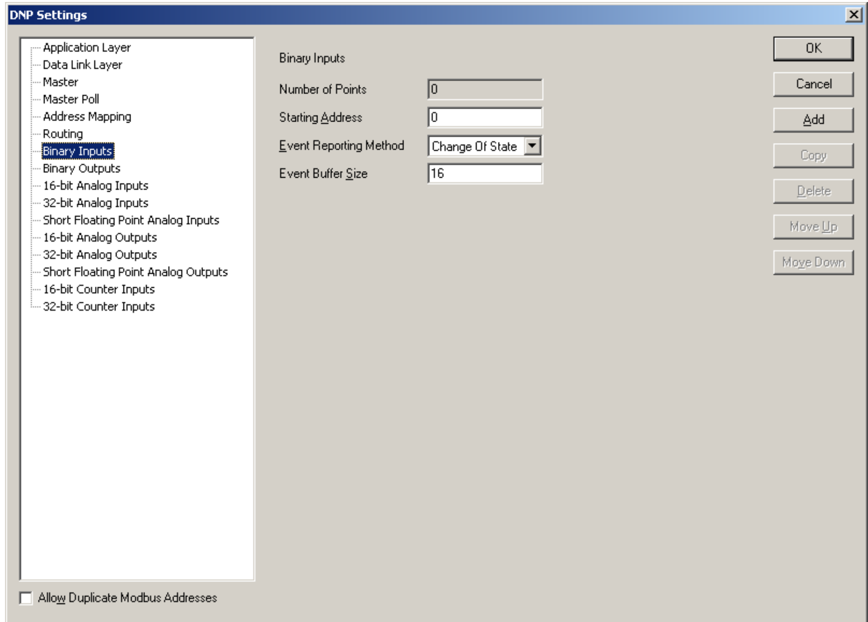
If there is no entry in the routing table, the RTU will use the dynamic routing entry to respond to a message on the same communication port as the incoming message.

The dynamic routing entry is not cleared on initialization. This is deliberate for controllers that need to be remotely reconfigured. In this case the host can initialize the controller without losing the communications link.

Dynamic routing should not be used in a master station. Configure slave stations in the routing table.

Binary Inputs Configuration

The Binary Inputs property page is selected for editing by clicking Binary Inputs in the tree control section of the DNP Settings window. When selected the Binary Inputs property page is active.



Binary Inputs parameters are set in this property page. Each parameter is described in the following paragraphs.

The **Number of Points** displays number of binary inputs reported by this RTU. This value will increment with the addition of each configured Binary Input point. The maximum number of points is 9999. The maximum number of actual points will depend on the memory available in the controller.

The **Starting Address** parameter specifies the starting DNP address of the first Binary Input point.

The **Event Reporting Method** selection specifies how binary input events are reported. A ***Change Of State*** event is an event object, without time, that is generated when the point changes state. Only one event is retained in the buffer for each point. If a subsequent event occurs for a point, the previous event object will be overwritten. The main purpose of this mode is to allow a master station to efficiently poll for changed data. A ***Log All Events*** is event object with absolute time will be generated when the point changes state. All events will be retained. The main purpose of this mode is to allow a master station to obtain a complete historical data log. The selections are:

- Change of State
- Log All Events

The **Event Buffer Size** parameter specifies the maximum number of binary input change events buffered by the RTU. The buffer holds binary input change events, regardless of the class to which they are assigned. If the buffer is completely full the RTU will lose the oldest events and retain the newest; the 'Event Buffer Overflowed' IIN flag will also be set to indicate that the buffer has overflowed. The Event Buffer size should be at least equivalent to the number of binary inputs defined as Change of State type. This will allow binary inputs to change simultaneously without losing any events. The value of this parameter depends on how often binary input change events occur and the rate at which the events are reported to the master station. The valid values for this parameter are 0 - 65535. Default value is 16.

SCADAPack 32, SCADAPack 32P, and SCADAPack 314, SCADAPack 330/334, SCADAPack 350/357 and SCADAPack controllers attempt to process DNP points every 100ms. If there are more DNP points than the controller can scan in 100ms the controller will respond by slowing the DNP scan rate. The DNP scan rate is backed off in multiples of 100ms until there is sufficient time to execute non-DNP functions (logic programs, C programs and communication). In the event the overload is transitory the DNP scan rate will return to the original scan rate of 100ms.

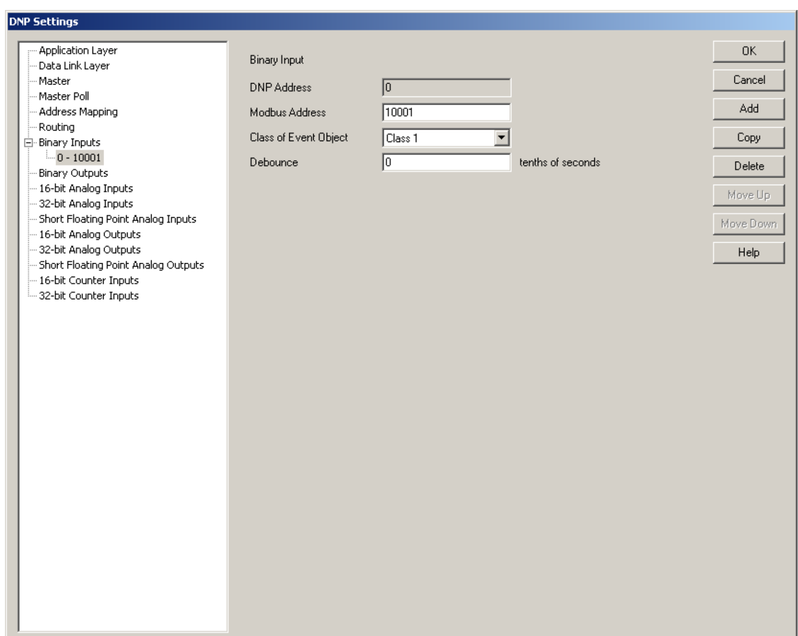
The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points needs to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Adding Binary Inputs

Binary Inputs are added to the DNP configuration using the Binary Input property page. To add a Binary Input:

- Select **Binary Inputs** in the tree control section of the DNP Settings window.
- Click the **Add** button in the Binary Inputs property page.
- The **Binary Input** property page is now displayed.
- Edit the Binary Input parameters as required and then click the **Add** button.

As Binary Inputs are defined they are added as leaves to the Binary Inputs branch of the tree control. When Binary Inputs are defined the Binary Inputs branch will display a collapse / expand control to the left of the branch. Click this control to display defined Binary Inputs.



The Binary Input parameters are described in the following paragraphs.

The **DNP Address** window displays the DNP Binary Input address of the point. Each Binary Input is assigned a DNP address as they are defined.

The DNP point address starts at the value defined in the Binary Inputs configuration dialog and increments by one with each defined Input.

The **Modbus Address** parameter specifies the Modbus address of the Binary Input assigned to the DNP Address. The SCADAPack and Micro16 controllers use Modbus addressing for digital inputs. Refer to the ***I/O Database Registers*** section of the ***Telepace Ladder Logic Reference and User Manual*** for complete information on digital input addressing in the SCADAPack and Micro16 controllers. Valid Modbus addresses are:

- 00001 through 09999
- 10001 through 19999

The **Class of Event Object** parameter specifies the event object class the Binary Input is assigned. The selections are:

- None
- Class 1
- Class 2
- Class 3

The **Debounce** parameter limits the frequency of change events. The input needs to remain in the same state for the debounce time for a change of state to be detected. The input is sampled every 0.1s. Changes shorter than the sample time cannot be detected. Valid values are 0 to 65535 tenths of seconds. The value 0 means no debounce. The default value is 0.

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click the **OK** button to accept the Binary Input parameters and close the DNP Settings dialog.

Click the **Cancel** button to close the dialog without saving any changes.

Click the **Add** button to add the current Binary Input to the DNP configuration.

Click the **Copy** button to copy the current Binary Input parameters to the next DNP Address.

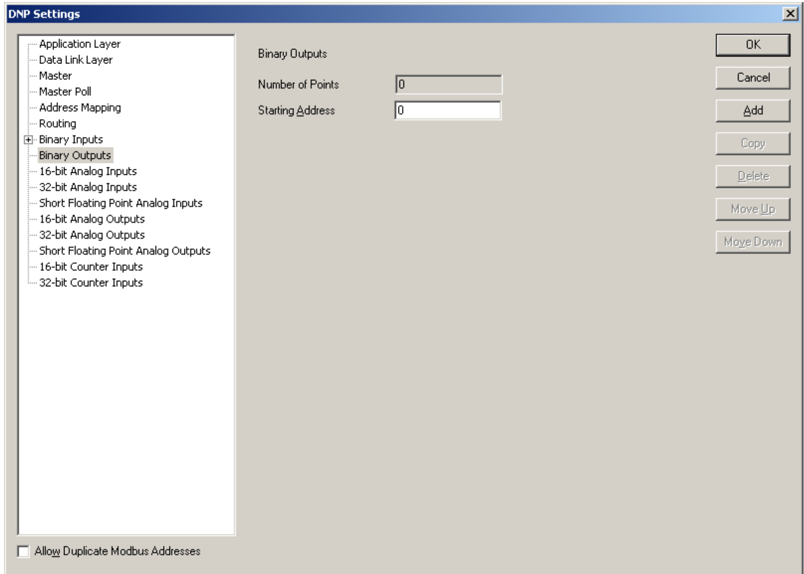
Click the **Delete** button to delete the current Binary Input.

Click the **Move Up** button to move the current Binary Input up one position in the tree control branch.

Click the **Move Down** button to move the current Binary Input down one position in the tree control branch.

Binary Outputs Configuration

The Binary Outputs property page is selected for editing by clicking Binary Outputs in the tree control section of the DNP Settings window. When selected the Binary Outputs property page is active.



Binary Outputs parameters are viewed in this property page.

The **Number of Points** displays the number of binary outputs reported by this RTU. This value will increment with the addition of each configured Binary Output point. The maximum number of points is 9999. The maximum number of actual points will depend on the memory available in the controller.

The **Starting Address** parameter specifies the starting DNP address of the first Binary Output point.

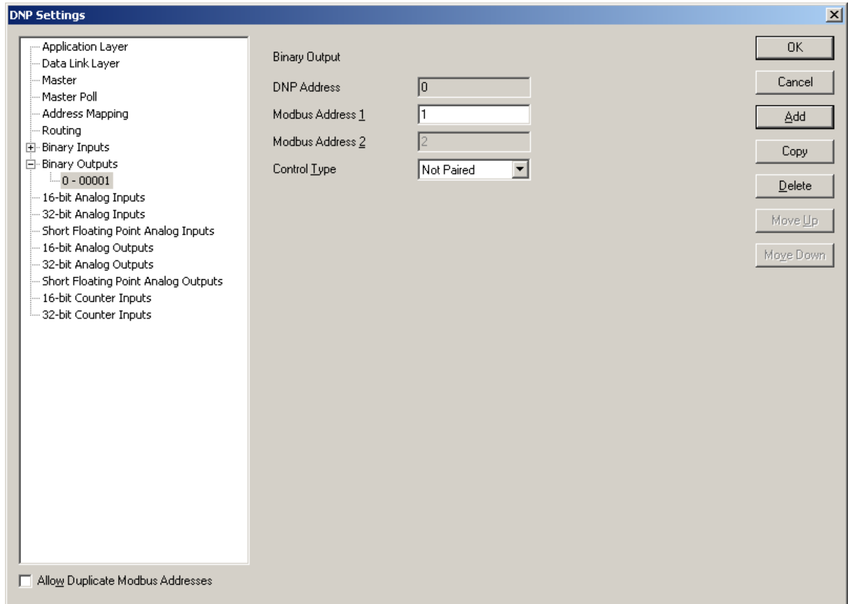
The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Adding Binary Outputs

Binary Outputs are added to the DNP configuration using the Binary Output property page. To add a Binary Output:

- Select **Binary Outputs** in the tree control section of the DNP Settings window.
- Click the **Add** button in the Binary Outputs property page.
- The Binary Output property page is now displayed.
- Edit the Binary Output parameters as required and then click the **Add** button.

As Binary Outputs are defined they are added as leaves to the Binary Outputs branch of the tree control. When Binary Outputs are defined the Binary Outputs branch will display a collapse / expand control to the left of the branch. Click this control to display defined Binary Outputs.



The Binary Output parameters are described in the following paragraphs.

The **DNP Address** window displays the DNP Binary Output address of the point. Each Binary Output is assigned a DNP address as they are defined. The DNP point address starts at the value defined in the Binary Outputs dialog and increments by one with each defined Output.

The **Modbus Address 1** parameter specifies the Modbus address of the Binary Output assigned to the DNP Address. The SCADAPack and Micro16 controllers use Modbus addressing for digital outputs. Refer to the ***I/O Database Registers*** section of the ***Telepace Ladder Logic Reference Manual*** for complete information on digital output addressing in the SCADAPack and Micro16 controllers. Valid Modbus addresses are:

- 00001 through 09999

The **Modbus Address 2** parameter specifies the second Modbus address of the second Binary Output assigned to the DNP Address when the Paired control type is selected. This selection is not active when the control type is Not Paired. Valid Modbus addresses are:

- 00001 through 09999

The **Control Type** parameter specifies whether the Binary Output is a paired control or not. If it is a paired control, i.e. trip/close output type, this means that the DNP address is associated to two physical control outputs and requires two Modbus addresses per DNP address. Control type selections are:

- Paired
- Not Paired

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click the **OK** button to accept the Binary Output parameters and close the DNP Settings dialog.

Click the **Cancel** button to close the dialog without saving any changes.

Click the **Add** button to add the current Binary Output to the DNP configuration.

Click the **Copy** button to copy the current Binary Output parameters to the next DNP Address.

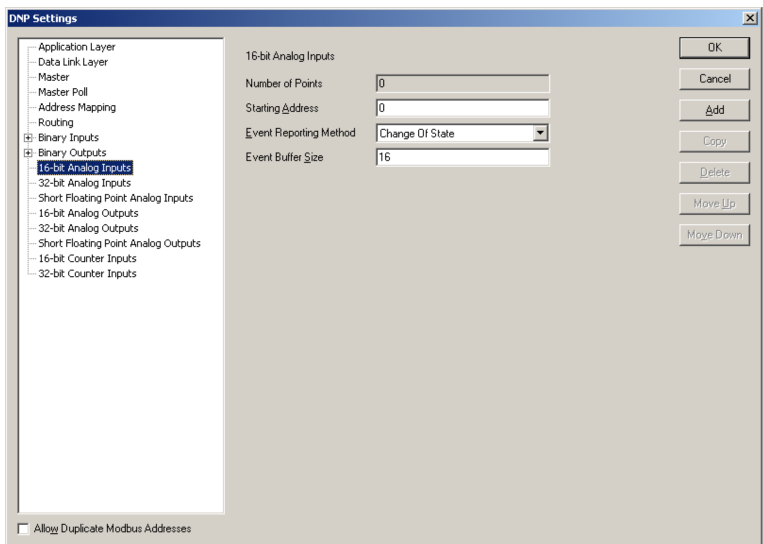
Click the **Delete** button to delete the current Binary Output.

Click the **Move Up** button to move the current Binary Output up one position in the tree control branch.

Click the **Move Down** button to move the current Binary Output down one position in the tree control branch.

16–Bit Analog Inputs Configuration

The 16-Bit Analog Inputs property page is selected for editing by clicking 16-Bit Analog Inputs in the tree control section of the DNP Settings window. When selected the 16-Bit Analog Inputs property page is active.



16-Bit Analog Inputs parameters are set in this property page. Each parameter is described in the following paragraphs.

The **Number of Points** displays the number of 16 bit analog inputs reported by the RTU. This value will increment with the addition of each configured 16-Bit Analog Input point. The maximum number of points is 9999. The maximum number of actual points will depend on the memory available in the controller.

The **Starting Address** parameter specifies the DNP address of the first 16-bit Analog Input point.

The **Event Reporting Method** selection specifies how 16-bit Analog Input events are reported. A ***Change Of State*** event is an event object, without time, that is generated when the point changes state. Only one event is retained in the buffer for each point. If a subsequent event occurs for a point, the previous event object will be overwritten. The main purpose of this mode is to allow a master station to efficiently poll for changed data. A ***Log All Events*** event object with absolute time will be generated when the point changes state. All events will be retained. The main purpose of this mode is to allow a master station to obtain a complete historical data log. The selections are:

- Change of State
- Log All Events

The **Event Buffer Size** parameter specifies the maximum number of 16-Bit Analog Input change events buffered by the RTU. The buffer holds 16-Bit Analog Input events, regardless of the class to which they are assigned. If the buffer is completely full the RTU will lose the oldest events and retain the newest; the ‘Event Buffer Overflowed’ IIN flag will also be set to indicate that the buffer has overflowed. The Event Buffer size should be at least equivalent to the number of 16-Bit Analog Inputs defined as Change of State type. That will allow 16-Bit Analog Inputs to exceed the deadband simultaneously without losing any events. The value of this parameter is dependent on how often 16-Bit Analog Input events occur and the rate at which the events are reported to the master station. The valid values for this parameter are 0 - 65535. Default value is 16.

For SCADAPack 32 and SCADAPack 32P controllers analog input events are processed by the DNP driver at a rate of 100 events every 100 ms. If more than 100 analog input events need to be processed they are processed sequentially in blocks of 100 until all events are processed. This allows the processing of 1000 analog input events per second.

SCADAPack 32, SCADAPack 32P, and SCADAPack 314, SCADAPack 330/334, SCADAPack 350/357 and SCADAPack controllers attempt to process DNP points every 100ms. If there are more DNP points than the controller can scan in 100ms the controller will respond by slowing the DNP scan rate. The DNP scan rate is backed off in multiples of 100ms until there is sufficient time to execute non-DNP functions (logic programs, C programs and communication). In the event the overload is transitory the DNP scan rate will return to the original scan rate of 100ms.

For SCADAPack controllers, SCADAPack 100, SCADAPack LP, SCADAPack and Micro16 controllers analog input events are processed by the DNP driver at a rate of 20 events every 100 ms. If more than 20 analog input events need to be processed they are processed sequentially in blocks of 20 until all events are processed. This allows the processing of 200 analog input events per second.

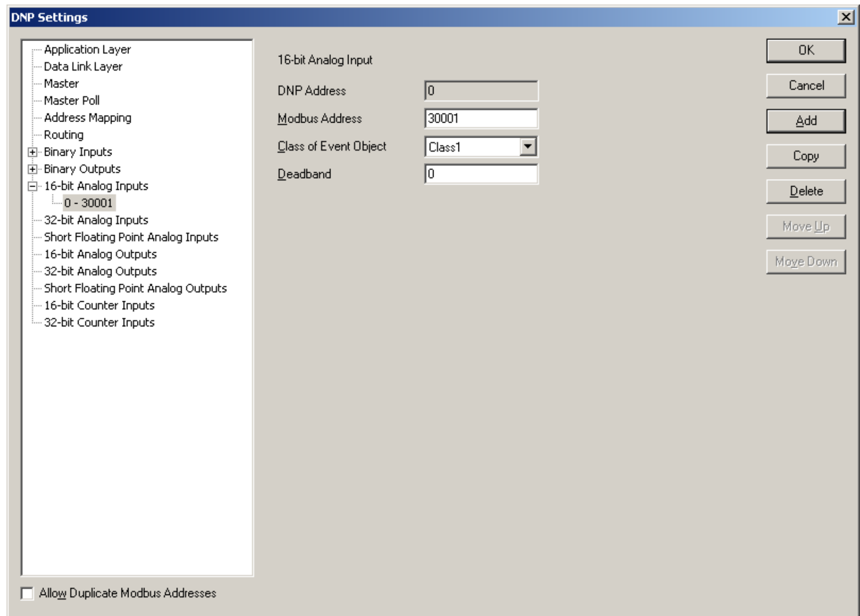
The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Adding 16-Bit Analog Inputs

16-Bit Analog Inputs are added to the DNP configuration using the 16-Bit Analog Input property page. To add a 16-Bit Analog Input:

- Select **16-Bit Analog Inputs** in the tree control section of the DNP Settings window.
- Click the **Add** button in the 16-Bit Analog Inputs property page.
- The **16-Bit Analog Input** property page is now displayed.
- Edit the 16-Bit Analog Input parameters as required and then click the **Add** button.

As 16-Bit Analog Inputs are defined they are added as leaves to the 16-Bit Analog Inputs branch of the tree control. When 16-Bit Analog Inputs are defined the 16-Bit Analog Inputs branch will display a collapse / expand control to the left of the branch. Click this control to display defined 16-Bit Analog Inputs.



The 16-Bit Analog Input parameters are described in the following paragraphs.

The **DNP Address** window displays the DNP 16-Bit Analog Input address of the point. Each 16-Bit Analog Input is assigned a DNP address as they are defined. The DNP point address starts at the value set in the 16-bit Analog Input configuration dialog and increments by one with each defined 16-Bit Analog Input.

The **Modbus Address** parameter specifies the Modbus address of the 16-Bit Analog Input assigned to the DNP Address. The SCADAPack and Micro16 controllers use Modbus addressing for analog inputs. Refer to the ***I/O Database Registers*** section of the ***Telepace Ladder Logic Reference and User Manual*** for complete information on analog input addressing in the SCADAPack and Micro16 controllers. Valid Modbus addresses are:

- 30001 through 39999
- 40001 through 49999

The **Class of Event Object** parameter specifies the event object class assigned to the 16-Bit Analog Input is assigned. If Unsolicited reporting is not required for a point, it is recommended to set its Class to **None**. Data points automatically become members of Class 0 or **None** (static data). The selections are:

- None
- Class 1
- Class 2
- Class 3

The **Deadband** parameter specifies whether the RTU generates events. The value entered is the minimum number of counts that the 16-Bit Analog Input needs to change in order to generate an event. Valid deadband values are 0 to 65535. A deadband value of 0 will cause any change to create an event.

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click the **OK** button to accept the 16-Bit Analog Input parameters and close the DNP Settings dialog.

Click the **Cancel** button to close the dialog without saving any changes.

Click the **Add** button to add the current 16-Bit Analog Input to the DNP configuration.

Click the **Copy** button to copy the current 16-Bit Analog Input parameters to the next DNP Address.

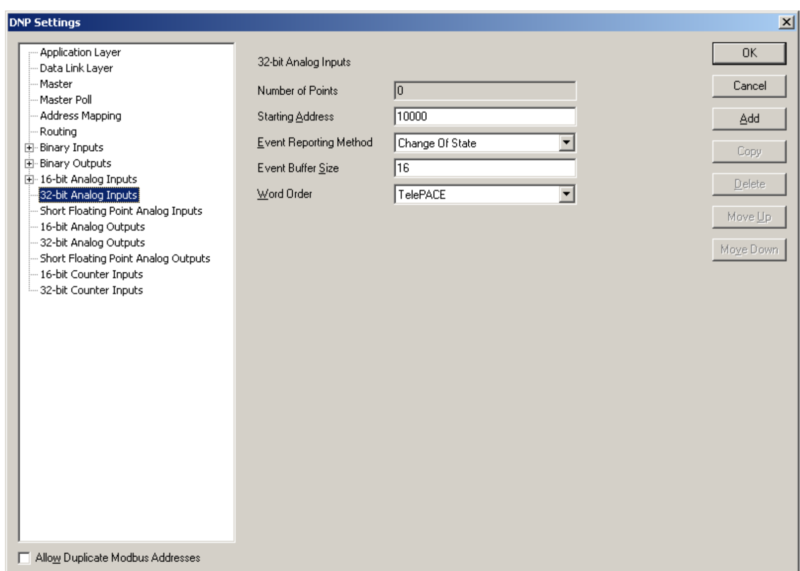
Click the **Delete** button to delete the current 16-Bit Analog Input.

Click the **Move Up** button to move the current 16-Bit Analog Input up one position in the tree control branch.

Click the **Move Down** button to move the current 16-Bit Analog Input down one position in the tree control branch.

32-Bit Analog Inputs Configuration

The 32-Bit Analog Inputs property page is selected for editing by clicking 32-Bit Analog Inputs in the tree control section of the DNP Settings window. When selected the 32-Bit Analog Inputs property page is active.



32-Bit Analog Inputs parameters are set in this property page. Each parameter is described in the following paragraphs.

The **Number of Points** displays the number of 32- bit analog inputs reported by the RTU. This value will increment with the addition of each configured 32-Bit Analog Input point. The maximum number of points is

9999. The maximum number of actual points will depend on the memory available in the controller.

The **Starting Address** parameter specifies the DNP address of the first 32-bit Analog Input point.

The **Event Reporting Method** selection specifies how 32-bit Analog Input events are reported. A ***Change Of State*** event is an event object, without time, that is generated when the point changes state. Only one event is retained in the buffer for each point. If a subsequent event occurs for a point, the previous event object will be overwritten. The main purpose of this mode is to allow a master station to efficiently poll for changed data. A ***Log All Events*** is event object with absolute time will be generated when the point changes state. All events will be retained. The main purpose of this mode is to allow a master station to obtain a complete historical data log. The selections are:

- Change of State
- Log All Events

The **Event Buffer Size** parameter specifies the maximum number of 32-Bit Analog Input change events buffered by the RTU. The buffer holds 32-Bit Analog Input events, regardless of the class to which they are assigned. If the buffer is completely full the RTU will lose the oldest events and retain the newest; the 'Event Buffer Overflowed' IIN flag will also be set to indicate that the buffer has overflowed. The Event Buffer size should be at least equivalent to the number of 32-Bit Analog Inputs defined as Change of State type. That will allow 32-Bit Analog Inputs to exceed the deadband simultaneously without losing any events. The value of this parameter is dependent on how often 32-Bit Analog Input events occur and the rate at which the events are reported to the master station. The valid values for this parameter are 0 - 65535. Default value is 16.

For SCADAPack 32 and SCADAPack 32P controllers analog input events are processed by the DNP driver at a rate of 100 events every 100 ms. If more than 100 analog input events need to be processed they are processed sequentially in blocks of 100 until all events are processed. This allows the processing of 1000 analog input events per second.

SCADAPack 32, SCADAPack 32P, and SCADAPack 314, SCADAPack 330/334, SCADAPack 350/357 and SCADAPack controllers attempt to process DNP points every 100ms. If there are more DNP points than the controller can scan in 100ms the controller will respond by slowing the DNP scan rate. The DNP scan rate is backed off in multiples of 100ms until there is sufficient time to execute non-DNP functions (logic programs, C programs and communication). In the event the overload is transitory the DNP scan rate will return to the original scan rate of 100ms.

For SCADAPack controllers, SCADAPack 100, SCADAPack LP, SCADAPack and Micro16 controllers analog input events are processed by the DNP driver at a rate of 20 events every 100 ms. If more than 20 analog input events need to be processed they are processed sequentially in blocks of 20 until all events are processed. This allows the processing of 200 analog input events per second.

The **Word Order** selection specifies the word order of the 32-bit value. The selections are:

- **Telepace** Least Significant Word in first register.

- **ISaGRAF** Most Significant Word in first register.

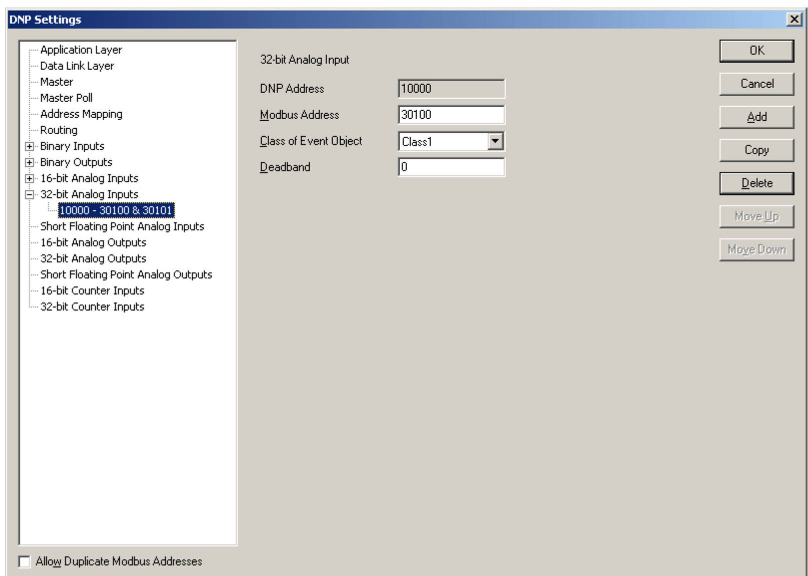
The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Adding 32-Bit Analog Inputs

32-Bit Analog Inputs are added to the DNP configuration using the 16-Bit Analog Input property page. To add a 32-Bit Analog Input:

- Select **32-Bit Analog Inputs** in the tree control section of the DNP Settings window.
- Click the **Add** button in the 32-Bit Analog Inputs property page.
- The **32-Bit Analog Input** property page is now displayed.
- Edit the 32-Bit Analog Input parameters as required and then click the **Add** button.

As 32-Bit Analog Inputs are defined they are added as leaves to the 32-Bit Analog Inputs branch of the tree control. When 32-Bit Analog Inputs are defined the 32-Bit Analog Inputs branch will display a collapse / expand control to the left of the branch. Click this control to display defined 32-Bit Analog Inputs.



The 32-Bit Analog Input parameters are described in the following paragraphs.

The **DNP Address** window displays the DNP 32-Bit Analog Input address of the point. Each 32-Bit Analog Input is assigned a DNP address as they are defined. The DNP point address starts at the value set in the 32-bit Analog Input configuration dialog and increments by one with each defined 32-Bit Analog Input.

The **Modbus Address** parameter specifies the Modbus addresses of the 32-Bit Analog Input assigned to the DNP Address. 32-Bit Analog Inputs use two consecutive Modbus registers for each assigned DNP Address, the address that is entered in this box and the next consecutive Modbus register. The SCADAPack and Micro16 controllers use Modbus addressing for analog inputs. Refer to the ***I/O Database Registers*** section of the ***Telepace Ladder Logic Reference and User Manual*** for complete information on analog input addressing in the SCADAPack and Micro16 controllers. Valid Modbus addresses are:

- 30001 through 39998
- 40001 through 49998

The **Class of Event Object** parameter specifies the event object class the 32-Bit Analog Input is assigned. If Unsolicited reporting is not required for a DNP point, it is recommended to set its Class 0 or **None**. Data points automatically become members of Class 0 or **None** (static data).The selections are:

- None
- Class 1
- Class 2
- Class 3

The **Deadband** parameter specifies whether the RTU generates events. The value entered is the minimum number of counts that the 32-Bit Analog Input needs to change in order to generate an event. Valid deadband values are 0 to 4,294,967,295. A deadband value of 0 will cause any change to create an event.

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click the **OK** button to accept the 32-Bit Analog Input parameters and close the DNP Settings dialog.

Click the **Cancel** button to close the dialog without saving any changes.

Click the **Add** button to add the current 32-Bit Analog Input to the DNP configuration.

Click the **Copy** button to copy the current 32-Bit Analog Input parameters to the next DNP Address.

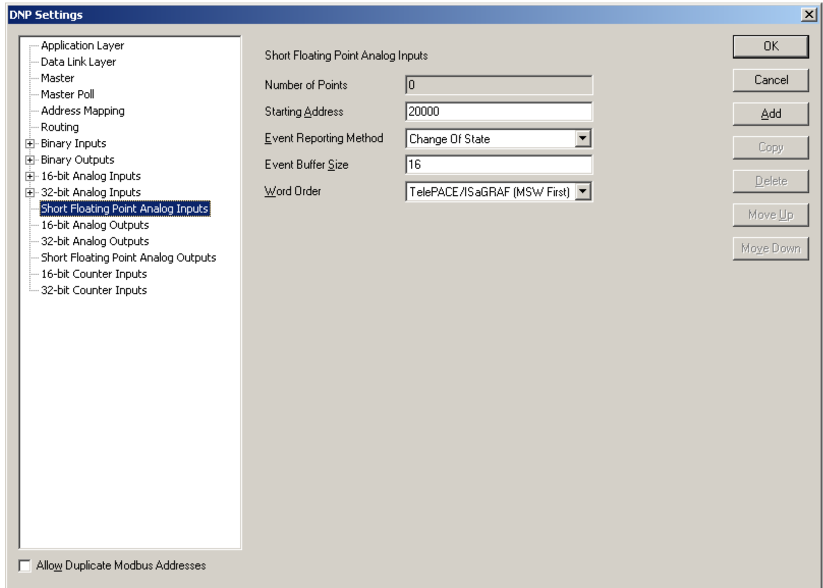
Click the **Delete** button to delete the current 32-Bit Analog Input.

Click the **Move Up** button to move the current 32-Bit Analog Input up one position in the tree control branch.

Click the **Move Down** button to move the current 32-Bit Analog Input down one position in the tree control branch.

Short Floating Point Analog Inputs

The Short Floating Point Analog Inputs property page is selected for editing by clicking Short Floating Point Analog Inputs in the tree control section of the DNP Settings window. When selected the Short Floating Point Analog Inputs property page is active.



Short Floating Point Analog Input parameters are set in this property page. Each parameter is described in the following paragraphs.

The **Number of Points** displays the number of Short Floating Point Analog Inputs reported by the RTU. This value will increment with the addition of each configured Short Floating Point Analog Input point. The maximum number of points is 9999. The maximum number of actual points will depend on the memory available in the controller.

The **Starting Address** parameter specifies the DNP address of the first Short Floating Point Analog Input point.

The **Event Reporting Method** selection specifies how Short Floating Point Analog Input events are reported. A ***Change Of State*** event is an event object, without time, that is generated when the point changes state. Only one event is retained in the buffer for each point. If a subsequent event occurs for a point, the previous event object will be overwritten. The main purpose of this mode is to allow a master station to efficiently poll for changed data. A ***Log All Events*** is event object with absolute time will be generated when the point changes state. All events will be retained. The main purpose of this mode is to allow a master station to obtain a complete historical data log. The selections are:

- Change of State
- Log All Events

The **Event Buffer Size** parameter specifies the maximum number of Short Floating Point Analog Input change events buffered by the RTU. The buffer holds Short Floating Point analog input events, regardless of the class to which they are assigned. If the buffer is completely full the RTU will lose the oldest events and retain the newest; the 'Event Buffer Overflowed' IIN flag will also be set to indicate that the buffer has overflowed. The Event Buffer size should be at least equivalent to the number of Short Floating point analog inputs defined as Change of State type. That will allow Short Floating Analog Point Inputs to exceed the deadband simultaneously without losing any events. The value of this parameter is dependent on how often Short Floating Point Analog Input events occur and the rate at which the events are reported to the master station. The valid values for this parameter are 0 - 65535. Default value is 16.

For SCADAPack 32 and SCADAPack 32P controllers analog input events are processed by the DNP driver at a rate of 100 events every 100 ms. If more than 100 analog input events need to be processed they are processed sequentially in blocks of 100 until all events are processed. This allows the processing of 1000 analog input events per second.

SCADAPack 32, SCADAPack 32P, and SCADAPack 314, SCADAPack 330/334, SCADAPack 350/357 and SCADAPack controllers attempt to process all DNP points every 100ms. If there are more DNP points than the controller can scan in 100ms the controller will respond by slowing the DNP scan rate. The DNP scan rate is backed off in multiples of 100ms until there is sufficient time to execute non-DNP functions (logic programs, C programs and communication). In the event the overload is transitory the DNP scan rate will return to the original scan rate of 100ms.

For SCADAPack controllers, SCADAPack 100, SCADAPack LP, SCADAPack and Micro16 controllers analog input events are processed by the DNP driver at a rate of 20 events every 100 ms. If more than 20 analog input events need to be processed they are processed sequentially in blocks of 20 until all events are processed. This allows the processing of 200 analog input events per second.

The **Word Order** selection specifies the word order of the 32-bit value. The selections are:

- **Telepace / ISaGRAF (MSW First)** Most Significant Word in first register.
- **Reverse (LSW First)** Least Significant Word in first register.

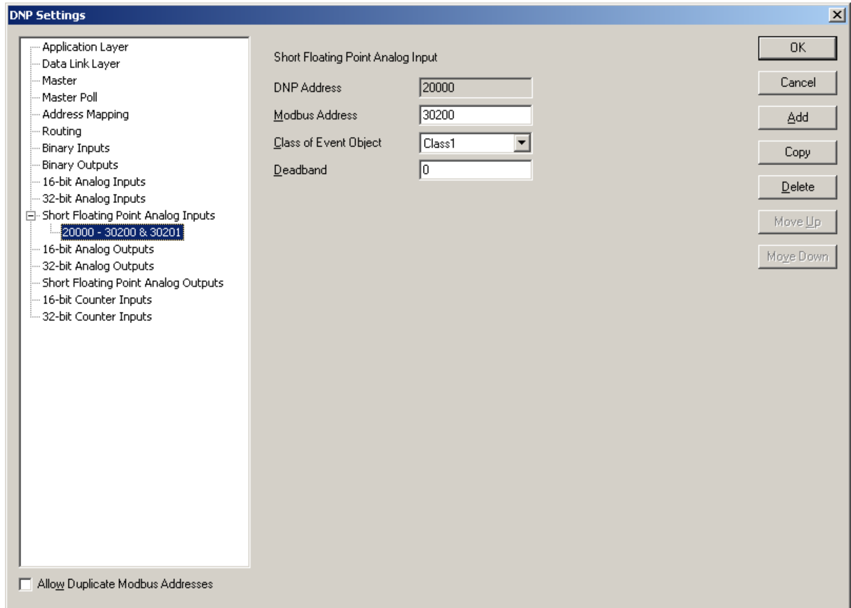
The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Adding Short Floating Point Analog Inputs

Short Floating Point Analog Inputs are added to the DNP configuration using the 16-Bit Analog Input property page. To add a Short Floating Point Analog Input:

- Select **Short Floating Point Analog Input** in the tree control section of the DNP Settings window.
- Click the **Add** button in the Short Floating Point Analog Inputs property page.
- The **Short Floating Point Analog Input** property page is now displayed.
- Edit the Short Floating Point Analog Input parameters as required and then click the **Add** button.

As Short Floating Point Analog Inputs are defined they are added as leaves to the Short Floating Point Analog Inputs branch of the tree control. When Short Floating Point Analog Inputs are defined the Short Floating Point Analog Inputs branch will display a collapse / expand control to the left of the branch. Click this control to display defined Short Floating Point Analog Inputs.



The Short Floating Point Analog Input parameters are described in the following paragraphs.

The **DNP Address** window displays the DNP Short Floating Point Analog Input address of the point. Each Short Floating Point Analog Input is assigned a DNP address as they are defined. The DNP point address starts at the value set in the Short Floating Point Analog Input configuration dialog and increments by one with each defined Short Floating Point Analog Input.

The **Modbus Address** parameter specifies the Modbus addresses of the Short Floating Point Analog Input assigned to the DNP Address. Short Floating Point Analog Inputs use two consecutive Modbus registers for each assigned DNP Address, the address that is entered in this box and the next consecutive Modbus register. The SCADAPack and Micro16 controllers use Modbus addressing for analog inputs. Refer to the ***I/O Database Registers*** section of the ***Telepace Ladder Logic Reference and User Manual*** for complete information on analog input addressing in the SCADAPack and Micro16 controllers. Valid Modbus addresses are:

- 30001 through 39998
- 40001 through 49998

The Class of Event Object parameter specifies the event object class the Short Floating Point Analog Input is assigned. If Unsolicited reporting is not required for a DNP point, it is recommended to set its Class 0 or None. The selections are:

- None
- Class 1
- Class 2
- Class 3

The **Deadband** parameter specifies whether the RTU generates events. The value entered is the minimum number of counts that the Short Floating Point Analog Input needs to change in order to generate an event. A deadband value of 0 will cause any change to create an event.

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click the **OK** button to accept the Short Floating Point Analog Input parameters and close the DNP Settings dialog.

Click the **Cancel** button to close the dialog without saving any changes.

Click the **Add** button to add the current Short Floating Point Analog Input to the DNP configuration.

Click the **Copy** button to copy the current Short Floating Point Analog Input parameters to the next DNP Address.

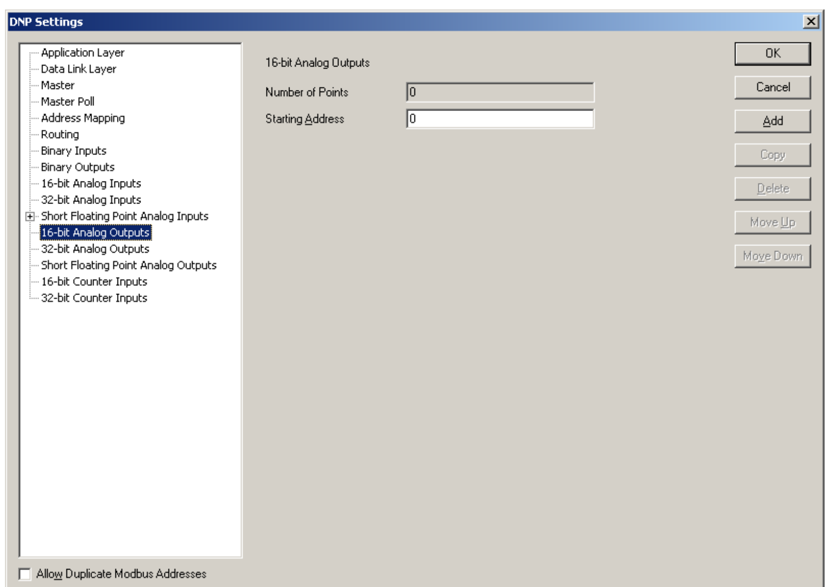
Click the **Delete** button to delete the current Short Floating Point Analog Input.

Click the **Move Up** button to move the current Short Floating Point Analog Input up one position in the tree control branch.

Click the **Move Down** button to move the current Short Floating Point Analog Input down one position in the tree control branch.

16-Bit Analog Outputs Configuration

The 16-Bit Analog Outputs property page is selected for editing by clicking 16-Bit Analog Outputs in the tree control section of the DNP Settings window. When selected the 16-Bit Analog Outputs property page is active.



16-Bit Analog Outputs parameters are viewed in this property page.

The **Number of Points** displays the number of 16-Bit Analog Outputs reported by this RTU. This value will increment with the addition of each configured 16-Bit Analog Input point. The maximum number of points is

9999. The maximum number of actual points will depend on the memory available in the controller.

The **Starting Address** parameter specifies the DNP address of the first 16-bit Analog Output point.

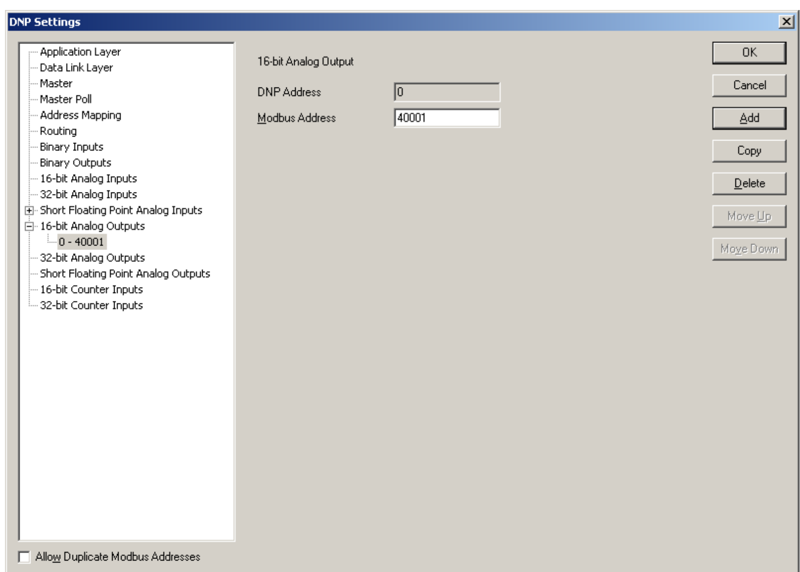
The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Adding 16-Bit Analog Outputs

16-Bit Analog Outputs are added to the DNP configuration using the 16-Bit Analog Outputs property page. To add a 16-Bit Analog Output:

- Select **16-Bit Analog Outputs** in the tree control section of the DNP Settings window.
- Click the **Add** button in the 16-Bit Analog Outputs property page.
- The **16-Bit Analog Output** property page is now displayed.
- Edit the 16-Bit Analog Outputs parameters as required and then click the **Add** button.

As 16-Bit Analog Outputs are defined they are added as leaves to the 16-Bit Analog Output branch of the tree control. When 16-Bit Analog Outputs are defined the 16-Bit Analog Outputs branch will display a collapse / expand control to the left of the branch. Click this control to display defined 16-Bit Analog Outputs.



The 16-Bit Analog Outputs parameters are described in the following paragraphs.

The **DNP Address** window displays the DNP 16-Bit Analog Output address of the point. Each 16-Bit Analog Output is assigned a DNP address as they are defined. The DNP point address starts at the value set in the 16-bit Analog Output configuration dialog and increments by one with each defined 16-Bit Analog Output.

The **Modbus Address** parameter specifies the Modbus address of the 16-Bit Analog Output assigned to the DNP Address. The SCADAPack and Micro16 controllers use Modbus addressing for analog outputs. Refer to the ***I/O Database Registers*** section of the ***Telepace Ladder Logic Reference and User Manual*** for complete information on analog output addressing in the SCADAPack and Micro16 controllers. Valid Modbus addresses are:

- 40001 through 49999

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click the **OK** button to accept the 16-Bit Analog Output parameters and close the DNP Settings dialog.

Click the **Cancel** button to close the dialog without saving any changes.

Click the **Add** button to add the current 16-Bit Analog Output to the DNP configuration.

Click the **Copy** button to copy the current 16-Bit Analog Output parameters to the next DNP Address.

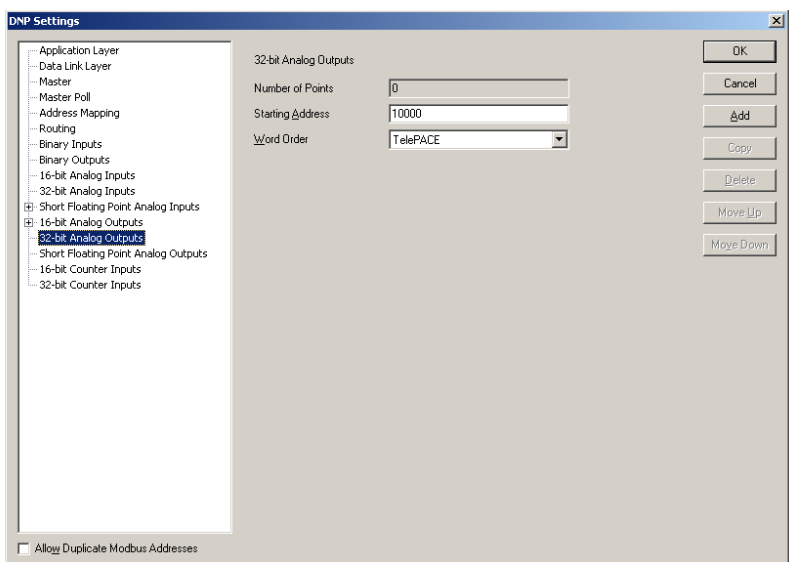
Click the **Delete** button to delete the current 16-Bit Analog Output.

Click the **Move Up** button to move the current 16-Bit Analog Output up one position in the tree control branch.

Click the **Move Down** button to move the current 16-Bit Analog Output down one position in the tree control branch.

32-Bit Analog Outputs Configuration

The 32-Bit Analog Outputs property page is selected for editing by clicking 32-Bit Analog Outputs in the tree control section of the DNP Settings window. When selected the 32-Bit Analog Outputs property page is active.



32-Bit Analog Outputs parameters are viewed in this property page.

The **Number of Points** displays the number of 32-Bit Analog Outputs reported by this RTU. This value will increment with the addition of each configured 32-Bit Analog Output point. The maximum number of points is 9999. The maximum number of actual points will depend on the memory available in the controller.

The **Starting Address** parameter specifies the DNP address of the first 16-bit Analog Output point.

The **Word Order** selection specifies the word order of the 32-bit value. The selections are:

- **Telepace** Least Significant Word in first register.
- **ISaGRAF** Most Significant Word in first register.

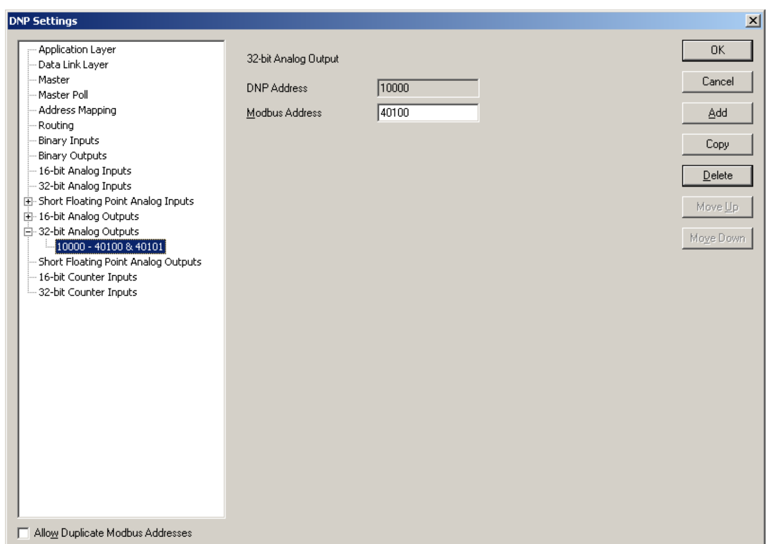
The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Adding 32-Bit Analog Outputs

32-Bit Analog Outputs are added to the DNP configuration using the 32-Bit Analog Outputs property page. To add a 32-Bit Analog Output:

- Select **32-Bit Analog Outputs** in the tree control section of the DNP Settings window.
- Click the **Add** button in the 16-Bit Analog Outputs property page.
- The **32-Bit Analog Output** property page is now displayed.
- Edit the 32-Bit Analog Outputs parameters as required and then click the **Add** button.

As 32-Bit Analog Outputs are defined they are added as leaves to the Binary Inputs branch of the tree control. When 32-Bit Analog Outputs are defined the 32-Bit Analog Outputs branch will display a collapse / expand control to the left of the branch. Click this control to display defined 32-Bit Analog Outputs.



The 32-Bit Analog Outputs parameters are described in the following paragraphs.

The **DNP Address** window displays the DNP 32-Bit Analog Output address of the point. Each 16-Bit Analog Output is assigned a DNP address s they are defined. The DNP point address starts at the value set in the 32-bit Analog Output configuration dialog and increments by one with each defined 32-Bit Analog Output.

The **Modbus Address** parameter specifies the Modbus address of the 32-Bit Analog Output assigned to the DNP Address. 32-Bit Analog Outputs use two consecutive Modbus registers for each assigned DNP Address, the address that is entered in this box and the next consecutive Modbus register. The SCADAPack and Micro16 controllers use Modbus addressing for analog outputs. Refer to the ***I/O Database Registers*** section of the ***Telepace Ladder Logic Reference and User Manual*** for complete information on analog output addressing in the SCADAPack and Micro16 controllers. Valid Modbus addresses are:

- 40001 through 49998

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click the **OK** button to accept the 16-Bit Analog Output parameters and close the DNP Settings dialog.

Click the **Cancel** button to close the dialog without saving any changes.

Click the **Add** button to add the current 32-Bit Analog Output to the DNP configuration.

Click the **Copy** button to copy the current 32-Bit Analog Output parameters to the next DNP Address.

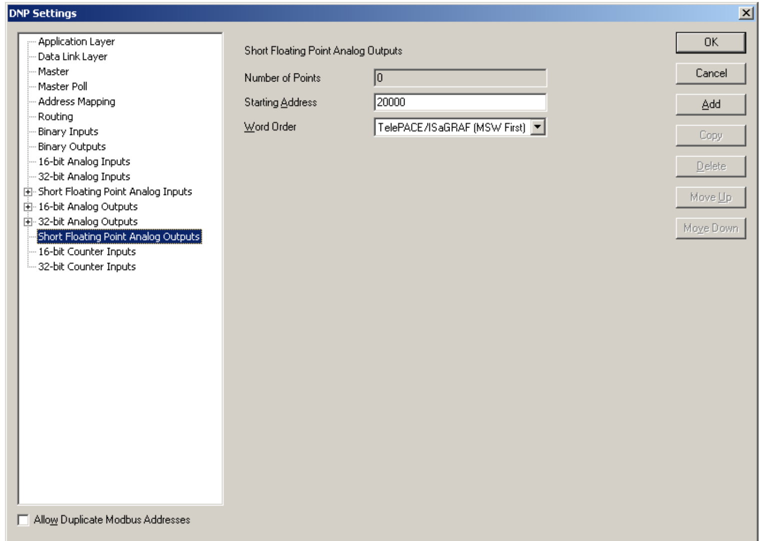
Click the **Delete** button to delete the current 32-Bit Analog Output.

Click the **Move Up** button to move the current 32-Bit Analog Output up one position in the tree control branch.

Click the **Move Down** button to move the current 32-Bit Analog Output down one position in the tree control branch.

Short Floating Point Analog Outputs

The Short Floating Point Analog Outputs property page is selected for editing by clicking Short Floating Point Analog Outputs in the tree control section of the DNP Settings window. When selected the Short Floating Point Analog Outputs property page is active.



Short Floating Point Analog Output parameters are set in this property page. Each parameter is described in the following paragraphs.

The **Number of Points** displays the number of Short Floating Point Analog Outputs reported by the RTU. This value will increment with the addition of each configured Short Floating Point Analog Input point. The maximum number of points is 9999. The maximum number of actual points will depend on the memory available in the controller.

The **Starting Address** parameter specifies the DNP address of the first Short Floating Point Analog Output point.

The **Word Order** selection specifies the word order of the 32-bit value. The selections are:

- **Telepace / ISaGRAF (MSW First)** Most Significant Word in first register.
- **Reverse (LSW First)** Least Significant Word in first register.

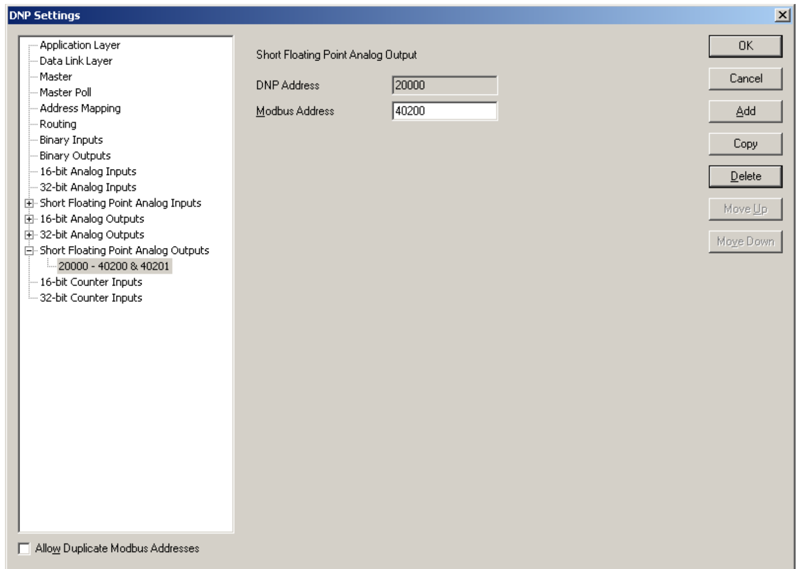
The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Adding Short Floating Point Analog Outputs

Short Floating Point Analog Outputs are added to the DNP configuration using the Short Floating Point Analog Output property page. To add a Short Floating Point Analog Output:

- Select **Short Floating Point Analog Output** in the tree control section of the DNP Settings window.
- Click the **Add** button in the Short Floating Point Analog Inputs property page.
- The **Short Floating Point Analog Output** property page is now displayed.
- Edit the Short Floating Point Analog Output parameters as required and then click the **Add** button.

As Short Floating Point Analog Outputs are defined they are added as leaves to the Short Floating Point Analog Outputs branch of the tree control. When Short Floating Point Analog Outputs are defined the Short Floating Point Analog Outputs branch will display a collapse / expand control to the left of the branch. Click this control to display defined Short Floating Point Analog Outputs.



The Short Floating Point Analog Output parameters are described in the following paragraphs.

The **DNP Address** window displays the DNP Short Floating Point Analog Output address of the point. Each Short Floating Point Analog Output is assigned a DNP address as they are defined. The DNP point address starts at the value set in the Short Floating Point Analog Output configuration dialog and increments by one with each defined Short Floating Point Analog Output.

The **Modbus Address** parameter specifies the Modbus addresses of the Short Floating Point Analog Output assigned to the DNP Address. Short Floating Point Analog Outputs use two consecutive Modbus registers for each assigned DNP Address, the address that is entered in this box and the next consecutive Modbus register. The SCADAPack and Micro16 controllers use Modbus addressing for analog inputs. Refer to the ***I/O Database Registers*** section of the ***Telepace Ladder Logic Reference and User Manual*** for complete information on analog input addressing in the SCADAPack and Micro16 controllers. Valid Modbus addresses are:

- 30001 through 39998
- 40001 through 49998

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click the **OK** button to accept the Short Floating Point Analog Input parameters and close the DNP Settings dialog.

Click the **Cancel** button to close the dialog without saving any changes.

Click the **Add** button to add the current Short Floating Point Analog Input to the DNP configuration.

Click the **Copy** button to copy the current Short Floating Point Analog Input parameters to the next DNP Address.

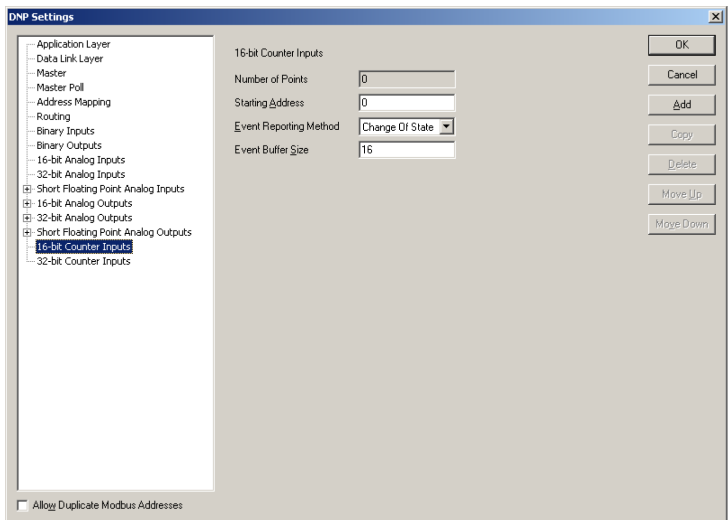
Click the **Delete** button to delete the current Short Floating Point Analog Input.

Click the **Move Up** button to move the current Short Floating Point Analog Input up one position in the tree control branch.

Click the **Move Down** button to move the current Short Floating Point Analog Input down one position in the tree control branch.

16–Bit Counter Inputs Configuration

The 16-Bit Counter Inputs property page is selected for editing by clicking 16-Bit Counter Inputs in the tree control section of the DNP Settings window. When selected the 16-Bit Counter Inputs property page is active.



16-Bit Counter Inputs parameters are set in this property page. Each parameter is described in the following paragraphs.

The **Number of Points** displays the number of 16-Bit Counter Inputs reported by the RTU. This value will increment with the addition of each configured 16-Bit Counter Inputs point. The maximum number of points is 9999. The maximum number of actual points will depend on the memory available in the controller.

The **Starting Address** parameter specifies the DNP address of the first 16-Bit Counter Input point.

The **Event Reporting Method** selection specifies how 16-Bit Counter Input events are reported. A ***Change Of State*** event is an event object, without time, that is generated when the point changes state. Only one event is retained in the buffer for each point. If a subsequent event occurs for a point, the previous event object will be overwritten. The main purpose of this mode is to allow a master station to efficiently poll for changed data. A ***Log All Events*** is event object with absolute time will be generated when the point changes state. All events will be retained. The main purpose of this mode is to allow a master station to obtain a complete historical data log. The selections are:

- Change of State
- Log All Events

The **Event Buffer Size** parameter specifies the maximum number of 16-Bit Counter Input change without time events buffered by the RTU. The buffer holds 16-Bit Counter Input events, regardless of the class to which they are assigned. If the buffer fills to 90 percent the RTU will send a buffer overflow event to the master station. If the buffer is completely full the RTU will lose the oldest events and retain the newest. The Event Buffer size should be at least equivalent to the number of 16-Bit Analog Inputs defined as Change of State type. That will allow all 16-Bit Counter Inputs to exceed the threshold simultaneously without losing any events. The value of this parameter is dependent on how often 16-Bit Counter Input events occur and the rate at which the events are reported to the master station. The valid values for this parameter are 0 - 65535. Default value is 16.

For SCADAPack 32 and SCADAPack 32P controllers counter input events are processed by the DNP driver at a rate of 100 events every 100 ms. If more than 100 counter input events need to be processed they are processed sequentially in blocks of 100 until all events are processed. This allows the processing of 1000 counter input events per second.

SCADAPack 32, SCADAPack 32P, and SCADAPack 314, SCADAPack 330/334, SCADAPack 350/357 and SCADAPack controllers attempt to process all DNP points every 100ms. If there are more DNP points than the controller can scan in 100ms the controller will respond by slowing the DNP scan rate. The DNP scan rate is backed off in multiples of 100ms until there is sufficient time to execute non-DNP functions (logic programs, C programs and communication). In the event the overload is transitory the DNP scan rate will return to the original scan rate of 100ms.

For SCADAPack controllers, SCADAPack 100, SCADAPack LP, SCADAPack and Micro16 controllers counter input events are processed by the DNP driver at a rate of 20 events every 100 ms. If more than 20 counter input events need to be processed they are processed sequentially in blocks of 20 until all events are processed. This allows the processing of 200 counter input events per second.

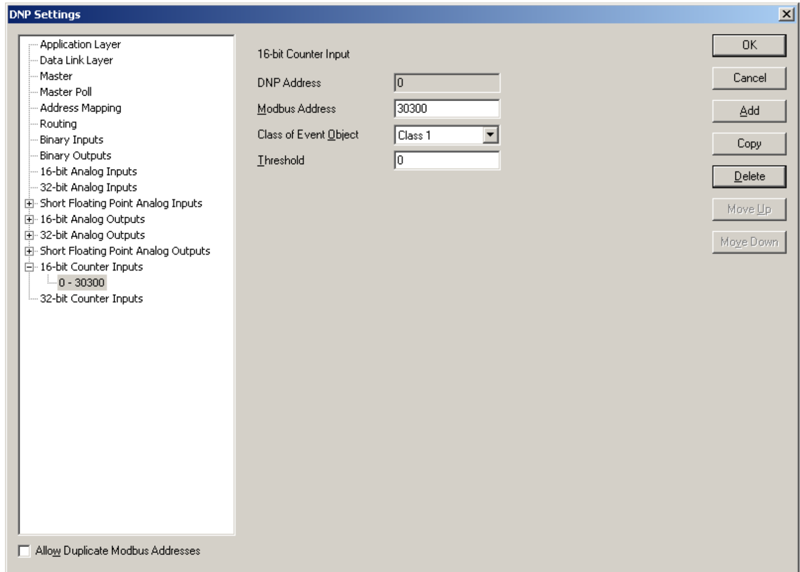
The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Adding 16-Bit Counter Inputs

16-Bit Counter Inputs are added to the DNP configuration using the 16-Bit Counter Inputs property page. To add a 16-Bit Counter Input:

- Select **16-Bit Counter Inputs** in the tree control section of the DNP Settings window.
- Click the **Add** button in the 16-Bit Counter Inputs property page.
- The **16-Bit Counter Input** property page is now displayed.
- Edit the 16-Bit Counter Inputs parameters as required and then click the **Add** button.

As 16-Bit Counter Inputs are defined they are added as leaves to the 16-Bit Counter Inputs branch of the tree control. When 16-Bit Counter Inputs are defined the 16-Bit Counter Inputs branch will display a collapse / expand control to the left of the branch. Click this control to display defined 16-Bit Counter Inputs.



The 16-Bit Counter Input parameters are described in the following paragraphs.

The **DNP Address** window displays the DNP 16-Bit Counter Input address of the point. Each 16-Bit Counter Input is assigned a DNP address s they are defined. The DNP point address starts at the value set in the 16-Bit Counter Input configuration dialog and increments by one with each defined 16-Bit Counter Input.

The **Modbus Address** parameter specifies the Modbus address of the 16-Bit Counter Input assigned to the DNP Address. The SCADAPack and Micro16 controllers use Modbus addressing for counter inputs. Refer to the ***I/O Database Registers*** section of the ***Telepace Ladder Logic Reference and User Manual*** for complete information on analog input addressing in the SCADAPack and Micro16 controllers. Valid Modbus addresses are:

- 30001 through 39999
- 40001 through 49999

The **Class of Event Object** parameter specifies the event object class the 16-Bit Counter Input is assigned. If Unsolicited reporting is not required for a DNP point, it is recommended to set its Class 0 or **None**. The selections are:

- None
- Class 1
- Class 2
- Class 3

The **Threshold** parameter specifies whether the RTU generates events. The value entered is the minimum number of counts that the 16-Bit Counter Input needs to change since it was last reported. Setting this value to zero disables generating events for the 16-Bit Counter Input point. Valid deadband values are 0 to 65535.

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click the **OK** button to accept the 16-Bit Analog Counter parameters and close the DNP Settings dialog.

Click the **Cancel** button to close the dialog without saving any changes.

Click the **Add** button to add the current 16-Bit Analog Input to the DNP configuration.

Click the **Copy** button to copy the current 16-Bit Analog Input parameters to the next DNP Address.

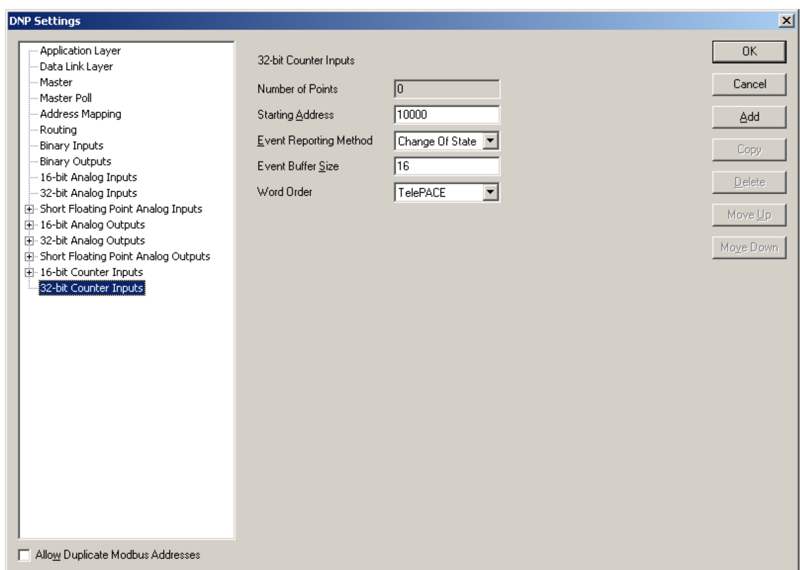
Click the **Delete** button to delete the current 16-Bit Analog Input.

Click the **Move Up** button to move the current 16-Bit Analog Input up one position in the tree control branch.

Click the **Move Down** button to move the current 16-Bit Analog Input down one position in the tree control branch.

32-Bit Counter Inputs Configuration

The 32-Bit Counter Inputs property page is selected for editing by clicking 32-Bit Counter Inputs in the tree control section of the DNP Settings window. When selected the 32-Bit Counter Inputs property page is active.



32-Bit Counter Inputs parameters are set in this property page. Each parameter is described in the following paragraphs.

The **Number of Points** displays the number of 32-Bit Counter Inputs reported by the RTU. This value will increment with the addition of each configured 32-Bit Counter Inputs point. The maximum number of points is 9999. The maximum number of actual points will depend on the memory available in the controller.

The **Starting Address** parameter specifies the DNP address of the first 32-Bit Counter Input point.

The **Event Reporting Method** selection specifies how 32-Bit Counter Input events are reported. A ***Change Of State*** event is an event object, without time, that is generated when the point changes state. Only one event is retained in the buffer for each point. If a subsequent event occurs for a point, the previous event object will be overwritten. The main purpose of this mode is to allow a master station to efficiently poll for changed data. A ***Log All Events*** is event object with absolute time will be generated when the point changes state. All events will be retained. The main purpose of this mode is to allow a master station to obtain a complete historical data log. The selections are:

- Change of State
- Log All Events

The **Event Buffer Size** parameter specifies the maximum number of 32-Bit Counter Input change events buffered by the RTU. The buffer holds all 32-Bt Counter Input events, regardless of the class to which they are assigned. If the buffer is completely full the RTU will lose the oldest events and retain the newest; the ‘Event Buffer Overflowed’ IIN flag will also be set to indicate that the buffer has overflowed. The Event Buffer size should be at least equivalent to the number of 32-Bit Counter Inputs defined as Change of State type. That will allow all 32-Bit Counter Inputs to exceed the deadband simultaneously without losing any events. The value of this parameter is dependent on how often 32-Bit Counter Input events occur and the rate at which the events are reported to the master station. The valid values for this parameter are 0 - 65535. Default value is 16.

For SCADAPack 32 and SCADAPack 32P controllers counter input events are processed by the DNP driver at a rate of 100 events every 100 ms. If more than 100 counter input events need to be processed they are processed sequentially in blocks of 100 until all events are processed. This allows the processing of 1000 counter input events per second.

SCADAPack 32, SCADAPack 32P, and SCADAPack 314, SCADAPack 330/334, SCADAPack 350/357 and SCADAPack controllers attempt to process all DNP points every 100ms. If there are more DNP points than the controller can scan in 100ms the controller will respond by slowing the DNP scan rate. The DNP scan rate is backed off in multiples of 100ms until there is sufficient time to execute non-DNP functions (logic programs, C programs and communication). In the event the overload is transitory the DNP scan rate will return to the original scan rate of 100ms.

For SCADAPack controllers, SCADAPack 100, SCADAPack LP, SCADAPack and Micro16 controllers counter input events are processed by the DNP driver at a rate of 20 events every 100 ms. If more than 20 counter input events need to be processed they are processed sequentially in blocks of 20 until all events are processed. This allows the processing of 200 counter input events per second.

The **Word Order** selection specifies the word order of the 32-bit value. The selections are:

- **Telepace** Least Significant Word in first register.
- **ISaGRAF** Most Significant Word in first register.

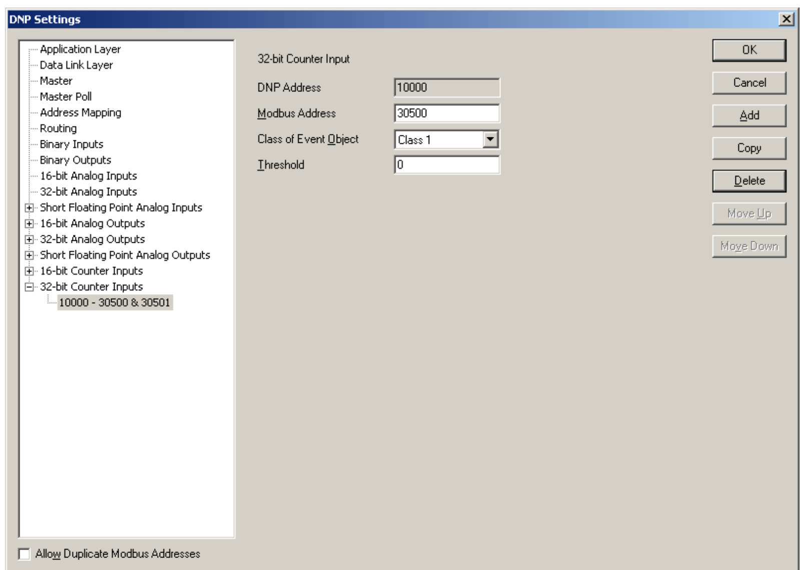
The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Adding 32-Bit Counter Inputs

32-Bit Counter Inputs are added to the DNP configuration using the 16-Bit Counter Input property page. To add a 32-Bit Analog Input:

- Select **32-Bit Counter Inputs** in the tree control section of the DNP Settings window.
- Click the **Add** button in the 32-Bit Counter Inputs property page.
- The **32-Bit Counter Input** property page is now displayed.
- Edit the 32-Bit Counter Input parameters as required and then click the **Add** button.

As 32-Bit Counter Inputs are defined they are added as leaves to the 32-Bit Counter Inputs branch of the tree control. When 32-Bit Counter Inputs are defined the 32-Bit Counter Inputs branch will display a collapse / expand control to the left of the branch. Click this control to display defined 32-Bit Counter Inputs.



The 32-Bit Counter Input parameters are described in the following paragraphs.

The **DNP Address** window displays the DNP 32-Bit Counter Input address of the point. Each 32-Bit Counter Input is assigned a DNP address as they are defined. The DNP point address starts at the value set in the 32-Bit Counter Input configuration dialog and increments by one with each defined 32-Bit Counter Input.

The **Modbus Address** parameter specifies the Modbus addresses of the 32-Bit Counter Input assigned to the DNP Address. 32-Bit Counter Inputs use two consecutive Modbus registers for each assigned DNP Address, the address that is entered in this box and the next consecutive Modbus register. The SCADAPack and Micro16 controllers use Modbus addressing for counter inputs. Refer to the ***I/O Database Registers*** section of the ***Telepace Ladder Logic Reference and User Manual*** for complete information on analog input addressing in the SCADAPack and Micro16 controllers. Valid Modbus addresses are:

- 30001 through 39998
- 40001 through 49998

The **Class of Event Object** parameter specifies the event object class the 32-Bit Counter Input is assigned. If Unsolicited reporting is not required for a DNP point, it is recommended to set its Class 0 or **None**. The selections are:

- None
- Class 1
- Class 2
- Class 3

The **Threshold** parameter specifies whether the RTU generates events. The value entered is the minimum number of counts that the 32-Bit Counter Input needs to change since it was last reported. Setting this value to zero disables generating events for the 32-Bit Counter Input point. Valid threshold values are 0 to 4,294,967,295.

The **Allow Duplicate Modbus Addresses** checkbox determines if the Modbus I/O database addresses assigned to the DNP data points need to be unique. Check this box if you want to allow more than one point to use the same Modbus address.

Click the **OK** button to accept the parameters and close the DNP Settings dialog. In PEMEX mode the OK button is not active if the user is not logged on with Administrator privileges.

Click the **Cancel** button to close the dialog without saving any changes.

Click the **Add** button to add the current 32-Bit Counter Input to the DNP configuration.

Click the **Copy** button to copy the current 32-Bit Counter Input parameters to the next DNP Address.

Click the **Delete** button to delete the current 32-Bit Counter Input.

Click the **Move Up** button to move the current 32-Bit Counter Input up one position in the tree control branch.

Click the Move Down button to move the current 32-Bit Counter Input down one position in the tree control branch.

DNP Diagnostics

DNP Diagnostics provide Master station and Outstation DNP diagnostics. The diagnostics provide detailed information on the status of DNP communication and DNP data points.

DNP diagnostics are available for local DNP information using the **DNP Status** command.

- For Telepace applications select **Controller >> DNP Status** from the menu bar.
- For ISaGRAF applications select **Tools >> Controller >> DNP Status** from the program window menu bar.

SCADAPack 32 controllers support DNP master operations. DNP diagnostics are available for master stations using the **DNP Master Status** command.

- For Telepace applications select **Controller >> DNP Master Status** from the menu bar. See section ***0*** for information on DNP Master Status diagnostics.
- For ISaGRAF applications select **Tools >> Controller >> DNP Master Status** from the program window menu bar.

DNP Diagnostics require firmware version 2.20 or newer for SCADAPack controllers and firmware version 1.50 or newer for SCADAPack 32 controllers. When an attempt is made to select the DNP Status or DNP Master Status command for controllers with firmware that does not support the commands an error message is displayed. An example of the error message is shown below.

To enable the use of DNP diagnostics you will need to upgrade the firmware in the controller to the newer version.

DNP Status

When the DNP Status command is selected the DNP Status dialog is displayed. This dialog shows the run-time DNP diagnostics and current data values for the local DNP points.

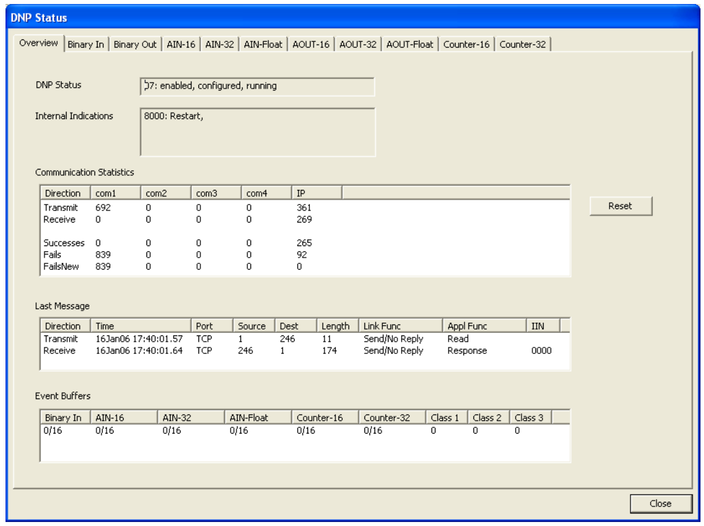
The DNP Status dialog has a number of selectable tabs and opens with the Overview tab selected. The following tabs are displayed.

- Overview
- Binary In (binary inputs information)
- Binary Out (binary outputs information)
- AIN-16 (16-bit analog inputs information)
- AIN-32 (32-bit analog inputs information)
- AIN-Float (short float analog inputs information)
- AOUT-16 (16-bit analog outputs information)
- AOUT-32 (32-bit analog outputs information)
- AOUT-Float (short float analog outputs information)
- Counter-16 (16-bit counter inputs information)
- Counter-32 (32-bit counter inputs information)

Clicking on any tab opens the tab and displays the selected information.

Overview Tab

The Overview Tab displays the run-time diagnostics for the local DNP station. The Overview display is divided into five areas of diagnostic information: DNP Status, Internal Indications, Communication Statistics, Last Message and Event Buffer. Each of these is explained in the following paragraphs.



The **DNP Status** window provides information on the status of the DNP protocol running in the controller. Depending on the status the window may contain the following text.

- **Enabled** or **Disabled** indicates whether the controller firmware supports DNP protocol.
- **Configured** or **Not Configured** indicates whether the controller has been configured with DNP protocol on at least one communications port.
- **Running** or **Not Running** indicates whether the DNP tasks are running in the controller.

The **Internal Indications** window displays the current state of the DNP internal indications (IIN) flags in the controller. Bits 0 – 7 (the first octet) are displayed on the left, then bits 8 - 15 (second octet) on the right.

The **Communication Statistics** window displays the message statistics for each DNP communication port. The statistics include the total number of messages transmitted and received and the total number of successes, failures, and failures since last success (which will only be updated for messages sent by this controller) for each communication port. The counters increment whenever a new DNP message is sent or received on the port, and roll over after 65535 messages.

- Click the **Reset** button to reset the counters to zero.

The **Last Message** window displays information about the recent DNP message. The information is updated each time a new message is received or transmitted. The Last Message window contains the following information.

- **Direction** displays whether the message was received or transmitted.

- **Time** displays the time at which the message was received or sent.
- **Port** displays which communication port was used for the message.
- **Source** displays the source DNP station address for the message.
- **Dest** displays the destination DNP station address for the message.
- **Length** displays the message length in bytes.
- **Link Func** displays the Link Layer function code.
- **Appl Func** displays the Application Layer function code.
- **IIN** displays the Internal indications received with the last message

The **Event Buffers** window displays the number of events in each type of event buffer and the allocated buffer size. The event buffers displayed are:

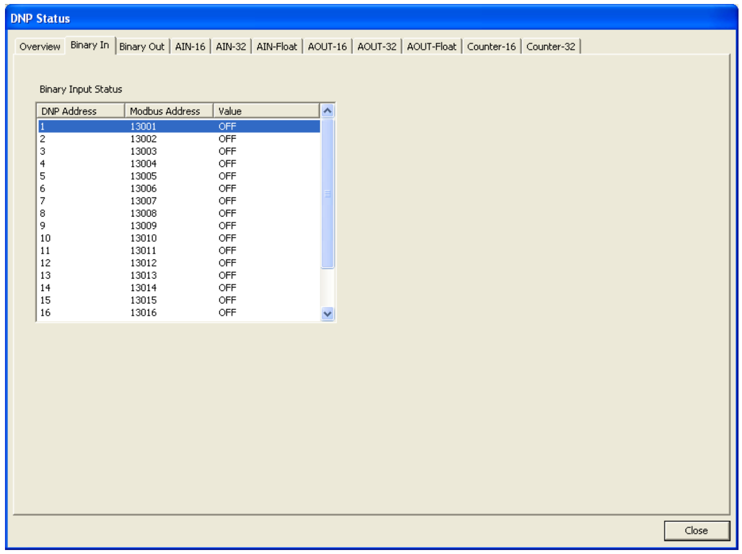
- Binary In (binary inputs)
- AIN-16 (16-bit analog inputs)
- AIN-32 (32-bit analog inputs)
- AIN-Float (floating point analog inputs)
- Counter-16 (16-bit counter inputs)
- Counter-32 (32-bit counter inputs)
- Class 1 (class 1 events)
- Class 2 (class 2 events)
- Class 3 (class 3 events)

Point Status Tabs

The point status tabs display the state of each point of the selected type in the controller. The following tabs are displayed.

- Binary In (binary inputs information)
- Binary Out (binary outputs information)
- AIN-16 (16-bit analog inputs information)
- AIN-32 (32-bit analog inputs information)
- AIN-Float (short float analog inputs information)
- AOUT-16 (16-bit analog outputs information)
- AOUT-32 (32-bit analog outputs information)
- AOUT-Float (short float analog outputs information)
- Counter-16 (16-bit counter inputs information)
- Counter-32 (32-bit counter inputs information)

Each of the tabs displays information in the same format. The example below shows the appearance of the binary input page.



The **DNP Address** column shows the DNP address of the point.

The **Modbus Address** column shows the Modbus register address of the point.

The **Value** column shows the value of the point. Binary points are shown as OFF or ON. Numeric points show the numeric value of the point.

DNP Master Status

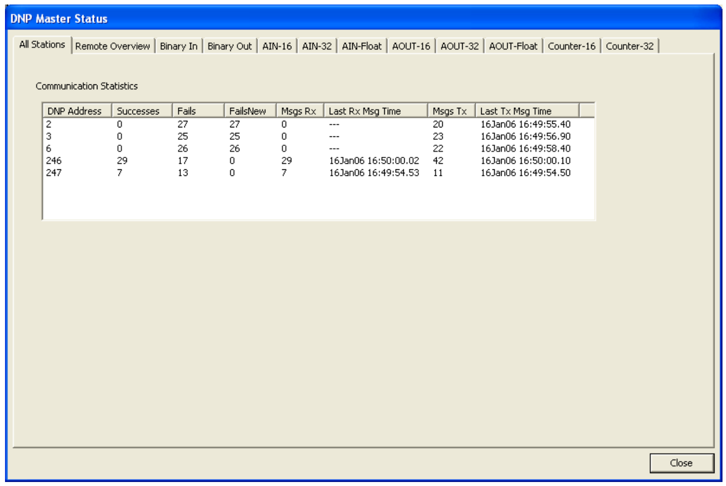
When the DNP Master Status command is selected the **DNP Master Status** dialog is displayed. This dialog shows the run-time DNP diagnostics and status of the DNP outstations and current data values for the DNP points in these outstations.

The DNP Master Status dialog has a number of selectable tabs and opens with the All Stations tab selected. The following tabs are displayed.

- All Stations
- Remote Overview
- Binary In (binary inputs information)
- Binary Out (binary outputs information)
- AIN-16 (16-bit analog inputs information)
- AIN-32 (32-bit analog inputs information)
- AIN-Float (short float analog inputs information)
- AOUT-16 (16-bit analog outputs information)
- AOUT-32 (32-bit analog outputs information)
- AOUT-Float (short float analog outputs information)
- Counter-16 (16-bit counter inputs information)
- Counter-32 (32-bit counter inputs information)

All Stations Tab

The **All Stations** tab displays the run-time communications diagnostics for all outstations polled by the master or outstations reporting unsolicited data to the master.



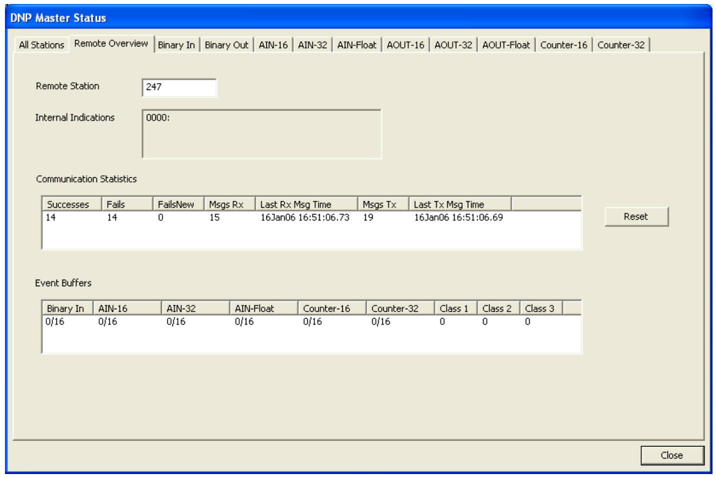
The **Communication Statistics** window displays a list of all outstations and the communication statistics for each station in the list. The statistics counters increment whenever a new DNP message is sent or received, and roll over after 65535 messages. The following statistics are displayed.

- **DNP Address** displays the DNP address of the outstation.
- **Successes** display the number of successful message transactions between this master and the corresponding remote station. This number includes master polls to the remote station and unsolicited responses from the outstation.
- **Fails** displays the number of failed message transactions between this master and the corresponding remote station. This counter increments by 1 for a failed message transaction irrespective of the number of application layer retries.
- **FailsNew** displays the number failed message transactions between this master and the corresponding remote station since the last successful poll.
- **Msgs Rx** displays the number of DNP packets (frames) received from the outstation station. This number includes frames containing unsolicited responses from the outstation.
- **Last Rx Msg Time** displays the time the last DNP packet (frame) was received from the outstation.
- **Msgs Tx** displays the number of DNP packets (frames) sent to the outstation.
- **Last Tx Msg Time** displays the time the last DNP packet (frame) was sent to the outstation.

The **Msgs Tx** and **Msgs Rx** counters could be greater than or equal to the Successes and Fails counters.

Remote Overview Tab

The Remote Overview tab displays the run-time diagnostics and current data values for a selected remote station. The data shown is from the image of the data in the master station.



The **Remote Station** window is where the DNP address of the remote station is entered. When the Remote station field is changed data fields on this tab and the following I/O tabs are updated with the values for the newly selected Remote Station.

The **Internal Indications** window displays the current state of the DNP internal indications (IIN) flags for the selected remote station.

The **Communication Statistics** window displays communication statistics for the remote station selected. The statistics counters increment whenever a new DNP message is sent or received, and roll over after 65535 messages. The following statistics are displayed.

- **Successes** displays the number of successful messages received in response to master polls sent to the station. This number includes unsolicited responses from the outstation.
- **Fails** displays the number of failed or no responses to master polls sent to the outstation.
- **FailsNew** displays the number failed or no responses to master polls sent to the outstation since the last successful poll.
- **Msgs Rx** displays the number of messages received from the outstation station. This number includes unsolicited responses from the outstation.
- **Last Rx Msg Time** displays the time the last message was received from the outstation.
- **Msgs Tx** displays the number of messages sent to the outstation station.
- **Last Tx Msg Time** displays the time the last message was sent to the outstation.

Click **Reset** to reset the counters to zero.

Event Buffers shows the number of events in each type of event buffer and the allocated buffer size. The buffers shown are for binary inputs, 16-bit analog inputs, 32-bit analog inputs, Floating point analog inputs, 16-bit counter inputs, and 32-bit counter inputs, and Class 1, 2, and 3 events.

The **Event Buffers** window displays the number of events in each type of event buffer and the allocated buffer size for the selected remote station. The event buffers displayed are:

- Binary In (binary inputs)
- AIN-16 (16-bit analog inputs)
- AIN-32 (32-bit analog inputs)
- AIN-Float (floating point analog inputs)
- Counter-16 (16-bit counter inputs)
- Counter-32 (32-bit counter inputs)
- Class 1 (class 1 events)
- Class 2 (class 2 events)
- Class 3 (class 3 events)

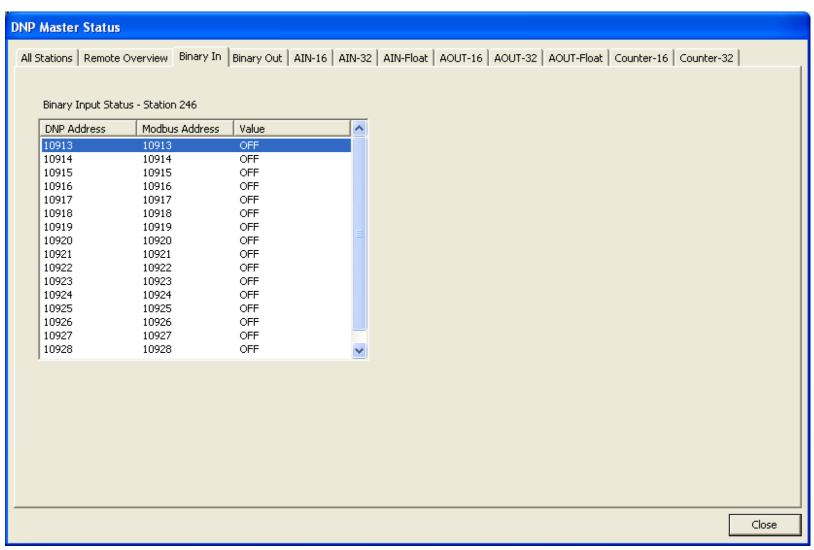
Due to a limitation of the DNP3 protocol, an Unsolicited message from an outstation is not capable of including information stating which data class generated the message. As a result, Unsolicited events when received by the master will be counted as Class 1 events. Events which are polled by the master, however, do contain class information and will be counted in the Event Buffer for the appropriate class.

Remote Point Status Tabs

The point status tabs show the state of each point of the selected type in the remote station selected on the Remote Overview tab. The values shown are from the image of the remote station in the master station.

Class 0 polling of an outstation needs to be enabled in the master in order to allow that outstation's DNP points to be listed on these tabs. This is the only way for the master to retrieve a complete list of points in an outstation.

The example below shows the appearance of the Binary In tab.



The **DNP Address** column shows the DNP address of the point.

The **Modbus Address** column shows the Modbus register address of the point. This is only relevant for points that have an address mapping in the master station. For points that have an address mapping, this will show the Modbus register address of the point. For points not having an address mapping, this will show '---'.

The **Value** column shows the value of the point. Binary points are shows as OFF or ON. Numeric points show the numeric value of the point.

DNP Master Device Profile Document

DNP v3.00

DEVICE PROFILE DOCUMENT

Vendor Name: Control Microsystems Inc.

Device Name: SCADAPack controllers

Highest DNP Level Supported:	Device Function:
For Requests 2	■ Master ☐ Slave
For Responses 2	

Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table):

- Function code 14 (warm restart)
- Function code 20 (Enable Unsolicited Messages) for class 1, 2, 3 objects only.
- Function code 21 (Disable Unsolicited Messages) for class 1, 2, 3 objects only.
- Object 41, variation 1 (32-bit analog output block)

Maximum Data Link Frame Size (octets):	Maximum Application Fragment Size (octets):
Transmitted 292 Received (must be 292)	Transmitted 2048 Received 2048
Maximum Data Link Re-tries: ☐ None ☐ Fixed at ■ Configurable, range 0 to 255	Maximum Application Layer Re-tries: ☐ None ■ Configurable, range 0 to 255

Requires Data Link Layer Confirmation:

☐ Never
☐ Always
☐ Sometimes If 'Sometimes', when?

■ Configurable for Always or Never

Requires Application Layer Confirmation:

☐ Never
☐ Always (not recommended)

☐ When reporting Event Data (Slave devices only)

☐ When sending multi-fragment responses (Slave devices only)

☐ Sometimes If 'Sometimes', when?

____

■ Configurable for always or only when Reporting Event Data and Unsolicited Messages

Timeouts while waiting for:

Data Link Confirm	☐ None	☐ Fixed at ________	☐ Variable	■ Configurable
Complete Appl. Fragment	☐ None	☐ Fixed at ________	☐ Variable	■ Configurable
Application Confirm	☐ None	☐ Fixed at ________	☐ Variable	■ Configurable
Complete Appl. Response	☐ None	☐ Fixed at ________	☐ Variable	■ Configurable

Others ____

Sends/Executes Control Operations:

WRITE Binary Outputs	☐ Never	☐ Always	☐ Sometimes	■ Configurable
SELECT/OPERATE	☐ Never	☐ Always	☐ Sometimes	■ Configurable
DIRECT OPERATE	☐ Never	☐ Always	☐ Sometimes	■ Configurable
DIRECT OPERATE - NO ACK	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Count > 1	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Pulse On	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Pulse Off	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Latch On	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Latch Off	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Queue	■ Never	☐ Always	☐ Sometimes	☐ Configurable
Clear Queue	■ Never	☐ Always	☐ Sometimes	☐ Configurable

FILL OUT THE FOLLOWING ITEM FOR MASTER DEVICES ONLY:

Expects Binary Input Change Events:

- ■ Either time-tagged or non-time-tagged for a single event
- ☐ Both time-tagged and non-time-tagged for a single event
- ☐ Configurable (attach explanation)

FILL OUT THE FOLLOWING ITEMS FOR SLAVE DEVICES ONLY:

Reports Binary Input Change Events when no specific variation requested: ☐ Never ☐ Only time-tagged ☐ Only non-time-tagged ☐ Configurable to send both, one or the other (attach explanation)	Reports time-tagged Binary Input Change Events when no specific variation requested: ☐ Never ☐ Binary Input Change With Time ☐ Binary Input Change With Relative Time ☐ Configurable (attach explanation)
Sends Unsolicited Responses: ☐ Never ☐ Configurable by class ☐ Only certain objects ☐ Sometimes (attach explanation) ■ ENABLE/DISABLE UNSOLICITED	Sends Static Data in Unsolicited Responses: ☐ Never ☐ When Device Restarts ☐ When Status Flags Change No other options are permitted.
Default Counter Object/Variation: ☐ No Counters Reported ☐ Configurable (attach explanation)	Counters Roll Over at: ☐ No Counters Reported ☐ Configurable (attach explanation)

☐	Default Object 20	☐	16 Bits
	Default Variation 05	☐	32 Bits
☐	Point-by-point list attached	☐	16 Bits for 16-bit counters 32 Bits for 32-bit counters
		☐	Point-by-point list attached
Sends Multi-Fragment Responses: ■ Yes ☐ No			

DNP V3.00

DEVICE PROFILE DOCUMENT

IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
1	0	Binary Input - All Variations	1	06		
1	1	Binary Input			129, 130	00, 01
1	2	Binary Input with Status			129, 130	00, 01
2	0	Binary Input Change - All Variations	1	06,07,08		
2	1	Binary Input Change without Time	1	06,07,08	129, 130	17, 28
2	2	Binary Input Change with Time	1	06,07,08	129, 130	17, 28
2	3	Binary Input Change with Relative Time	1	06,07,08	129, 130	17, 28
10	0	Binary Output - All Variations	1	06		
10	1	Binary Output				
10	2	Binary Output Status			129, 130	00, 01
12	0	Control Block - All Variations				

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DEVICE PROFILE DOCUMENT

IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
12	1	Control Relay Output Block	3, 4, 5, 6	17, 28	129	echo of request
12	2	Pattern Control Block				
12	3	Pattern Mask				
20	0	Binary Counter - All Variations	1, 7, 8, 9, 10	06		
20	1	32-Bit Binary Counter			129, 130	00, 01
20	2	16-Bit Binary Counter			129, 130	00, 01
20	3	32-Bit Delta Counter				
20	4	16-Bit Delta Counter				
20	5	32-Bit Binary Counter without Flag			129, 130	00, 01
20	6	16-Bit Binary Counter without Flag			129, 130	00, 01
20	7	32-Bit Delta Counter without Flag				
20	8	16-Bit Delta Counter without Flag				

DNP V3.00

DEVICE PROFILE DOCUMENT

IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
21	0	Frozen Counter - All Variations	1	06		
21	1	32-Bit Frozen Counter			129, 130	00, 01
21	2	16-Bit Frozen Counter			129, 130	00, 01
21	3	32-Bit Frozen Delta Counter				
21	4	16-Bit Frozen Delta Counter				
21	5	32-Bit Frozen Counter with Time of Freeze				
21	6	16-Bit Frozen Counter with Time of Freeze				
21	7	32-Bit Frozen Delta Counter with Time of Freeze				
21	8	16-Bit Frozen Delta Counter with Time of Freeze				
21	9	32-Bit Frozen Counter without Flag			129, 130	00, 01
21	10	16-Bit Frozen Counter without Flag			129, 130	00, 01
21	11	32-Bit Frozen Delta Counter without Flag				

DNP V3.00

DEVICE PROFILE DOCUMENT

IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
21	12	16-Bit Frozen Delta Counter without Flag				
22	0	Counter Change Event - All Variations	1	06,07,08		
22	1	32-Bit Counter Change Event without Time			129, 130	17, 28
22	2	16-Bit Counter Change Event without Time			129, 130	17, 28
22	3	32-Bit Delta Counter Change Event without Time				
22	4	16-Bit Delta Counter Change Event without Time				
22	5	32-Bit Counter Change Event with Time				
22	6	16-Bit Counter Change Event with Time				
22	7	32-Bit Delta Counter Change Event with Time				
22	8	16-Bit Delta Counter Change Event with Time				
23	0	Frozen Counter Event - All Variations				
23	1	32-Bit Frozen Counter Event without Time				

DNP V3.00

DEVICE PROFILE DOCUMENT

IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
23	2	16-Bit Frozen Counter Event without Time				
23	3	32-Bit Frozen Delta Counter Event without Time				
23	4	16-Bit Frozen Delta Counter Event without Time				
23	5	32-Bit Frozen Counter Event with Time				
23	6	16-Bit Frozen Counter Event with Time				
23	7	32-Bit Frozen Delta Counter Event with Time				
23	8	16-Bit Frozen Delta Counter Event with Time				
30	0	Analog Input - All Variations	1	06		
30	1	32-Bit Analog Input			129, 130	00, 01
30	2	16-Bit Analog Input			129, 130	00, 01
30	3	32-Bit Analog Input without Flag			129, 130	00, 01
30	4	16-Bit Analog Input without Flag			129, 130	00, 01
30	5	Short Floating Point Analog Input			129, 130	00, 01

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DEVICE PROFILE DOCUMENT

IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
31	0	Frozen Analog Input - All Variations				
31	1	32-Bit Frozen Analog Input				
31	2	16-Bit Frozen Analog Input				
31	3	32-Bit Frozen Analog Input with Time of Freeze				
31	4	16-Bit Frozen Analog Input with Time of Freeze				
31	5	32-Bit Frozen Analog Input without Flag				
31	6	16-Bit Frozen Analog Input without Flag				
32	0	Analog Change Event - All Variations	1	06,07,08		
32	1	32-Bit Analog Change Event without Time			129,130	17,28
32	2	16-Bit Analog Change Event without Time			129,130	17,28
32	3	32-Bit Analog Change Event with Time			129,130	17,28
32	4	16-Bit Analog Change Event with Time			129,130	17,28

DNP V3.00

DEVICE PROFILE DOCUMENT

IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
32	5	Short Floating Point Analog Change Event without Time			129,130	17,28
33	0	Frozen Analog Event - All Variations				
33	1	32-Bit Frozen Analog Event without Time				
33	2	16-Bit Frozen Analog Event without Time				
33	3	32-Bit Frozen Analog Event with Time				
33	4	16-Bit Frozen Analog Event with Time				
40	0	Analog Output Status - All Variations	1	06		
40	1	32-Bit Analog Output Status			129, 130	00, 01
40	2	16-Bit Analog Output Status			129, 130	00, 01
40	3	Short Floating Point Analog Output Status			129, 130	00, 01
41	0	Analog Output Block - All Variations				
41	1	32-Bit Analog Output Block	3, 4, 5, 6	17, 28	129	echo of request

DNP V3.00

DEVICE PROFILE DOCUMENT

IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
41	2	16-Bit Analog Output Block	3, 4, 5, 6	17, 28	129	echo of request
41	3	Short Floating Point Analog Output Block	3, 4, 5, 6	17, 28	129	echo of request
50	0	Time and Date - All Variations				
50	1	Time and Date	2 (see 4.14)	07 where quantity = 1		
50	2	Time and Date with Interval				
51	0	Time and Date CTO - All Variations				
51	1	Time and Date CTO			129, 130	07, quantity=1
51	2	Unsynchronized Time and Date CTO			129, 130	07, quantity=1
52	0	Time Delay - All Variations				
52	1	Time Delay Coarse			129	07, quantity=1
52	2	Time Delay Fine			129	07, quantity=1

DNP V3.00

DEVICE PROFILE DOCUMENT

IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
60	0					
60	1	Class 0 Data	1	06		
60	2	Class 1 Data	1 20,21	06,07,08 06		
60	3	Class 2 Data	1 20,21	06,07,08 06		
60	4	Class 3 Data	1 20,21	06,07,08 06		
70	1	File Identifier				
80	1	Internal Indications	2	00 index=7		
81	1	Storage Object				
82	1	Device Profile				
83	1	Private Registration Object				
83	2	Private Registration Object Descriptor				

DNP V3.00

DEVICE PROFILE DOCUMENT

IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
90	1	Application Identifier				
100	1	Short Floating Point				
100	2	Long Floating Point				
100	3	Extended Floating Point				
101	1	Small Packed Binary-Coded Decimal				
101	2	Medium Packed Binary-Coded Decimal				
101	3	Large Packed Binary-Coded Decimal				
		No Object	13			
		No Object	14			
		No Object	23 (see 4.14)			

DNP V3.00

TIME SYNCHRONISATION PARAMETERS

This table describes the worst-case time parameters relating to time synchronization, as required by DNP Level 2 Certification Procedure section 8.7

PARAMETER	VALUE
Time base drift	+/- 1 minute/month at 25°C +1 / -3 minutes/month 0 to 50°C
Time base drift over a 10-minute interval	+/- 14 milliseconds at 25°C +14 / -42 milliseconds 0 to 50°C
Maximum delay measurement error	+/- 100 milliseconds
Maximum internal time reference error when set from the protocol	+/- 100 milliseconds
Maximum response time	100 milliseconds

DNP Slave Device Profile Document

DNP v3.00 **DEVICE PROFILE DOCUMENT**	
Vendor Name: Control Microsystems Inc.	
Device Name: SCADAPack controllers	
Highest DNP Level Supported: For Requests 2 For Responses 2	Device Function: ☐ Master ■ Slave
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table): Function code 14 (warm restart) Function code 20 (Enable Unsolicited Messages) for class 1, 2, 3 objects only. Function code 21 (Disable Unsolicited Messages) for class 1, 2, 3 objects only. Object 41, variation 1 (32-bit analog output block)	

Maximum Data Link Frame Size (octets): Transmitted 292 Received (must be 292)	Maximum Application Fragment Size (octets): Transmitted 2048 Received 2048
Maximum Data Link Re-tries: ☐ None ☐ Fixed at ■ Configurable, range 0 to 255	Maximum Application Layer Re-tries: ☐ None ■ Configurable, range 0 to 255
Requires Data Link Layer Confirmation: ☐ Never ☐ Always ☐ Sometimes If 'Sometimes', when? ■ Configurable for Always or Never	
Requires Application Layer Confirmation: ☐ Never ☐ Always (not recommended) ☐ When reporting Event Data (Slave devices only) ☐ When sending multi-fragment responses (Slave devices only) ☐ Sometimes If 'Sometimes', when? ______________________________________ ■Configurable for always or only when Reporting Event Data and Unsolicited Messages	

Timeouts while waiting for:

Data Link Confirm	☐ None	☐ Fixed at ________	☐ Variable	■ Configurable
Complete Appl. Fragment	☐ None	☐ Fixed at ________	☐ Variable	■ Configurable
Application Confirm	☐ None	☐ Fixed at ________	☐ Variable	■ Configurable
Complete Appl. Response	☐ None	☐ Fixed at ________	☐ Variable	■ Configurable

Others ____

Sends/Executes Control Operations:

WRITE Binary Outputs	☐ Never	☐ Always	☐ Sometimes	■ Configurable
SELECT/OPERATE	☐ Never	☐ Always	☐ Sometimes	■ Configurable
DIRECT OPERATE	☐ Never	☐ Always	☐ Sometimes	■ Configurable
DIRECT OPERATE - NO ACK	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Count > 1	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Pulse On	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Pulse Off	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Latch On	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Latch Off	☐ Never	☐ Always	☐ Sometimes	■ Configurable
Queue	■ Never	☐ Always	☐ Sometimes	☐ Configurable
Clear Queue	■ Never	☐ Always	☐ Sometimes	☐ Configurable

FILL OUT THE FOLLOWING ITEM FOR MASTER DEVICES ONLY:

Expects Binary Input Change Events:

☐ Either time-tagged or non-time-tagged for a single event

☐ Both time-tagged and non-time-tagged for a single event

☐ Configurable (attach explanation)

FILL OUT THE FOLLOWING ITEMS FOR SLAVE DEVICES ONLY:

Reports Binary Input Change Events when no specific variation requested: ☐ Never ☐ Only time-tagged ■ Only non-time-tagged ☐ Configurable to send both, one or the other (attach explanation)	Reports time-tagged Binary Input Change Events when no specific variation requested: ■ Never ☐ Binary Input Change With Time ☐ Binary Input Change With Relative Time ☐ Configurable (attach explanation)
Sends Unsolicited Responses: ☐ Never ■ Configurable by class ☐ Only certain objects ☐ Sometimes (attach explanation) ■ ENABLE/DISABLE UNSOLICITED	Sends Static Data in Unsolicited Responses: ■ Never ☐ When Device Restarts ☐ When Status Flags Change No other options are permitted.
Default Counter Object/Variation: ☐ No Counters Reported ☐ Configurable (attach explanation) ■ Default Object 20 Default Variation 05 ☐ Point-by-point list attached	Counters Roll Over at: ☐ No Counters Reported ☐ Configurable (attach explanation) ☐ 16 Bits ☐ 32 Bits ■ 16 Bits for 16-bit counters 32 Bits for 32-bit counters ☐ Point-by-point list attached

Sends Multi-Fragment Responses: ■ Yes ☐ No

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IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
1	0	Binary Input - All Variations	1	06		
1	1	Binary Input			129, 130	00, 01
1	2	Binary Input with Status			129, 130	00, 01
2	0	Binary Input Change - All Variations	1	06,07,08		
2	1	Binary Input Change without Time	1	06,07,08	129, 130	17, 28
2	2	Binary Input Change with Time	1	06,07,08	129, 130	17, 28
2	3	Binary Input Change with Relative Time	1	06,07,08	129, 130	17, 28
10	0	Binary Output - All Variations	1	06		
10	1	Binary Output				
10	2	Binary Output Status			129, 130	00, 01
12	0	Control Block - All Variations				

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IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
12	1	Control Relay Output Block	3, 4, 5, 6	17, 28	129	echo of request
12	2	Pattern Control Block				
12	3	Pattern Mask				
20	0	Binary Counter - All Variations	1, 7, 8, 9, 10	06		
20	1	32-Bit Binary Counter			129, 130	00, 01
20	2	16-Bit Binary Counter			129, 130	00, 01
20	3	32-Bit Delta Counter				
20	4	16-Bit Delta Counter				
20	5	32-Bit Binary Counter without Flag			129, 130	00, 01
20	6	16-Bit Binary Counter without Flag			129, 130	00, 01
20	7	32-Bit Delta Counter without Flag				
20	8	16-Bit Delta Counter without Flag				

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IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
21	0	Frozen Counter - All Variations	1	06		
21	1	32-Bit Frozen Counter			129, 130	00, 01
21	2	16-Bit Frozen Counter			129, 130	00, 01
21	3	32-Bit Frozen Delta Counter				
21	4	16-Bit Frozen Delta Counter				
21	5	32-Bit Frozen Counter with Time of Freeze				
21	6	16-Bit Frozen Counter with Time of Freeze				
21	7	32-Bit Frozen Delta Counter with Time of Freeze				
21	8	16-Bit Frozen Delta Counter with Time of Freeze				
21	9	32-Bit Frozen Counter without Flag			129, 130	00, 01
21	10	16-Bit Frozen Counter without Flag			129, 130	00, 01
21	11	32-Bit Frozen Delta Counter without Flag				

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IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
21	12	16-Bit Frozen Delta Counter without Flag				
22	0	Counter Change Event - All Variations	1	06,07,08		
22	1	32-Bit Counter Change Event without Time			129, 130	17, 28
22	2	16-Bit Counter Change Event without Time			129, 130	17, 28
22	3	32-Bit Delta Counter Change Event without Time				
22	4	16-Bit Delta Counter Change Event without Time				
22	5	32-Bit Counter Change Event with Time				
22	6	16-Bit Counter Change Event with Time				
22	7	32-Bit Delta Counter Change Event with Time				
22	8	16-Bit Delta Counter Change Event with Time				
23	0	Frozen Counter Event - All Variations				
23	1	32-Bit Frozen Counter Event without Time				

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IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
23	2	16-Bit Frozen Counter Event without Time				
23	3	32-Bit Frozen Delta Counter Event without Time				
23	4	16-Bit Frozen Delta Counter Event without Time				
23	5	32-Bit Frozen Counter Event with Time				
23	6	16-Bit Frozen Counter Event with Time				
23	7	32-Bit Frozen Delta Counter Event with Time				
23	8	16-Bit Frozen Delta Counter Event with Time				
30	0	Analog Input - All Variations	1	06		
30	1	32-Bit Analog Input			129, 130	00, 01
30	2	16-Bit Analog Input			129, 130	00, 01
30	3	32-Bit Analog Input without Flag			129, 130	00, 01
30	4	16-Bit Analog Input without Flag			129, 130	00, 01
30	5	Short Floating Point Analog Input			129, 130	00, 01

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IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
31	0	Frozen Analog Input - All Variations				
31	1	32-Bit Frozen Analog Input				
31	2	16-Bit Frozen Analog Input				
31	3	32-Bit Frozen Analog Input with Time of Freeze				
31	4	16-Bit Frozen Analog Input with Time of Freeze				
31	5	32-Bit Frozen Analog Input without Flag				
31	6	16-Bit Frozen Analog Input without Flag				
32	0	Analog Change Event - All Variations	1	06,07,08		
32	1	32-Bit Analog Change Event without Time			129,130	17,28
32	2	16-Bit Analog Change Event without Time			129,130	17,28
32	3	32-Bit Analog Change Event with Time			129,130	17,28
32	4	16-Bit Analog Change Event with Time			129,130	17,28

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IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			**REQUEST** (slave must parse)		**RESPONSE** (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
32	5	Short Floating Point Analog Change Event without Time			129,130	17,28
33	0	Frozen Analog Event - All Variations				
33	1	32-Bit Frozen Analog Event without Time				
33	2	16-Bit Frozen Analog Event without Time				
33	3	32-Bit Frozen Analog Event with Time				
33	4	16-Bit Frozen Analog Event with Time				
40	0	Analog Output Status - All Variations	1	06		
40	1	32-Bit Analog Output Status			129, 130	00, 01
40	2	16-Bit Analog Output Status			129, 130	00, 01
40	3	Short Floating Point Analog Output Status			129, 130	00, 01
41	0	Analog Output Block - All Variations				
41	1	32-Bit Analog Output Block	3, 4, 5, 6	17, 28	129	echo of request

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IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
41	2	16-Bit Analog Output Block	3, 4, 5, 6	17, 28	129	echo of request
41	3	Short Floating Point Analog Output Block	3, 4, 5, 6	17, 28	129	echo of request
50	0	Time and Date - All Variations				
50	1	Time and Date	2 (see 4.14)	07 where quantity = 1		
50	2	Time and Date with Interval				
51	0	Time and Date CTO - All Variations				
51	1	Time and Date CTO			129, 130	07, quantity=1
51	2	Unsynchronized Time and Date CTO			129, 130	07, quantity=1
52	0	Time Delay - All Variations				
52	1	Time Delay Coarse			129	07, quantity=1
52	2	Time Delay Fine			129	07, quantity=1

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IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			**REQUEST** (slave must parse)		**RESPONSE** (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
60	0					
60	1	Class 0 Data	1	06		
60	2	Class 1 Data	1 20,21	06,07,08 06		
60	3	Class 2 Data	1 20,21	06,07,08 06		
60	4	Class 3 Data	1 20,21	06,07,08 06		
70	1	File Identifier				
80	1	Internal Indications	2	00 index=7		
81	1	Storage Object				
82	1	Device Profile				
83	1	Private Registration Object				
83	2	Private Registration Object Descriptor				

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IMPLEMENTATION OBJECT

This table describes the objects, function codes and qualifiers used in the device:

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
Obj	**Var**	**Description**	**Func Codes (dec)**	**Qual Codes (hex)**	**Func Codes**	**Qual Codes (hex)**
90	1	Application Identifier				
100	1	Short Floating Point				
100	2	Long Floating Point				
100	3	Extended Floating Point				
101	1	Small Packed Binary-Coded Decimal				
101	2	Medium Packed Binary-Coded Decimal				
101	3	Large Packed Binary-Coded Decimal				
		No Object	13			
		No Object	14			
		No Object	23 (see 4.14)			

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TIME SYNCHRONISATION PARAMETERS

This table describes the worst-case time parameters relating to time synchronization, as required by DNP Level 2 Certification Procedure section 8.7

PARAMETER	VALUE
Time base drift	+/- 1 minute/month at 25°C +1 / -3 minutes/month 0 to 50°C
Time base drift over a 10-minute interval	+/- 14 milliseconds at 25°C +14 / -42 milliseconds 0 to 50°C
Maximum delay measurement error	+/- 100 milliseconds
Maximum internal time reference error when set from the protocol	+/- 100 milliseconds
Maximum response time	100 milliseconds