Operations manual
00809-0300-3104, Rev AD
March 2025

Rosemount™ 3410 Series Gas Ultrasonic Flow meter

Rosemount 3415, 3416, and 3417 GUSM

ROSEMOUNT™

EMERSON™

Safety and approval information

This Rosemount product complies with all applicable European directives when properly installed in accordance with the instructions in this manual. Refer to the EU Declaration of Conformity for directives that apply to this product. The EU Declaration of Conformity, with all applicable European directives, and the complete ATEX installation drawings and instructions are available on the Internet at Emerson.com/Global or through your local Emerson support center.

Information affixed to equipment that complies with the Pressure Equipment Directive can be found on the Internet at Emerson.com/Global.

For hazardous installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

Other information

Full product specifications can be found in the product data sheet. Troubleshooting information can be found in the 3812 Maintenance and Troubleshooting Manual (00809-0100-3812).

Product data sheets and manuals are available at Emerson.com/Global.

Return policy

Follow Emerson procedures when returning equipment.

These procedures ensure legal compliance with government transportation agencies and help provide a safe working environment for Emerson employees. Emerson will not accept your returned equipment if you fail to follow Emerson procedures. Return procedures and forms are available on our website at Emerson.com/Global.

Emerson Flow customer service

- Worldwide: flow.support@emerson.com
- Asia-Pacific: APflow.support@emerson.com

Contents

1 Start-up

1.1 Checklist

During meter start-up, have the following equipment and information on hand:

Meter start-up checklist	
	Site pipe and ID drawings with elevations
	Site wiring diagrams
	Rosemount Gas Ultrasonic Meter calibration data
	Rosemount Gas Ultrasonic Meter manuals
	Information and manuals for all other flow instrumentation - flow computers, pressure and temperature transmitter data sheets, and wiring
	Shutoff and control valve information, specifications, operation, and setup data.
	Ethernet (Cat 5 cables) or serial cables to link the laptop to the meter
	Field service representative's telephone numbers for major components: valves, meter, flow computer, communication gear, transmitters, site designers, or integrators
	Check all ultrasonic meter wiring.
	Check the settings of any bit switches on transmitter input/output (I/O) cards.
	Start MeterLink™.
	Establish flow in the meter (at least 3 feet per second to ensure good thermal mixing).
	Save the meter configuration file - your ***As Found*** record of the meter. In MeterLink, select **Tools** → **Edit/Compare Configuration**. Click the **Read** button and select **File Save**.
	Open **File** → **Program Settings** and customize MeterLink user preferences.
	Open **Meter** → **Monitor** and check the measurement paths or chords and that they agree with each other to approximately 0.2%.
	Check for alarms; open **Meter** → **Monitor** and click **Check Status**.
	Check for good signal strength (usually shown as "SNR") or Signal to Noise Ratio.
	Check for reasonably correct flow profile.
	Go to **Logs/Reports** → **Maintenance Logs/Reports** to collect and save a Maintenance log to record the initial performance of your meter (this is your ***As Found*** record).
	From the **Meter** → **Field Setup Wizard** menu, make any configuration adjustments, such as setting the frequency output variable and frequency full scale.
	Save another Maintenance log (this is your ***As Left*** record).

1.2 Cybersecurity and network communications

In order to mitigate cybersecurity risks, configure the 3410 electronics TCP/IP communications as follows:

1. MeterLink™ uses either FTP or HTTP protocols for Archive and Smart Meter Verification log collection. It is recommended to disable the FTP protocol and leave the HTTP protocol enabled using the **Meter** → **Communications Settings** dialog in

MeterLink™. Both can be disabled for additional security, but log collection will not be possible in this configuration.

2. Leave the `Telnet` port disabled. This port is not required for any communications to field devices or MeterLink. Beginning with Rosemount 3410 Series Firmware v1.60, Telnet is permanently disabled.
3. Enabling the physical `Write Protect` switch will prevent metrology configuration changes and firmware upgrades. It will also prevent enabling TCP/IP protocols such as FTP, HTTP, and Telnet.
4. Disable unused protocols or set them to read-only if write capability is not required. The Modbus TCP/IP protocol can be set to **Read-only** or **Disabled** on the `Ethernet` port. Modbus protocols can be disabled or made read-only on serial ports while still allowing authenticated MeterLink communications.
5. Rosemount 3410 Series Firmware v1.60 and later require user authentication and has a default administrator password. While the password is unique to each meter, it is highly recommended to be changed at meter startup. For added security, the default username, administrator, can be changed as well.
6. Other users can be added with different privileges and passwords in the Rosemount 3410 Series Firmware v1.60 and later. Only give users privileges to perform their job functions. For more information, see Manage users on how to add, change, and delete users.

This transmitter:

1. Is not intended to be directly connected to an enterprise or to an internet facing-network without a compensating control in place.
2. Must be installed following industry best practices for cybersecurity.

2 Communications

2.1 Set up meter communications

After the installation of your Rosemount Ultrasonic Meter, install MeterLink™ on your PC or laptop as described in the MeterLink Software for Gas and Liquid Ultrasonic Flow Meters Quick Start Manual for your operating system. Then configure the meter.

The MeterLink Software for Gas and Liquid Ultrasonic Flow Meters Quick Start Manual is made available with the meter.

The MeterLink installation program is available for download from the Emerson website: Emerson.com/meterlink.

2.1.1 MeterLink utilities

MeterLink™ provides the following utilities to configure the meter's flow measurement units, meter output parameters, communications settings, output tests, and logs and reports file management.

Meter

- Connect
- Disconnect
- Monitor
- Field setup wizard
  - Startup
  - General
  - Frequency/Digital output sources
  - Frequency outputs
  - Meter digital outputs
  - Analog outputs
  - Meter corrections
  - Temperature and pressure
  - Gas chromatograph setup
  - Gas chromatograph component data
  - AGA8
  - Continuous flow analysis
  - Alarm limits
  - Local display
- Communications settings
- Signal analyzer
- Meter information
- Manage users

	• Key manager • Open data folder
Tools	• Edit/Compare configuration • Waveform viewer • Gas SOS calculator • Outputs test • Transducer swap-out • Set transducer type • Reset tracking • Reset velocity estimation • Override velocity estimation update time • Locate meter • Set baseline wizard • Program download • Warm start meter • Communications analyzer
Log/Reports	• Maintenance Logs and Reports • Trend Maintenance Logs • Meter Archive Logs • Smart Meter Verification • Create PDF from XML SMV Report • Compare Excel® Meter Configurations
Calibration	• Analog Inputs Wizard • Meter Factors • Flow Calibration • Zero Calibration

Set up the meter directory

Set up the connection properties for your meter.

By default, the meter directory contains only one record named ***New Meter***, which is defaulted to connect to a Rosemount Gas Ultrasonic Meter configured as shipped from the factory.

Create a new meter record

Procedure

1. Select **Insert**, **Insert Duplicate**, or **Add** from the ***File*** dropdown list to create a new record.
2. Set up the record:
    a) Enter a **Meter Name**, **Short Desc**, and **Meter Type**.

b) Select the connection type(s) check boxes **Direct**, **Ethernet**, and **Ethernet 2**.

For each connection type selected, a button will be enabled at the bottom of the dialog with the same name.

3. To edit the connection properties of a selected connection method, click its enabled button from the previous step.
4. After choosing the connection properties, click **OK** accept the changes or click **Cancel** to discard any changes and close the dialog.
   a) Select **Direct connection** to connect to the meter directly through one of the serial ports on the meter using one of the serial ports on your computer.

   b) Click **Direct** to set the following parameters:

Protocol TCP/IP (transmission control protocol/Internet protocol) is a read-only field and is the only protocol MeterLink™ uses.

Note
Rosemount ultrasonic meters still support Modbus® ASCII and Modbus remote terminal unit (RTU) when talking to other applications or devices.

Comms Address Enter the communication address that is configured in the meter hardware. The default address for meters from the factory is `32`. For ultrasonic meters, the valid range is from 1 to 247.

Port Select the available driver from the list of those installed on your machine.

Baud Rate Select the serial port baud rate from the dropdown list for which the meter hardware is configured. The default baud rate is `19200`.

   c) **Ethernet connection**: Set the following properties to configure the ultrasonic meter hardware for Ethernet connectivity:

IP Address Enter the IP address for the meter's Ethernet port. The factory set IP address is `172.16.17.200` for gas ultrasonic meters, or you can use `192.168.135.100` if DHCP is enabled in the meter (see Dynamic Host Configuration Protocol (DHCP) for more details).

Dynamic Host Configuration Protocol (DHCP) Business PCs are usually configured to work in a network environment where a DHCP server assigns an IP address to each computer when they connect to the network.

If a PC is configured to obtain an IP address from a DHCP server, and it is going to connect through the Ethernet cable (1-360-01-596) to a meter that is not connected to a network, then the DHCP server in the meter must be enabled so it can assign an IP address to the PC when it connects.

The DHCP server can be enabled on the meter by setting the DHCP switch on the central processing unit (CPU) module to the **ON** position.

When connecting to a meter with DHCP enabled, use the IP address of `192.168.135.100` to connect to the meter. In this mode, you can create just one ***Meter Directory*** record with this IP address to connect to all your meters with DHCP enabled. When the connection is made, select to use the **Meter Name** in the meter instead of the **Meter Directory Name** in order to keep all log files and configurations separate for each meter.

Click **OK** to accept the changes or click **Cancel** to discard any changes and return to the ***Meter Directory*** dialog box.

NOTICE
It is strongly recommended that the meter be configured using an independent (off network) single host computer. After configuration of the meter, the dynamic host configuration protocol (DHCP) option should be disabled.

Meter groups

This dialog, available from the ***Meter Directory*** dialog, allows you to manage meter groups for:

Filtering the list of meters in the ***Connect to Meter*** dialog

Exporting to other MeterLink™ users

Filtering the list of meters in MeterLink Net Monitor's main window

There is a predefined meter group for **All meters**. Otherwise, meters can be grouped together in any way, such as meters for geographic regions or meters that require daily monitoring.

User-defined meter groups can be added, edited, and deleted in this dialog. The left side displays a list of meter groups. The right side displays all available meters (meter directory records) in the currently selected group and allows meters to be added to or removed from the currently selected group using a check box next to each meter.

MeterLink communciations settings for dual configuration

Dual configuration - serial connection

Procedure

To connect to dual configuration meter using serial connection, enter the serial connection properties for Transmitter Head 1. MeterLink will connect to both transmitter heads using the Ethernet settings configured for each Transmitter Head.

- Check Box labeled Route IP packets to connection (recommended for Dual-Configuration meters).
- Transmitter Head 1 and Head 2 IP address and Data Sharing Dual-Configuration Meter IP must be configured properly for each meter and meters must be connected to same network either via Expansion I/O module or local network switch. (For more information, see section for Dual Config Initial Meter Communication Settings Head 1 and Head 2.)

Ethernet initial connection steps

Procedure

1. Power up the meter.
2. Shut down the PC.

3. Plug the Ethernet adapter cable Phoenix end into the meter Field Connection Board connector **J8** and connect the RJ-45 end into the PC Ethernet connector.
4. Enable the Ethernet local area network (LAN) connector dynamic host configuration protocol (DHCP) server on the central processing unit (CPU) module by moving the DHCP (switch-1) to the **ON** position (see direction arrow on the CPU module label).
5. Power up (boot) the PC and log in to the initial Windows® login prompt.
6. Verify the Ethernet connection status by the CPU module **LINK** LED. The desired color is solid green.
7. Launch MeterLink™ and create a new meter record.

Dual configuration - Initial meter communication settings – Transmitter head 1

Procedure

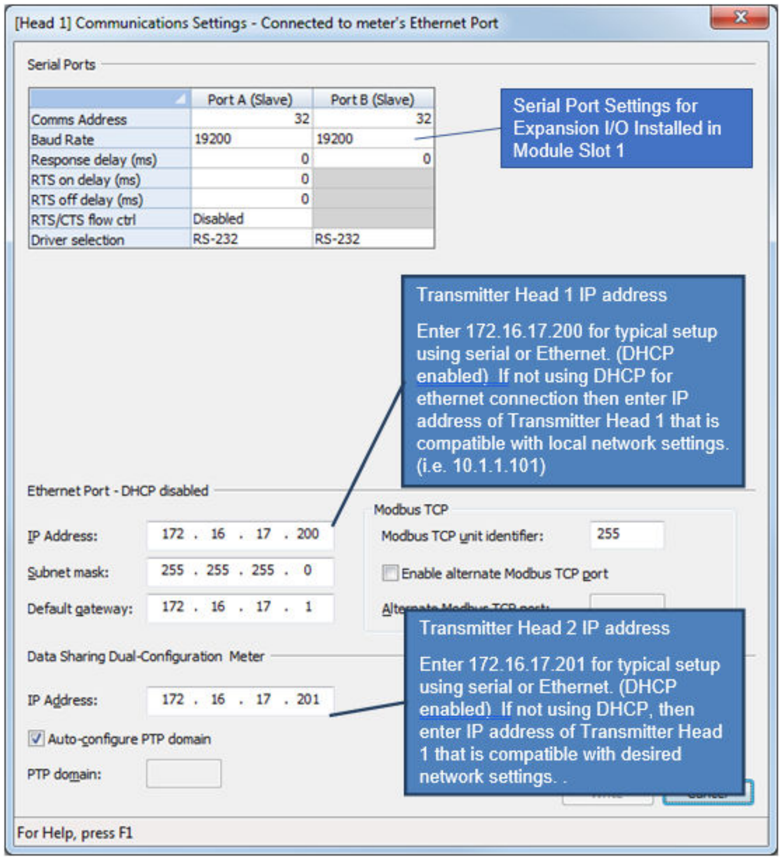
1. Turn on DHCP Switch for Transmitter Head 1.

   Note
   When DHCP is enabled on Head 1, Head 1 and Head 2 IP address settings automatically become 192.168.135.100 and 192.168.135.101, respectively. This allows for simple direct laptop ethernet connection to both heads if meters are connected with Expansion I/O module. This eliminates requirement to connect separately to each meter for initial startup.

2. Turn off DHCP Switch for Transmitter Head 2 or disconnect Ethernet to Head 2.
3. Connect to Transmitter Head 1 (192.168.135.100) using MeterLink.
4. Select **Meter** → **Communication Settings**.
5. Enter IP address of Transmitter Head 1 in Data Sharing Dual-Configuration Meter IP address entry box.
   - DHCP Disabled : 172.16.17.200 or user specified
   - DHCP Enabled : Use Default, no changes required in configuration
6. Enter IP address of Transmitter Head 2 in Data Sharing Dual-Configuration Meter IP address entry box.
   - DHCP Disabled : 172.16.17.201 or user specified
   - DHCP Enabled : Use default

     Note
     If using DHCP for connection to meter, then use default address 172.16.17.200 for IP address of Head 1 and 172.16.17.201 for IP address of Head 2. Only enable DHCP Switch on one head when performing setup and in normal operation. For operation with DHCP, it is recommended to have Head 1 with DHCP enabled.
     If DHCP is used, dual-configuration meters will use IP address 192.168.135.100 (Head 1) and 192.168.135.101(Head 2) for data sharing regardless of settings for IP address. Do not connect meters to local network with DHCP enabled.

Figure 2-1: Transmitter Head 1 - Commnication settings shown for Dual Configuration Data sharing

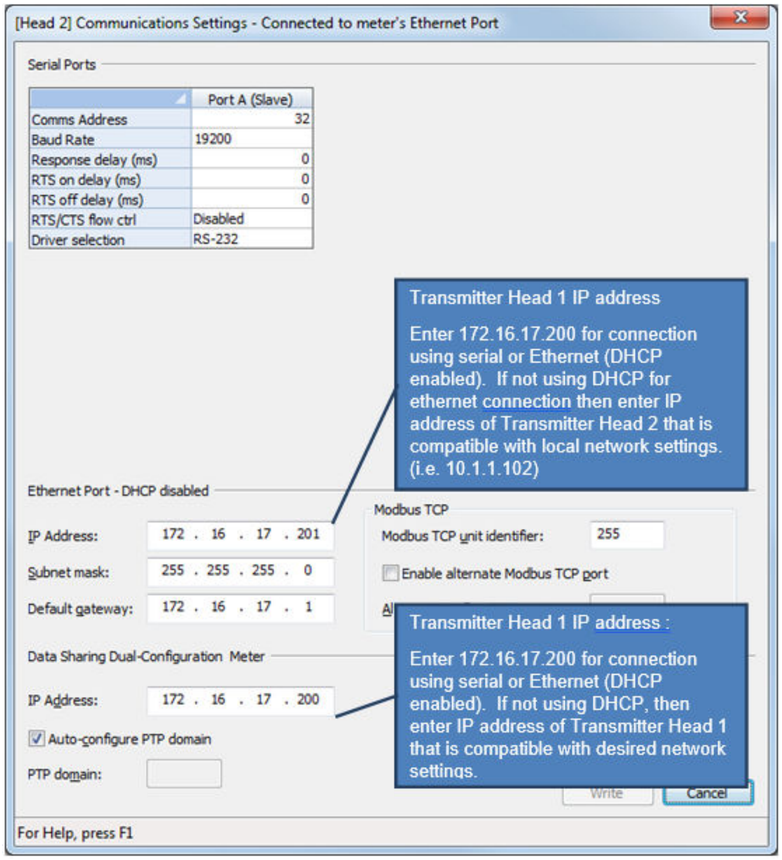


Dual configuration - Initial meter communication settings – Transmitter head 2

Procedure

1. Turn off DHCP Switch for Transmitter Head 1.
2. Turn on DHCP Switch for Transmitter Head 2.
3. Connect to Transmitter Head 2 Using MeterLink™.
4. Select **Meter** → **Communication Settings**.
5. Enter IP address of Transmitter Head 2 in Ethernet Port entry box.
   - DHCP Disabled : 172.16.17.201 or user specified
   - DHCP Enabled (Head 2): 172.16.17.201
6. Enter IP address of Transmitter Head 1 in Data Sharing Dual-Configuration Meter entry box.
   - DHCP Disabled : 172.16.17.200 or user specified
   - DHCP Enabled (Head 1): 172.16.17.200

Figure 2-2: Transmitter Head 2 - Communications settings shown for Dual Configuration Data sharing



Import a meter record

Procedure

Select **File** → **Import** from the ***Meter Directory*** dropdown list or click **Import**.

The ***Import Meter Directory File*** dialog, which allows you to select a meter directory .DAT file to import the file into the currently used meter directory file, opens.

If an identical meter record already exists and a duplicate is trying to be imported, MeterLink™ inserts the duplicate meter record. The **Import** button performs the same operation.

Export a meter record

Use the **Export** command to save the current meter directory to a file. Select **File** → **Meter Directory** from the ***Meter Directory*** dropdown menu or click **Export**.

Procedure

1. Enable the meter directory record check box you want to export or click **Select All**.
2. Click **OK** to begin exporting the meter record(s). Use the ***Export Meter Directory File*** dialog to save the exported record to the default folder (`C:\Ultrasonic Data`) or enter another location.

3. Click **Save**. If you have an existing *METER_DIRECTORY_EXPORT.DAT* file, you are prompted to change the file name or replace the file. If changing the file name, keep the .DAT extension to maintain functionality when importing the file to the new machine.
4. Copy the exported file to the new machine.
5. Use the **Import** command to select this file and import it into the ***Meter Directory***.

Important
Due to limitations in the Microsoft® Dial-Up Networking, not all of the directory information for Direct and Modem connection can be exported to the *METER_DIRECTORY.DAT* file for Rosemount Ultrasonic meters. It will be able to export the meter names, Comms Address, Interface, and Telephone numbers. It will still be necessary to recheck the connection properties and verify the communication parameters, such as COM port, data bits, and parity, are configured correctly.

Connect to the meter

Procedure

1. From the menu bar, select **Meter** → **Connect** or select the **Connect** icon on the toolbar.
   The ***Connect to Meter*** dialog box displays a list of meters setup in MeterLink™.
2. Click either **Direct** or **Ethernet** next to the meter name to establish a connection with your ultrasonic meter.

   For Rosemount 3410 Series Firmware v1.60 and later, MeterLink will display a **Meter Login** dialog box and require a valid username and password to be entered to make a connection.

   The default username for a meter from the factory or for a meter upgraded from a firmware version prior to v1.60 is `administrator`. The default password is `Administrator-XXXXX` where *XXXXX* is the non-zero padded central processing unit (CPU) serial number, which can be found on a label on the CPU module.

   MeterLink v1.90 or later is required to make a connection to a meter requiring user authentication. See **Meter** → **Manage Users** for more details on setting up users, user types, and passwords.

Meter monitor

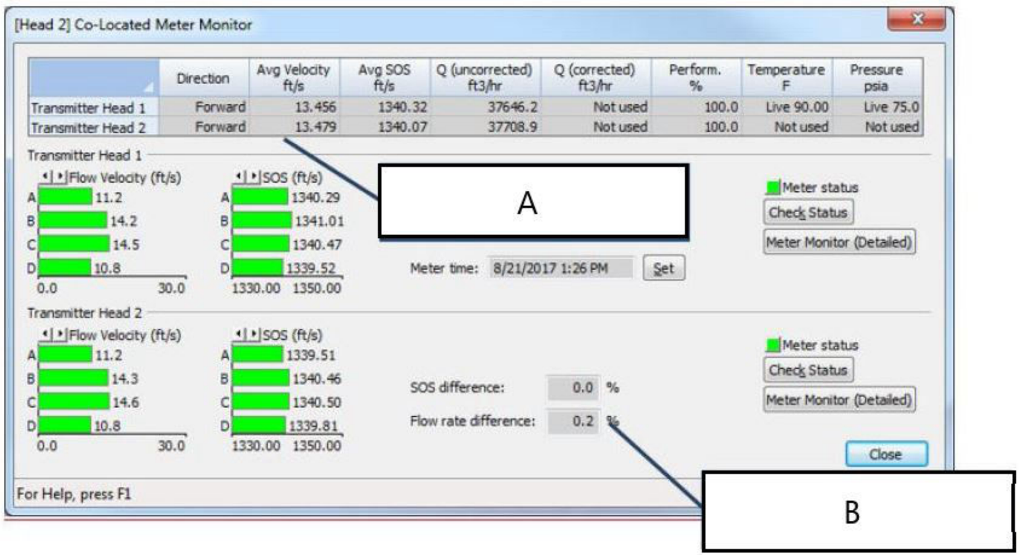
Summary page - Dual configuration

Dual-Configuration meter functionality can be verified by viewing the Summary Page in MeterLink. Summary page will show measurement data and meter status from both transmitter heads. Data sharing communication settings must be properly configured in Meter setup.

Procedure

Select **Meter** → **Monitor** → **Summary**.

Figure 2-3: Transmitter Head 1 and Head 2 Summary



A. Transmitter Head 1 and Head 2 Summary
B. SOS and flow rate percent difference between

Collect As Found logs and reports

Use the MeterLink™ ***Logs/Reports*** menu to collect and save the logs and reports for a historical record of the meter at several velocities within the operating range of the meter. This will establish a baseline to be used for the trending of the meter diagnostics. Save the following logs and reports for the **As Found** settings (factory default):

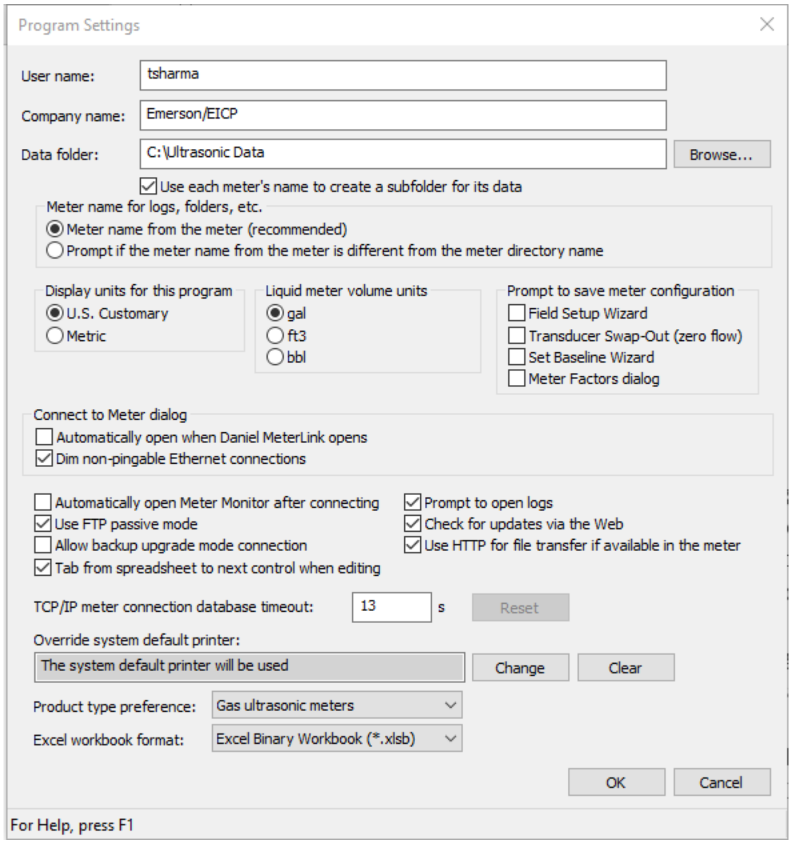
- ***Maintenance*** log
- ***Event*** log, including ***Audit***, ***Alarm***, and ***System*** logs
- Save your meter's configuration file.
- Use the **Tools** → **Edit/Compare Configuration** menu to display the dialog. Enable the **View All** or **Metrology** radio button and click **Read**.
  The ***All*** view displays the meter's extended configuration parameters. Grayed out values are read-only, but help describe the configuration. The ***Metrology*** view displays the path dimensions, pipe diameter, transducer delay parameters, zero flow calibration coefficients, and flow calibration coefficients.
  — Click the question mark icon, ?, for the data point to display additional information.
- Click **Save** to save the configuration file. By default, the file is saved to the ***Data*** folder set up in **File** → **Program Settings**.

Customize MeterLink settings

Open MeterLink™ and access **File** → **Program Settings**; then input the desired settings for your meter.

Your **User name** and `Company name` is included on reports and logs generated with MeterLink.

Figure 2-4: Program Settings



- User name
- Company name
- Data folder (where meter's data is stored)
- Select the check box to create a subfolder with the meter's name under the ***Data*** folder for saving and opening files for your meter.
- Display units (of measurement): U.S. Customary or Metric for necessary unit conversions read by the meter
- Meter volume units: gal, cubic feet, or bbl
- Prompt to save meter configuration prompts you to save a copy of the meter configuration after writing changes to the meter.
- Run ***Connect*** dialog automatically after connecting.
- Run ***Meter Monitor*** automatically after connecting.
- Run ***Meter Monitor*** summary or detailed view after connecting.
- Use FTP (file transfer protocol) passive mode (client - server port communications).
- Tab from spreadsheet to next control instead of next cell.
- TCP/IP meter connection database timeout - amount of time MeterLink waits to respond to a request for data from the meter database (default 13 seconds)
- Override system default printer - used to change printer

- Product type preference - meter type you will most often connect, gas or liquid

HTTP file transfer

Use HTTP for file transfer if available in the meter.

- A checkbox is enabled when selected.
- MeterLink™ uses HTTP protocol for file transfer with meter if it is supported by firmware.
- Rosemount 3410 Series Firmware v1.50 and later supports HTTP protocol for file transfer for Program Download, Collect Archive Logs, Collect XML SMV Report, and cache database configuration XML file when connecting to meter for the first time.
- Alternatively, Rosemount 3410 Series Firmware also supports file transfer protocol (FTP) protocol for file transfer for Program Download, Collect Archive Logs, Collect XML SMV Report, and cache database configuration XML file when connecting to meter for the first time.

2.1.2 Set up Modbus® communications

Rosemount 3410 Series Gas Ultrasonic Flow Meters support RS-232 or RS-485 four-wire or two-wire half duplex serial interface to an external system (such as a flow computer) using Modbus ASCII protocol with the following parameters:

Table 2-1: Modbus communications

Setting	Value
Baud rate	19200
Data bits	7
Stop bits	1
Parity	even
Protocol	Modbus ASCII

Refer to your flow computer user manual to set input/output (I/O) settings required to allow serial communication with the meters.

The meters support ASCII and remote terminal unit (RTU) Modbus communication. For ASCII Modbus, both 7E1 and 7O1 are supported. For RTU Modbus, 8N1 is supported. The communication ports provide automatic protocol detection; only the baud rate and Modbus ID need to be specified. Also, refer to the Emerson website and select the Product page for the model of your meter: Emerson.com/Global.

2.1.3 Setup HART® communications

Rosemount Ultrasonic Flow Meters are HART-capable devices utilizing the 4-20mA signal Analog Output 1 on the CPU Module, in which the digital signal is sent from the field device (Rosemount Ultrasonic Flow Meter) to the host (PC running AMS Device Manager or a Field Communicator). An external 24V power supply is required for the analog signal from the CPU Module.

The HART Device Description application provides dynamic variables, device-specific commands, universal commands and common practice commands in accordance with the HART Communication Foundation. The Device Description defines the communication details from the device to the host (e.g. menus for the Field Communicator, graphical displays for AMS Device Manager and the device parameters - process variables, pressure, temperature, diagnostics and three status alert groups - Failed, Maintenance and Advisory). For more details, refer to the Rosemount 3410 Series Gas Ultrasonic Meters HART® Field Device Specification.

Also see, the HART Communications Foundation, AMS Device Manager and AMS Trex Field Communicator websites:

- Emerson.com/AMSDeviceManager
- Emerson.com/AMSTrexDeviceCommunicator

2.1.4 Setup the meter in a DeltaV System

Rosemount 3410 Series Gas Ultrasonic Flow Meters are compatible with DeltaV System communications. The following are optional communications configurations of Rosemount Ultrasonic Flow Meters:

- Serial connection for RS-232 or RS-485
- Ethernet
- HART
- Modbus TCP/IP (requires a VIM card)

Refer to the *Install Your Digital Automation System* manual for field wiring terminations, I/O interface, power, and DeltaV control Network.

1. Access the DeltaV website hyperlink:
   Emerson.com/DeltaV
2. Click **Books Online** under **Quick Links**.
3. Setup your user account and access the manual.

2.2 Manage users

Starting with Rosemount 3410 Series Firmware v1.60, the meter will authenticate any user making a connection to the meter using MeterLink™.

MeterLink will prompt for a username and password that will be authenticated by the meter before a successful connection is established.

Only users with an Administrator user type can access the **Meter** → **Manage Users** dialog box in MeterLink to add, change, or delete users within the user database. Changes to the user database are not write protected by the **WRITE PROT**. switch. A user with the **Administrator** user type can also export and import the user database from one meter to another to facilitate the user management function across multiple meters. MeterLink v1.90 or later is required to make a connection to a meter requiring user authentication.

Note
Modbus® protocols do not support authentication, so meters cannot authenticate communications over these protocols. No changes have been made to how these protocols function.

2.2.1 User setup

Open MeterLink and connect to the meter as a user with the Administrator user type.

Access **Meter** → **Manage Users** to bring up the dialog box to add, change, or delete users. A maximum of 25 users can be set up in a meter.

To set up new users in a meter:

Username

Usernames can be from 1 to 20 characters in length. Usernames are stored in the meter in all lowercase lettering. The user can enter a username in upper or lowercase lettering, but it will be converted to lowercase for authentication.

Allowed characters:

- Uppercase letters (A to Z)
- Lowercase letters (a to z)
- Numbers (0 to 9)

User type

There are three user types supported:

User Type	
Administrator	Full read/write capability plus privileges for user management
Engineer	Full read/write capability but without user management privileges
Operator	Read-only capability. Operator is not allowed to acknowledge alarms.

At least one user with the Administrator user type must be always configured in the meter. The meter will not allow the last user with an Administrator user type to be deleted. Multiple users can have the same user type.

Passwords

Passwords must be 8 to 20 characters long. Only characters from the following groups are allowed:

- Must have at least one uppercase letter (A-Z)
- Must have at least one lowercase letter (a-z)
- Must have at least one number (0-9)
- Must have at least one special character from the following:
  — & (Ampersand)
  — * (Asterisk)
  — @ (At symbol)
  — \ (Backslash)
  — ^ (Caret-circumflex)
  —) (Close parenthesis)
  — } (Closing brace)
  —] (Closing bracket)
  — : (Colon)
  — , (Comma)
  — $ (Dollar)
  — = (Equals)
  — ! (Exclamation mark)

- ` (Grave accent)
- > (Greater than)
- - (Hyphen)
- < (Less than)
- # (Number)
- { (Opening brace)
- [(Opening bracket)
- ((Open parenthesis)
- % (Percentage)
- . (Period)
- + (Plus)
- ? (Question mark)
- ; (Semicolon)
- / (Slash)
- " (Straight double quote)
- ' (Straight single quote or Apostrophe)
- ~ (Tilde)
- _ (Underscore)
- | (Vertical bar)

2.2.2 Import/Export user database

To help facilitate managing users across multiple meters, there are options to export and import the user database from one meter to another.

This allows a user to be set up on one meter and easily transferred to others. These functions are also needed in the event a central processing unit (CPU) module in a meter must be cold started to default values or replaced.

Import user database

To import an encrypted user database file on your computer to a meter:

Procedure

Click **Import** under Meter → Manage Users in MeterLink.
MeterLink will prompt for the password that was used to encrypt the file during export. The file and password will be sent to the meter and if the meter can successfully decrypt the file, the existing user database in the meter will be deleted and replaced with the imported user database.

Export user database

To export the user database from the meter to a local file on your computer:

Procedure

Click **Export** under Meter → Manage Users in MeterLink™.

MeterLink will prompt for a password for the meter to use to encrypt the database to provide some level of security for this file once MeterLink saves it to your computer. This encrypted user database file and the password must be kept in a secure location, since the file contains sensitive information, such as usernames and passwords.

2.2.3 Reset users

It is important to keep track of the login credentials for at least one user with the Administrator user type to avoid a situation where administration rights are lost to a meter.

If this occurs, there is a user reset mode that can be initiated to delete all users in the user database and restore the default administrator username and password.

Prerequisites

- The default password is Administrator-XXXXX where XXXXX is the non-zero padded CPU serial number which can be found on a label on the CPU Module.
- This operation cannot be done remotely and requires physical access to the CPU module.

To delete all users and restore back the default administrative user:

Procedure

1. Connect your computer with MeterLink™ to the meter that requires the user database to be reset using the appropriate cable.
2. To put the meter in reset mode, transition the Port A Override switch on the CPU module from the Off position to the On position three times within five seconds and leave the switch in the On position after the third transition.
   The meter will enter Meter Reset mode after five seconds and remain in Meter Reset mode for up to two minutes or until a reset action is complete or the **Port A** override switch is moved to the **OFF** position.

   Tip
   Use a retractable ballpoint pen with the ballpoint retracted as a tool to transition the switch.

3. Within the two minutes, connect to the meter with MeterLink. A **Meter Reset Mode is enabled** dialog box will appear.
4. Click the option to **Reset Users**.
   MeterLink prompts you to confirm that the user database should be reset.

   Once the operation is confirmed, the meter will delete the user database and create the default administrator user. MeterLink will disconnect from the meter.

5. Connect to the meter again using the default administrator username and go to **Meter** → **Manage Users** to setup new users and change the default password for the administrator user.

   Note
   For added security, the default username for the administrator user can be changed as well.

3 Optional feature keys

3.1 General overview of the Optional feature keys

Rosemount 3410 Series Gas Ultrasonic Flow Meters offer many industry-leading features including Chapter 21-compliant data log access, Gas Chromatograph (GC) interface, sound velocity calculation (with comparison to measured sound velocity) and Continuous Flow Analysis diagnostics.

With Rosemount 3410 Series Firmware v1.50 and later, features keys will be generated on meter start up automatically and this makes all optional features available in the meter.

For firmware versions older than 1.50, use **Meter** → **Key Manager** in MeterLink™ to enter keys to enable optional features.

3.1.1 GC interface key

The GC interface key is enabled/disabled via the GCKEY datapoint. The GC interface feature allows the meter to read gas property data (composition and heating value) from a Rosemount gas chromatograph.

The meter can use the gas composition data to:

- Calculate AGA8 compressibilities for converting volumetric flow rate and volumes to standard (base) condition. AGA8 Gross Method 1, AGA8 Gross Method 2, AGA8 Detailed Method and GERG-2008 calculations are available.
- Calculate AGA8 density for calculating mass rate and mass totals
- Calculate the sound velocity (see AGA10 key (sound velocity calculation)).

The meter uses the GC-reported gas heating value to calculate the energy rate and totalized energy rate values.

Note
Only Head 1 will require the GC interface key to enable data sharing of T, P and GC composition with Head 2.

3.1.2 AGA10 key (sound velocity calculation)

The sound velocity calculation feature allows the meter to calculate the predicted sound velocity based upon the gas composition and compare this value to the measured average sound velocity. The gas composition can be either specified via data points or optionally read live from a GC. The sound velocity is calculated using AGA10 if **HCHMethod** is set to Detail Method or GERG-2008 (AGA8 Part2) if **HCHMethod** is set to GERG-2008. This feature is enabled or disabled via the **AGA10Key** data point.

3.1.3 Continuous Flow Analysis (CFA) key

The Continuous Flow Analysis key enables all optional features and provides extensive diagnostics for the meter's operational health.

Note
Two Separate CFA keys are required for enabling Continuous Flow Analysis in both transmitter heads. If a CFA key is available for only Head 1, then Head 2 will only support GC interface. AGA10 and CFA functionality will not be available in Head 2.

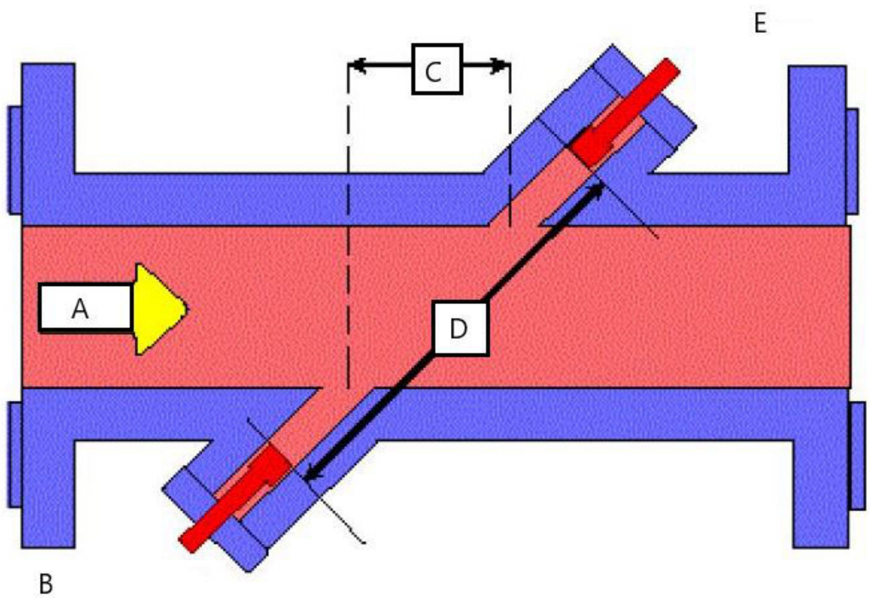
4 Flow measurement

Rosemount 3410 Series Gas Ultrasonic Flow Meters measure the transit times of ultrasonic pulses passing through the medium on two parallel planes. The measurement paths (also referred to as "chords") are angled to the pipe axis, and each chord has two transducers acting alternately as transmitter and receiver as shown in Figure 4-1. This permits the transit times to be measured both upstream and downstream.

The transducers are mounted on the meter body at accurately known locations for each pipe size so the distance L between opposing transducers and the angle are precisely defined for the measurement path.

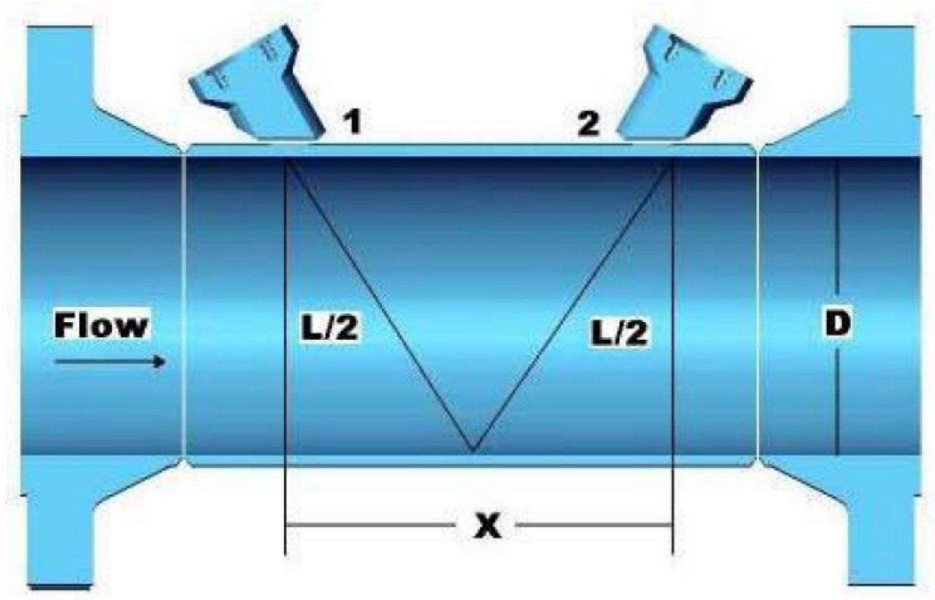
Rosemount 3415, 3416, and 3417 consist of two meters in one body. Transmitter head 1 for all models controls 4 direct transducer paths. Transmitter head 2 for the 3415 and 3416 controls 1 or 2 reflective paths. Transmitter head 2 for the 3417 controls 4 direct paths that are a mirror image of transmitter head 1.

Figure 4-1: Direct path transit-time measurement principle



- *A. Flow*
- *B. Transducer 1*
- *C. X*
- *D. L*
- *E. Transducer 2*

Figure 4-2: Reflective path measurement principle



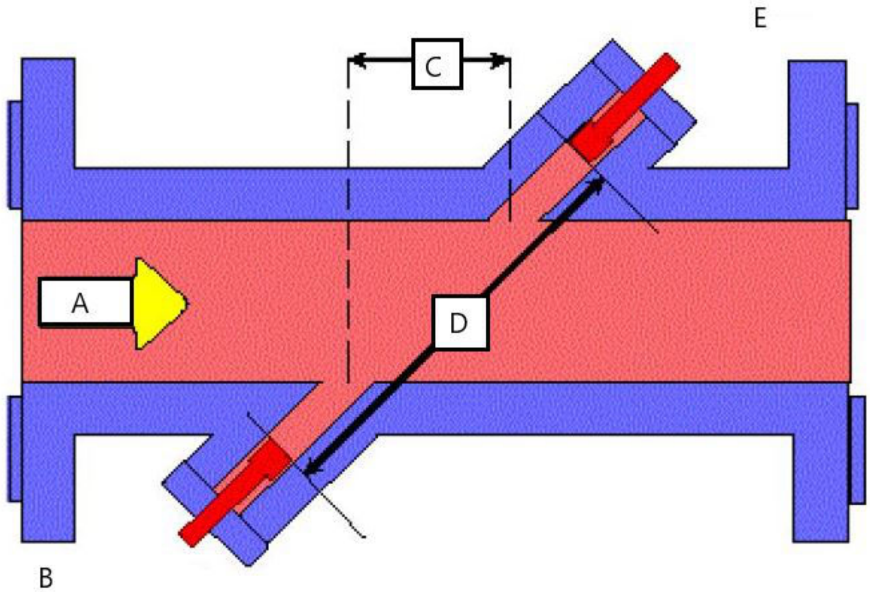
4.1 Flow measurement

Rosemount 3410 Series Gas Ultrasonic Flow Meters measure the transit times of ultrasonic pulses passing through the medium on two parallel planes. The measurement paths (also referred to as "chords") are angled to the pipe axis, and each chord has two transducers acting alternately as transmitter and receiver as shown in Figure 4-3. This permits the transit times to be measured both upstream and downstream.

The transducers are mounted on the meter body at accurately known locations for each pipe size so the distance L between opposing transducers and the angle are precisely defined for the measurement path.

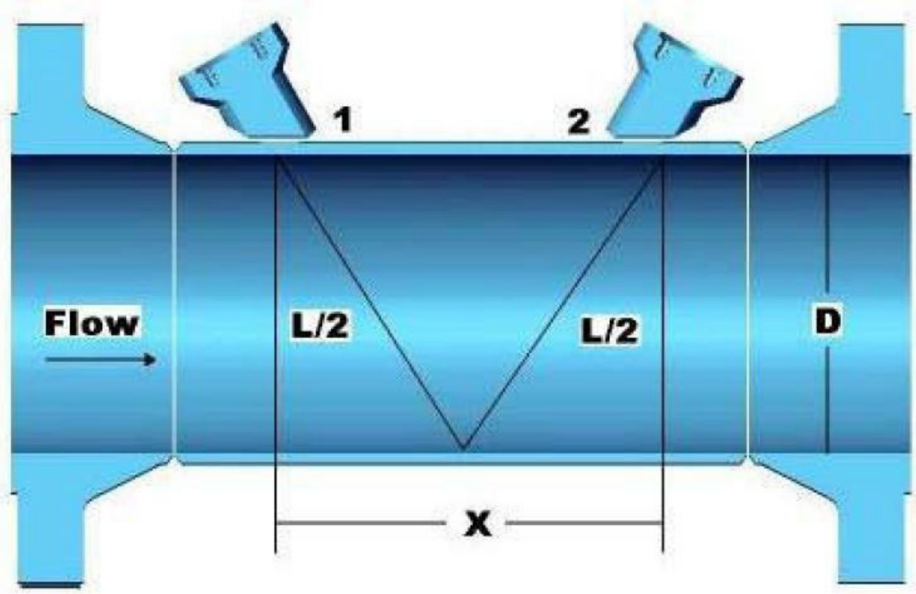
Rosemount 3415, 3416, and 3417 consist of two meters in one body. Transmitter head 1 for all models controls 4 direct transducer paths. Transmitter head 2 for the 3415 and 3416 controls 1 or 2 reflective paths. Transmitter head 2 for the 3417 controls 4 direct paths that are a mirror image of transmitter head 1.

Figure 4-3: Direct path transit-time measurement principle



A. Flow
B. Transducer 1
C. X
D. L
E. Transducer 2

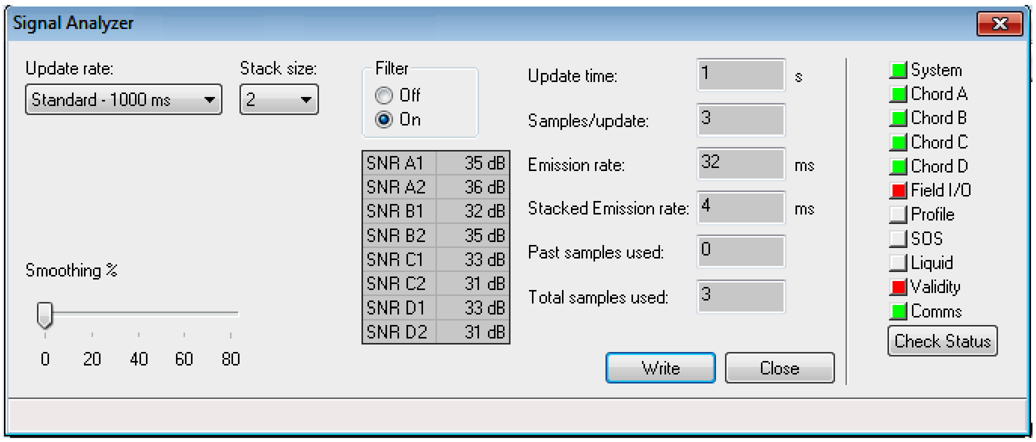
Figure 4-4: Reflective path measurement principle



4.1.1 Transducer timing control

The following terms are used in explaining the effects of transducer timing control, the performance of batch data collection and calculation updates in Rosemount 3410 Series Gas Ultrasonic Flow Meters.

Figure 4-5: Signal Analyzer - update rate, stack size, filter and emission rate



4.1.2 Signal analyzer for dual configuration

MeterLink™ Signal Analyzer page allows for simultaneous viewing of transducer signals from both meters, in addition to allow for change of meter update rates, stack size, and filtering.

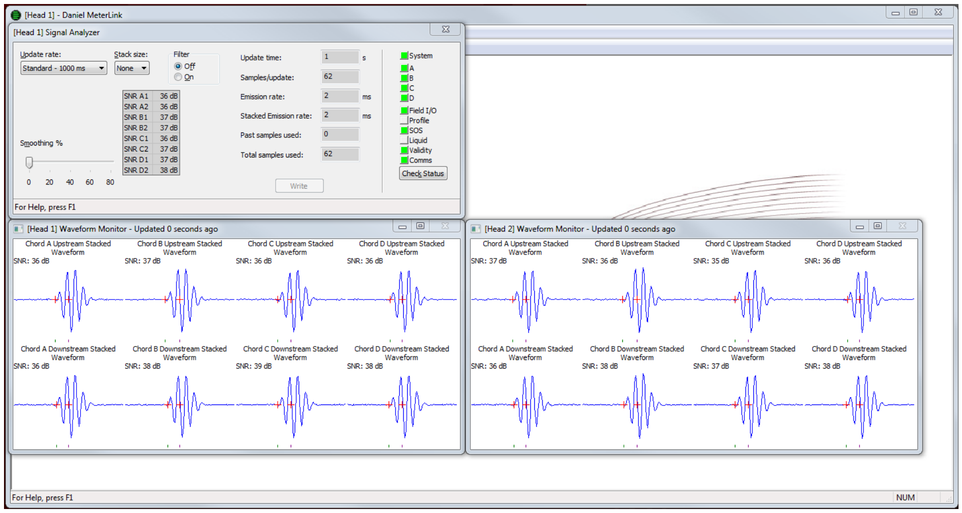
Procedure

1. Modification to update rate parameters will only be written to the Meter shown in upper right hand corner of Signal Analyzer. The other meter can be selected by closing window and typing Ctrl+Shift+1 or 2 for Head 1 or Head 2 respectively.

   Note
   Alternately, select **Meter** → **Head 1 meter name** or **Meter** → **Head 2 meter name**.

2. Co-located communication settings must be properly set in each meter.
3. Select **Meter** → **Signal Analyzer**.

Figure 4-6: Signal analyzer for Dual configuration



Terminology

- ***Batch period, or batch cycle*** Synonymous with ***Update time***.
- ***Chords inactive or active*** The exclusion or inclusion of a chord-forming pair of transducers in the sequence of transducer operation.
- ***Emission rate*** The time elapsed before the next transducer in a sequence is fired, regardless of stack size (minimum emission rate is 2 milliseconds with the Filter **ON** or **OFF**). We recommend the default Filter setting, which is the **OFF** position.
- ***Sample*** Refers to one point on the waveform as in samples per cycle. The data that is collected from one Sequence of transducer operation. (This term is displayed in the MeterLink Signal Analyzer screen, and is nearly synonymous with Sequence, as defined above. That is, Samples/update, as displayed in the MeterLink™ Signal Analyzer Wizard, could be interpreted as Sequences/update.) This shows the average number of new samples collected during an update period.
- ***Sequence*** A complete cycle of firing all enabled transducers in a single round of transducer operation.
- ***Stacking*** The process of modifying a sequence so that each individual transducer is fired "x" times (where x equals the stack size) before the next transducer in the sequence is fired.
- ***Stack emission rate*** The time elapsed before a single transducer is re-fired when stacking is enabled (minimum stack emission rate is 2 milliseconds with the Filter **OFF**).
- ***Stack size*** The multiple of times each transducer is fired before the next transducer within the sequence is fired. (When stacking is absent or disabled, the stack size is actually 1, because each enabled transducer is fired once during the sequence. When stacking is applied or enabled, it is applied increments of 2, 4, 8, and 16 and are the only stack size choices, so that each enabled transducer is fired 2, 4, 8, or 16 times before the next transducer in the sequence is fired.)
- ***Update time*** The time elapsed, in seconds, between each processing, or recalculation of data that is collected from sequences of transducer firings.

4.2 Signal processing

The signal at the receiving transducer is amplified, digitized and processed digitally to provide accurate transit time measurement.

A measure of the signal **quality** is the Signal-to-Noise ratio (SNR). The higher the SNR, the better the signal. In general there are two types of noise: **white noise** and **colored** noise.

White noise is noise that occurs across the frequency spectrum and is asynchronous to the transmitted signal.

Colored noise is concentrated around a particular frequency and can be synchronous with the transmitted signal.

The meter provides two methods for improving the received signal waveform SNR by reducing the noise energy: Stacking and Filtering.

To maintain compatible transducer firing sequence duration when make these parameter changes in dual configuration meters such as the 3415, 3416, and 3417, it is generally necessary to make the same change in both transmitter heads. The meter will generate an alarm if the two transmitter heads are not in synchronization which may be an indication that they are not configured the same.

4.2.1 Stacking

Stacking is a method of firing a transducer multiple times and averaging the received signals on a point-by-point basis.

Stacking is effective on asynchronous noise such as is typically seen with valve noise. This method is not useful for removing synchronous noise. Meters are configured by default with a stack size of 1 (no stacking).

NOTICE
Do not use when there is a great deal of signal jitter.

Exercise caution when turning ON stacking.

NOTICE
If uncertain how stacking a signal can affect meter operation, consult Rosemount Customer Service. Contact information can be found in Help -> Technical Support in MeterLink.

The number of consecutive times to fire each transducer is specified via the StackSize data point. Available stack sizes are 1 (None), 2, 4, 8, and 16. A stack size of 1 selects no stacking (i.e., stacking disabled). Stacking is only available when the standard update rate is selected (see Batch update period).

4.2.2 Filtering

Filtering applies a bandpass filter that removes noise that is above and below the transducer frequency.

Filtering is effective on noise outside of the frequency passband of the filter (e.g., filtering works on any noise outside of the passband of the filter).

Filtering is enabled/disabled via the **Filter** data point (TRUE = enable filtering, FALSE = disable filtering). Meters are configured by default with filtering disabled. The minimum emission rate for the gas meter is 2 milliseconds with the **filter ON** or **OFF**. We recommend the default **Filter** setting, which is the **OFF** position.

Ensure care is taken when enabling/disabling filtering and it is recommended to consult with Flow Lifecycle Services for Rosemount products if you are unsure of how this change can affect the meter's operation. Refer to Technical Support under the Help menu of MeterLink™ for contact information.

4.2.3 Batch cycle processing

Batch update period

Calculation updates performed by the meter, for deriving volume and velocity, are based on batches of data samples collected from sequences of transducer firings. The batch update period is dependent upon the user specified batch update period (**SpecBatchUpdtPeriod**) and the stack size (**StackSize**) as shown in Table 4-1. The **Standard** batch update period is the default. The actual batch update period is readable via the **BatchUpdatePeriod** data point.

Table 4-1: Actual meter update period

		Stack size				
		1 (None)	**2**	**4**	**8**	**16**
SpecBatchUpdtPeriod	Rapid (250 ms)	0.25 sec	N/A	N/A	N/A	N/A
	Standard (1000 ms)	1 sec	1 sec	1.5 sec	3 sec	5 sec

Emission rates

The emission rate is the period between firing two different transducers. The stacked emission rate is the period between consecutive firings of a single transducer when stacking is used (i.e., the stack size is not set to **None**).

The actual emission rates used (readable via the **EmRateActual** and **StackEmRateActual** data points) are functions of the desired emission rates, meter type, firing sequence, stack size, and pipe diameter.

4.2.4 Smoothing

The Rosemount 3410 Series Gas Ultrasonic Flow Meter applies a method for smoothing the output (particularly the frequency output) by averaging times collected from past batch periods with new times for the current batch period.

Smoothing can be applied in the following increments: 0 (i.e., smoothing is disabled), 20, 40, 60, or 80%.

For example, setting **Smoothing** to 20% means that of the samples used for the current update, 20% will be from previously collected samples and 80% will be from the newly collected samples. Thus, if eight new samples are collected, then those eight samples along with the last two previous samples would be used together for the current update period calculations.

Meters are configured by default for **Smoothing** of 0% (only new samples are used for the **Current Update period**).

4.3 Acquisition mode

Rosemount 3410 Series Gas Ultrasonic Flow Meters have two modes of normal operation: **Acquisition** and **Measurement**. The **Acquisition** mode is used to acquire the ultrasonic signals. This mode is entered when power is applied to the meter.

Once the ultrasonic signals are acquired, the **Measurement** mode is entered and the flow velocity is measured. The meter remains in the **Measurement** mode while at least one chord is operational.

If while in the **Measurement** mode all chords fail, then the meter re-enters the **Acquisition** mode. If the **VelHold** data point is set to a value greater than zero, then, while in the **Acquisition** mode, the meter holds the average weighted flow velocity to the last good value for up to the **VelHold** number of batches before setting the velocity to zero. The **VelHold** default value is 0.

The **Acquisition** mode uses the chords' **L** dimensions (**LA**...**LD** as appropriate to the meter type) and the specified minimum and maximum sound velocities (**SSMin** and **SSMax**) determines the signal search range. **MinHoldTime** and **MaxHoldTime** are also used to determine the signal search range. The meter uses the more restrictive of **SSMin**/ **MaxHoldTime** and **SSMax**/**MinHold** time.

4.3.1 Re-acquisition

When fewer than **MinChord** (default 1) chords are good, the meter re-enters the **Acquisition** mode. If **MinChord** is set to the number of active chords, the meter will reacquire on the first time a chord is failed for a batch.

Note
Note that failed for a batch is different from hard failed. A chord fails for a batch when Pct-Good[A1..D2] is less than **MinPctGood**.

Hard fails occur after **AlarmDef** number of batches in a row.

4.4 Chord gas and sound velocity measurements

At each batch update period, each firing path's transit time measurements are averaged. The average (mean) value for each path is available via data points **MeanTmA1... MeanTmD2** (as appropriate for the meter type).

NOTICE
The data point names often use an abbreviated way of identifying the receiving transducer. The last two characters identify the chord (A...D) and the transducer (1 = upstream, 2 = downstream). For example, **MeanTmA1** is the mean transit time for the chord A upstream transducer.

The difference between a chord's average upstream transit time and average downstream transit time is the average delta time. The chord's average times and the chord **X** and **L** dimensions are used to calculate the gas velocity and sound velocity measured by the chord as shown in Equation 4-1 and Equation 4-2.

Equation 4-1: Chord Gas Velocity

$$V_{chord}=\frac{L^2_{chord}}{2X_{chord}}\left[\frac{t_1-t_2}{t_1t_2}\right]$$

and

Equation 4-2: Chord Sound Velocity

$$C_{chord,classic} = \frac{L_{chord}}{2}\left[\frac{t_1+t_2}{t_1 t_2}\right]$$

$$C_{chord} = C_{chord,classic} \times PortAngleFactor$$

Where the **PortAngleFactor** is a dimensionless factor that is dependent upon the chord port angle with respect to the direction of flow. The **PortAngleFactor** is calculated based on chord **X** dimension, chord length **L**, chordal configuration, port angle, transducer type, speed of sound, and fluid velocity. The factor is one for **Dual-X Chordal** configuration meters and for **BG Chordal** configuration meters with 45-degree port angles and **Transducer** type is not set.

4.4.1 Average sound velocity

The Average Sound Velocity is calculated as the average of the active chord sound velocity measurements as shown in the equation below:

Equation 4-3: Average sound velocity

$$C_{Avg} = \frac{\sum_{ActiveChords} C_{chord}}{NumActiveChords}$$

where

C_{Avg} = Average sound velocity (m/s) (**AvgSndVel**)
C_{chord} = Chord average sound velocity (m/s) (**SndVelA... SndVelD**)
NumActiveChords = Number of active chords

4.4.2 Sound velocity calculation and comparison

The Rosemount 3410 Series Gas Ultrasonic Flow Meter offers an option to calculate the sound velocity and compare the result to the meter- measured sound velocity on an hourly basis.

This feature is enabled via the AGA10 key (see AGA10 key (sound velocity calculation)). The gas property data required for using this feature can be specified via data points or optionally read from a Rosemount GC (Configure Gas Chromatograph parameters). The AGA8 Detail Method or GERG-2008 must be selected (via the **HCH_Method** data point, Configure Gas Chromatograph parameters) in order for the sound velocity calculations to be performed.

Every five seconds the meter updates the calculated sound velocity. This value is readable via the **AGA10SndVel** data point and the calculation status value is readable via the **AGA10SndVelStatus** data point. The status values are as listed in the table below:

Table 4-2: Status of AGA speed of sound calculation

AGA10SndVelStatus value	Description
0	Calculation OK (no errors)
1	Calculation not performed as the feature is not enabled. **AGA10SndVel** is set to zero.
2	Calculations not performed as the AGA8 method (**HCH_Method**) is not the Detail Method or GERG-2008. **AGA10SndVel** is set to zero.

Table 4-2: Status of AGA speed of sound calculation *(continued)*

AGA10SndVelStatus value	Description
3	Calculations not performed as the AGA8 calculations are invalid. **AGA10SndVel** is set to zero.
4	Calculations not performed due to encountered division by zero. **AGA10SndVel** is set to zero.

Beginning at the top of each hour, the meter calculates the average measured sound velocity (the average of the average weighted sound velocity) and the average calculated sound velocity. At the end of the hour, the two averages are compared; the comparison error (%) is readable via the **SndVelCompErr** data point.

Note
The comparison error is only calculated at the end of the hour when there is at least 75% of a log hour worth of valid flow data during the hour.

A valid flow data means that all of the following are true:

- No sound velocity calculation errors occurred (i.e., **AGA10SndVelStatus** always equal to 0),
- The measured average flow velocity (**AvgFlow**) is between the diagnostic flow analysis limits (**FlowAnalysisLowFlowLmt** and **FlowAnalysisHighFlowLmt**), and
- The measured sound velocity was always valid (as indicated by the **QMeterValidity** data point).

4.4.3 Average weighted gas flow velocity

When all active chords are non-failed, the average weighted gas flow velocity is a weighted sum of the chord velocity measurements as shown in Equation 4-4 where the chord weights are determined by the meter geometry.

Equation 4-4: Average weighted gas flow velocity

$$V_{AvgWtd} = \sum_{ActiveChords} Wt_{chord}\, V_{chord}$$

where

V_{AvgWtd} = average weighted gas flow velocity (m/s) (**AvgWtdFlowVel**)
Wtd_{chord} = chord weight (dimensionless) (**WtA ... WtD**)
V_{chord} = chord average gas velocity (m/s) (**FlowVelA ... FlowVelD**)

4.4.4 Average weighted flow velocity using chord proportions

In the event of one or more chord failure(s), the meter operation is dependent upon the number of non-failed chords. If there is at least one operating chord, then the meter uses a velocity estimation method described in the following paragraphs.

If all chords fail, then the meter re-enters the **Acquisition** mode as described in Re-acquisition.

The meter partitions the velocity range (for forward and reverse flow) into ten consecutive, non-overlapping bins (where the velocity range is as specified via the **MeterMaxVel** data point).

The meter maintains a set of bins for each active chord. Each bin contain three data values:

- (1) the chord's average velocity (within the bin's velocity range)
- (2) the chord's average proportion value
- (3) an indicator that the value is still the default (**Is[Fwd/Rev]Prop[A..D]DfltBin[1..10]**)

A chord proportion value is the ratio of the chord velocity to the average weighted flow velocity as shown in Equation 4-5. The default indicator is used to determine if a bin's velocity and proportion data values have been updated from their initialized values. The bins are initialized with the average velocity over the bin's range and meter-geometry-dependent proportion values. All default indicators are initialized to **TRUE**. The bin data is stored in non-volatile memory.

Equation 4-5: Chord proportion calculation

$$\text{Prop}_{\text{chord}} = \frac{V_{\text{chord}}}{V_{\text{AvgWtd}}}$$

where

$\text{Prop}_{\text{chord}}$ = chord proportion (dimensionless)
V_{chord} = chord velocity (m/s) (**FlowVelA ... FlowVelD**)
V_{AvgWtd} = (**AvgWtdFlowVel**)

When the meter has operated for a user-specified number of consecutive batches without any chord failures, the meter updates each chord's data values for the bin containing the chord velocity as shown in Equation 4-6 and sets the bin's default indicator to FALSE. The **PropUpdtBatches** data point, configurable via the MeterLink™ **Edit/Compare Configuration** screen, specifies the number of consecutive failure-free batches required for updating the bin data (range: [1, 1000], default: 24). The **NumVals** data point (that determines how quickly an average value changes) is also configurable via the **Edit/Compare Configuration** screen (range: [1, 1000], default: 10).

Equation 4-6: Updating chord proportion bin data values

$$\text{AvgVel}_{\text{ChordBin }n+1} = \frac{\left(\text{AvgVel}_{\text{ChordBin }n} \bullet (\text{NumVals - 1})\right) + V_{\text{chord}}}{\text{NumVals}}$$

$$\text{AvgProp}_{\text{ChordBin }n+1} = \frac{\left(\text{AvgProp}_{\text{ChordBin }n} \bullet (\text{NumVals - 1})\right) + \text{Prop}_{\text{chord}}}{\text{NumVals}}$$

where

$\text{AvgVel}_{\text{ChordBin}_{n+1}}$ = chord bin (n+1)st average velocity (m/s)
$\text{AvgVel}_{\text{ChordBin}_{n}}$ = chord bin nth average velocity (m/s)
NumVals = update factor data point (dimensionless) (**NumVals**)
V_{chord} = chord velocity (m/s) (**FlowVelA ... FlowVelD**)
$\text{AvgProp}_{\text{ChordBin}_{n+1}}$ = chord bin (n+1)st average proportion value (dimensionless)
$\text{AvgVel}_{\text{ChordBin}_{n}}$ = chord bin nth average proportion value (dimensionless)
$\text{Prop}_{\text{chord}}$ = chord proportion (dimensionless)

In the event of a chord failure with at least one operating chord, the meter's average weighted flow velocity is estimated as shown in Equation 4-7.

Equation 4-7: Estimating average flow velocity using proportion values

$$V_{\text{AvgWtd est}} = \frac{\sum_{\text{Non-Failed Chord(s)}} V_{\text{chord}}}{\sum_{\text{Non-Failed Chord(s)}} \text{InterpProp}_{\text{chord}}}$$

where

$V_{AvgWtd_{est}}$ = estimated average weighted flow velocity (m/s) (**AvgWtdFlowVel**)
V_{Chord} = (non-failed) chord velocity (m/s) (**FlowVelA ... FlowVelD**)
$InterProp_{chord}$ = (non-failed) chord interpolated proportion value (dimensionless)

For each non-failed chord, the interpolated proportion value used in Equation 4-7 is calculated as follows:

- If the chord's velocity is surrounded by non-default (average velocity, average proportion) data pairs, then the interpolated proportion is the linear interpolation between the two data pairs.
- If the chord's velocity has a non-default (average velocity, average proportion) data pair on one side of it but not the other, then the interpolated proportion is the data pair average proportion.
- If there are only default (average velocity, average proportion) data pairs, then the interpolated proportion is the corresponding bin's default average proportion value.

4.5 Volumetric flow rate values

The Rosemount 3410 Series Gas Ultrasonic Flow Meter meter provides three volumetric flow rate values: raw, (expansion-corrected and/or profile-effect corrected) flow-condition, and base-condition. Note that a positive volumetric flow rate indicates flow in the forward direction whereas a negative volumetric flow rate indicates flow in the reverse direction.

4.5.1 Raw volumetric flow rate

The raw volumetric flow rate is calculated from the average gas flow velocity (wet-calibration gas flow velocity) as shown in Equation 4-8.

Equation 4-8: Raw volumetric flow rate

$$Q_{Raw} = V_{WetCal} \cdot \left[\frac{\pi D^2}{4}\right] \cdot 3600(s/h)$$

where

Q_{Raw} = Raw volumetric flow rate (m^3/h) (**QMeter**)
V_{WetCal} = Wet-calibration gas flow velocity (m/s) (**AvgFlow**)
π = Geometric constant, pi (dimensionless) (3.14159...)
D = Pipe inside diameter (m) (**PipeDiam**)

4.5.2 Flow-condition volumetric flow rate

The flow-condition volumetric flow rate is the result of applying expansion correction and flow- profile correction to the raw volumetric flow rate as shown in Equation 4-9 subject to the low- flow cut-off. If the resulting value is below the low-flow cut-off value, it is set to zero. The low-flow cut-off volumetric flow rate (**QCutOff**) is the specified low-flow velocity threshold (**ZeroCut**) converted to a volumetric flow rate.

Equation 4-9: Flow-condition volumetric flow rate

$$Q_{Flow} = (Q_{Raw})(ExpCorr_P)(ExpCorr_T)(CorrFctr)$$

where

Q_{Flow} = Flow-condition volumetric flow rate (m^3/h) (**QFlow**)
Q_{Raw} = Raw volumetric flow rate (m^3/h) (**QMeter**)
$ExpCorr_P$ = Expansion correction factor due to pressure (dimensionless) (**ExpCorrPressure**) calculated as shown in Equation 4-10.
$ExpCorr_T$ = Expansion correction factor due to temperature (dimensionless) (**ExpCorrTemperature**) calculated as shown in Equation 4-12.
CorrFctr = Profile-effect correction factor (**CorrectionFactor**) calculated as shown in Equation 4-11.

4.5.3 Pressure-effect expansion correction

The meter is capable of correcting the raw volumetric flow rate for the effect of pipe expansion due to pressure changes.

Note that for the pressure-effect expansion correction factor to be calculated, the correction must be enabled (via the **EnableExpCorrPress** data point) and the flow-condition pressure must be available (i.e., the **EnablePressureInput** data point must be set to **Live** (1) or **Fixed** (2), see Configure the pressure parameters for the meter. The pressure-effect calculation is shown in Equation 4-10. If the pressure-effect expansion correction factor is not calculated, it is set to 1.0.

Equation 4-10: Pressure-effect expansion correction

$$ExpCorr_P = 1 + \left[3 \times \beta \times \left(P_{abs,f} - P_{ref}\right)\right]$$

where

$ExpCorr_P$ = Expansion correction factor due to pressure (dimensionless) (**ExpCorrPressure**)
ß = Pipe linear expansion coefficient due to temperature (**MPaas-1**) (**StrainPerUnitStress**) calculated as shown in Equation 4-8.
$P_{abs,f}$ = Flow-condition absolute pressure (**MPaa**) (**AbsFlowPressure**) calculated as shown in Equation 4-15
P_{ref} = Reference absolute pressure (**MPaa**) (0.101325 MPaa) reference temperature for the pipe linear expansion coefficient (K)

Equation 4-11: Pressure-effect strain per unit stress

$$\beta = \frac{\left[D_{out}^2(1+\upsilon)\right] + \left[D_{in}^2(1\text{-}2\upsilon)\right]}{E \times \left(D_{out}^2\text{-}D_{in}^2\right)}$$

where

β = Pipe strain per unit stress (MPaa-1) (**StrainPerUnitStress**)
D_{out} = Outside diameter of the meter or pipe (m) (**PipeOutsideDiameter**)
D_{in} = Inside diameter of the meter or pipe (m) (**PipeDiam**)
υ = Poisson's Ratio (dimensionless) (**PoissonsRatio**)
E = Young's Modulus of elasticity (MPaa) (**YoungsModulus**)

4.5.4 Temperature-effect expansion correction

The meter is capable of correcting the raw volumetric flow rate for the effect of pipe expansion due to temperature changes.

Note that for the temperature-effect expansion correction factor to be calculated, the correction must be enabled (via the **EnableExpCorrTemp** data point) and the flow-condition temperature must be available (i.e., the **EnableTemperatureInput** data point must be set to 'Live'(1) or 'Fixed'(2), see Temperature expansion correction. The temperature-effect calculation is shown in Equation 4-12. If the temperature-effect expansion correction factor is not calculated, it is set to 1.0.

Equation 4-12: Temperature-effect expansion correction

$$ExpCorr_T = 1 + \left[3 \times \alpha \times \left(T_f - T_{ref}\right)\right]$$

where

$ExpCorr_T$ = expansion correction factor due to temperature (dimensionless) (**ExpCorrTemperature**)

α = pipe linear expansion coefficient due to temperature (K-1) (**LinearExpansionCoef**)

T_f = flow-condition temperature (K) (**FlowTemperature**)

T_{ref} = reference temperature for the pipe linear expansion coefficient (K) (**RefTempLinearExpCoef**)

4.5.5 Profile-effect correction

For meter types that require profile-effect correction, the correction factor can be either user- specified or meter-calculated depending upon the value of the **SpecCorrectionFactor** data point: if set to 0.0, then the correction factor is meter-calculated; if set within [0.90, 1.05], then the specified value is used.

Calculating the meter factor requires that the flow-condition pressure and temperature be live or fixed and that the AGA8 calculations are performed either internally or externally. If the profile-effect correction factor is to be meter-calculated but either the flow-condition pressure and/or temperature are/is disabled or the AGA8 calculations are not performed, then the flow- condition correction factor is set to the default value of 0.95. Otherwise, it is calculated as shown in Equation 4-13.

Equation 4-13: Profile-effect correction factor

$$CorrFctr = 1 + \frac{0.242}{\log\left(0.2703\frac{WR}{D_{in}} + \frac{0.835}{\mathrm{Re}^{0.8}}\right)}$$

where

CorrFctr = flow-profile correction factor (**CorrectionFactor**)

WR = pipe wall roughness (m) (**WallRoughness**)

D_{in} = pipe inside diameter (m) (**PipeDiam**)

Re = Reynolds number (dimensionless) (**ReynoldsNumber**) calculated as shown in Equation 4-14.

4.5.6 Reynolds number

Reynolds Number is a dimensionless value that represents the nature of the gas flow within the pipe. Although the primary reason for calculating Reynolds Number is for reflective path meters (transmitter head 2 for 3415 and 3416) profile-effect correction, the value is calculated for all meter types.

Reynolds Number is calculated as shown in Equation 4-14.

Equation 4-14: Reynolds number

$$Re = \text{Max}\left[(\text{PathFactor})\left(\frac{4}{\pi}\right)\left(\frac{Q_{Raw}\rho(P_f,T_f)}{3600*D_{in}\mu}\right),10^4\right]$$

where

Re = Reynolds Number (dimensionless) (**ReynoldsNumber**)
MAX = maximum function that takes the maximum of the values within the brackets
PathFactor = factor to (approximately) correct for velocity profile effects (0.94 for JuniorSonic™ meters, 1.00 for SeniorSonic™ meters) (dimensionless)
π = geometric constant, pi (dimensionless) (3.14159...)
Q_{Raw} = "raw" volumetric flow rate (m^3/h) (**QMeter**)
$\rho(P_f,T_f)$ = natural gas mixture mass density at the flow condition (either calculated as part of internal AGA8 calculations or specified via (**SpecRhoMixFlow**) (kg/m^3) (**RhoMixFlow**)
D_{in} = pipe inside diameter (m) (**PipeDiam**)
μ = dynamic viscosity (Pa•s) (**Viscosity**)

4.5.7 Base-condition volumetric flow rate

The base-condition volumetric flow rate is the result converting the flow-condition volumetric flow rate to the base pressure-temperature condition.

This conversion requires (1) AGA8 calculations to be either performed internally (i.e., by the meter) or externally (with the resulting compressibilities specified to the meter via the **SpecZFlow** and **SpecZBase** data points), and (2) the flow-condition temperature and pressure to be live or fixed. If AGA8 calculations are not performed (i.e., neither internally nor externally) or the flow-condition temperature and/or pressure are/is not enabled, then the base-condition volumetric flow rate is set to zero. The base-condition volumetric flow rate is calculated as shown in Equation 4-15.

Equation 4-15: Base-condition volumetric flow rate

$$Q_{Base} = Q_{Flow}\left(\frac{P_{abs,f}}{P_{abs,b}}\right)\left(\frac{T_b}{T_f}\right)\left(\frac{Z_b}{Z_f}\right)$$

where

Q_{Base} = “raw” volumetric flow rate (m^3/h) (**QMeter**)
Q_{Flow} = flow-condition volumetric flow rate (m^3/h) (**QFlow**)
$P_{abs,b}$ = flow-condition absolute pressure (MPaa) (**AbsFlowPressure**) calculated as shown in Equation 4-10.
T_b = base-condition temperature (K) (**TBase**)
T_f = flow-condition temperature (K) (**FlowTemperature**)
Z_b = base-condition compressibility factor (**ZBase**)
Z_f = flow-condition compressibility factor (**ZFlow**)

4.5.8 Volume

The Rosemount 3410 Series Gas Ultrasonic Flow Meter provides forward and reverse volume accumulators for each of the three volumetric flow rate values: raw, flow-condition (raw with expansion and/or profile correction), and base-condition.

Each volume accumulator is actually stored as a data pair: (64-bit unsigned integer portion, 32-bit floating point fractional portion). For example, a volume of 12345.750 m^3 is stored as 12345 m^3 for the integer portion and 0.750 m^3 as the fractional portion. Note that while a volumetric flow rate can be positive (indicating forward flow) or negative (indicating reverse flow), the volume accumulators are always positive values.

The non-volatile volume accumulator data points are as listed in the table below:

Table 4-3: Volume accumulation data points

Volumetric flow rate type	Forward Direction		Reverse direction	
	Integer	Fraction	Integer	Fraction
Raw	**PosVolUncorr**	**PosVolUncorrFrac**	**NegVolUncorr**	**NegVolUncorrFrac**
Flow-condition	**PosVolFlow**	**PosVolFlowFrac**	**NegVolFlow**	**NegVolFlowUncorr**
Base-condition	**PosVolBase**	**PosVolBaseFrac**	**NegVolBase**	**NegVolBaseUncorr**

4.5.9 Energy rate and totals

These calculations require that the flow-condition pressure and temperature are available (either fixed or optional analog inputs, Flow-condition pressure and temperature, the gas property data (composition and heating value) are available (either fixed or optionally read from a GC, Flow-condition pressure and temperature), and the AGA8 calculations are performed (internally by the meter or externally with the results written to the meter, Flow-condition pressure and temperature).

The energy rate is calculated as shown in Equation 4-16.

Equation 4-16: Energy rate

$$Q_E = Q_{Base} \times HV \times \frac{1MJ}{1000kJ} \times \frac{1000dm^3}{1m^3}$$

where

Q_E = energy rate (MJ/h) (**EnergyRate**)
Q_{Base} = base-condition volumetric flow rate (m^3/h) (**QBase**)
HV = "in-use" heating value (kJ/dm^3) (**HeatingValueInUse**)

The sign of the energy rate indicates the flow direction: a positive value indicates flow in the forward direction, a negative value indicates flow in the reverse direction.

The energy rate validity is indicated by the **EnergyRateValidity** data point TRUE (1) indicates valid). The energy rate is valid if the base-condition volumetric flow rate is valid (indicated by **QBaseValidity** where TRUE (1) indicates valid) and if the in-use gas properties are valid (indicated by **AreGasPropertiesInvalidInUse** where FALSE (0) indicates valid).

The energy rate is accumulated into the corresponding direction energy total regardless of the energy rate validity.

The forward and reverse direction energy totals are each stored in non-volatile memory as a data pair: a 64-bit unsigned integer portion and a 32-bit floating point fractional portion. For example, an energy total of 12345.750 MJ is stored as 12345 MJ for the integer portion and 0.750 MJ as the fractional portion. Note that while the energy rate can be positive (indicating forward flow) or negative (indicating reverse flow), the energy totals are always positive values.

The non-volatile energy total data points are as listed in the table below:

Table 4-4: Energy total data points

Forward direction		Reverse direction	
Integer	**Fraction**	**Integer**	**Fraction**
PosEnergy	PosEnergyfrac	NegEnergy	NegEnergyFrac

4.5.10 Mass rate and totals

The Rosemount 3410 Series Gas Ultrasonic Flow Meter meter calculates the mass rate and mass totals (forward and reverse).

These calculations requires that the flow-condition pressure and temperature are available (either fixed or optional analog inputs, Gas properties), the gas composition is available (either fixed or optionally read from a GC, Gas property data), and the AGA8 calculations are performed (internally by the meter or externally with the results written to the meter, Configure Gas Chromatograph parameters).

The mass rate is calculated as shown in Equation 4-17.

Equation 4-17: Mass rate

$$MassRate = Q_{Flow} \times \rho_{Flow}$$

MassRate = mass rate (kg/h) (**MassRate**)
Q_{Flow} = flow-condition volumetric flow rate (m^3/h) (**QFlow**)
ρ_{Flow} = "in-use" flow-condition gas mass density (kg/m^3) (**RhoMixFlow**)

The sign of the mass rate indicates the flow direction: a positive value indicates flow in the forward direction, a negative value indicates flow in the reverse direction.

The mass rate validity is indicated by the **MassRateValidity** data point (TRUE(1) indicates valid). The mass rate is valid if the flow-condition volumetric flow rate is valid (indicated by **QFlowValidity** where TRUE(1) indicates valid) and if the AGA8 flow-condition calculation is valid (indicated by **AGA8FlowCalcValidity** where TRUE(1) indicates valid).

The mass rate is accumulated into the corresponding direction mass total regardless of the mass rate validity.

The forward and reverse direction mass totals are each stored in non-volatile memory as a data pair: a 64-bit unsigned integer portion and a 32-bit floating point fractional portion. For example, a mass total of 12345.750 kg is stored as 12345 kg for the integer portion and 750 kg as the fractional portion. Note that while the mass rate can be positive (indicating forward flow) or negative (indicating reverse flow), the mass totals are always positive values.

The non-volatile mass total data points are as listed in the table below:

Table 4-5: Mass total data points

Forward direction		Reverse direction	
Integer	**Fraction**	**Integer**	**Fraction**
PosMass	PosMassFrac	NegMass	NegMassFrac

4.6 Rosemount 3410 Series gas flow meter characterizations

For Rosemount 3410 Series Gas Ultrasonic Flow Meter SeniorSonic meters only, the following flow characterizations are calculated/estimated: symmetry, cross-flow, chord turbulence, profile factor, and swirl angle. Alarm limits are provided for the chord turbulence and swirl angle values.

Symmetry
Symmetry is a dimensionless measure of the flow symmetry comparing the upper chords to the lower chords and is readable via the Symmetry data point. The ideal **Symmetry** is 1.0.

Cross-flow
Cross-flow is a dimensionless measure of the flow symmetry comparing the chords on one side of the meter to the chords on the other side. It is readable via the **CrossFlow** data point. The ideal **CrossFlow** is 1.0.

Chord turbulence
Chord Turbulence is a estimate of the turbulence (percentage) at a chord location. A value is calculated for each active chord and is readable via the **TurbulenceA**, **TurbulenceB**, **TurbulenceC**, or **TurbulenceD** data points. A value of 0% indicates no appreciable turbulence.

Profile Factor
The profile factor is a dimensionless ratio of the inner chord velocities to the outer chord velocities. It is readable via the **ProfileFactor** data point. The ideal Profile Factor is 1.17 for a 4-path transmitter head. It is not possible to calculate Profile Factor for a reflective path transmitter head.

Swirl angle
The swirl angle is an estimate of the swirl (to the nearest degree) and is readable via the **SwirlAngle** data point. It is calculated as a function of the meter body style and Profile Factor (see above). A value of 0 degrees indicates no appreciable swirl. Swirl is only calculated for a 4-path transmitter head.

5 Configurations

5.1 Calibrate and configure the meter

Use MeterLink™ to calibrate and configure the meter parameters:

- Analog (current)
- Meter Factors
- Flow Calibration
- Frequency/Digital Output Sources
- Frequency and Digital inputs and outputs
- HART® output
- Meter corrections (for transmitter head 2 of Rosemount 3415 and 3416)
- Temperature and Pressure
- AGA8 calculations
- Local Display parameters

5.1.1 Calibration methods

The Rosemount 3410 Series Gas Ultrasonic Flow meter uses two calibration steps: Dry calibration procedure and Wet calibration procedure using gas flow velocity.

In this methodology, the **dry** calibration values are set by Rosemount at the factory and are not expected to be modified; the **wet** calibration values are expected to be set as the result of a user flow calibration (if desired). These two calibration methods are explained in further detail below.

Important
The **WRITE PROT.** switch on the CPU Module must be disabled (**OFF**) before writing calibration factors to the meter.

After the meter is configured, enable the **WRITE PROT.** switch (**ON**) to write-protect the configuration.

Collect a Maintenance Log and configuration file the meter's "As left" configuration settings.

Gas flow velocity for dry calibration

The dry-calibration gas flow velocity is the result of applying a third-order polynomial equation to the average weighted gas flow velocity as shown in Equation 5-1.

Equation 5-1: Dry-calibration gas flow velocity

$$V_{DryCal} = A_0 + A_1 V_{AvgWtd} + A_2 V_{AvgWtd}^2 + A_3 V_{AvgWtd}^3$$

where

V_{DryCal} = dry-calibration gas flow velocity (m/s) (**DryCalVel**)
V_{AvgWtd} = average weighted gas flow velocity (m/s) (**AvgWtdFlowVel**)
A_0 = dry-calibration 0th order coefficient (m/s) (**FwdA0 or RevA0**)

A_1 = dry-calibration 1st order coefficient (dimensionless) (**FwdA1 or RevA1**)
A_2 = dry-calibration 2nd order coefficient (s/m) (**FwdA2 or RevA2**)
A_3 = dry-calibration 3rd order coefficient (s^2/m^2) (**FwdA3 or RevA3**)

Note
Note that the meter provides two sets of dry calibration coefficients - one set for each flow direction.

Dry calibration procedure

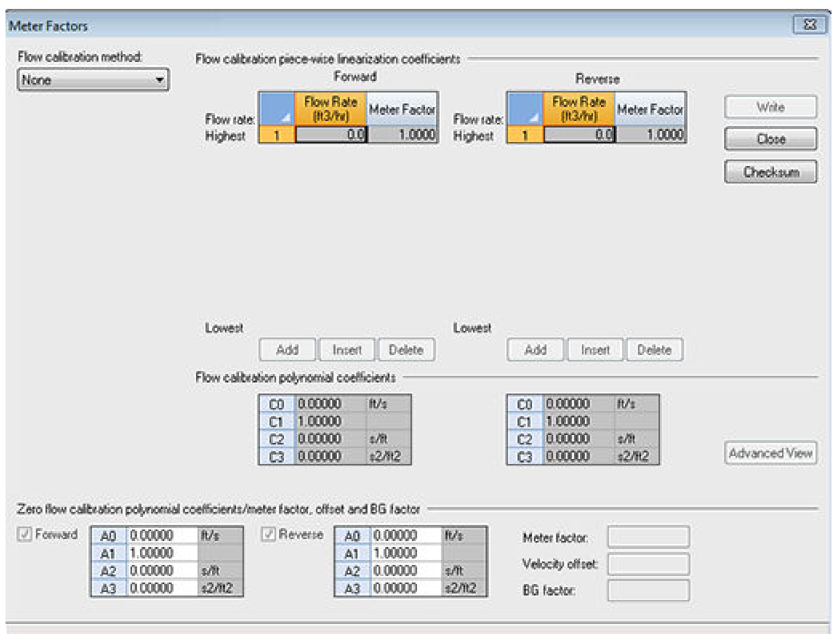
Prerequisites

NOTICE
Modification of dry calibration parameters is not recommended. Unless directed to do so by an Emerson representative, do not modify the dry calibration parameters.

Procedure

1. Select the **Calibration** → **Meter Factors** menu.

Figure 5-1: Calibration - Meter factors page



2. Click the **Advanced View** button to display the zero flow calibration polynomial coefficients. Regardless of what flow calibration method is selected, the zero flow calibration polynomial coefficients will be applied first.
3. Set the **Flow Calibration Method** to **None**.
4. Enter the appropriate forward and reverse meter factors and click **Write** to send the factors to the meter.
5. Click the **Cancel** button to cancel any changes and close the dialog box.

   The meter provides separate dry calibration coefficients for each flow direction as listed in Table 5-1.

Table 5-1: Data Points for dry calibration

MeterLink™ Display Name	Data points, options and guidelines
Forward A0	Data points affected: • FwdA Options: • Enter a value (m/s or ft./s) within the range [-1,1 m/s]. Guidelines: • Only modify this value under direction of an Emerson representative.
Forward A1	Data points affected: • FwdA Options: • Enter a value (dimensionless) within the range [0.95, 1.05]. Guidelines: • Only modify this value under direction of an Emerson representative.
Forward A2	Data points affected: • FwdA2 Options: • Enter a value (s/m or s/ft.) within the range [-0.1, 0.1]. Guidelines: • Only modify this value under direction of an Emerson representative.
Forward A3	Data points affected: • FwdA Options: • Enter a value (s^2/m^2 or s^2/ft^2) within the range [-0.1, 0.1 s^2/m^2]. Guidelines: • Only modify this value under direction of an Emerson representative.
Reverse A0	Data points affected: • RevA Options: • Enter a value (s/m or s/ft) within the range [-1, 1]. Guidelines: • Only modify this value under direction of an Emerson representative.
Reverse A1	Data points affected: • RevA Options: • Enter a value (dimensionless) within the range [0.95, 1.05]. Guidelines: • Only modify this value under direction of an Emerson representative.

Table 5-1: Data Points for dry calibration *(continued)*

MeterLink™ Display Name	Data points, options and guidelines
Reverse A2	Data points affected: • RevA Options: • Enter a value (s/m or s/ft) within the range [-0.1, 0.1]. Guidelines: • Only modify this value under direction of an Emerson representative.
Reverse A3	Data points affected: • RevA Options: • Enter a value s^2/m^2 or s^2/ft^2) within the range [-0.1, 0.1 s^2/m^2]. Guidelines: • Only modify this value under direction of an Emerson representative.

Gas flow velocity for wet calibration

The Rosemount 3410 Series Gas Ultrasonic Flow meter offers three selections for wet calibration: 12-point piece-wise linearization, a third-order polynomial, or none. The wet calibration method is selected via the **CalMethod** data point with **None** being the default value. The wet calibration gas flow velocity is calculated from the dry calibration gas flow velocity as shown in Equation 5-2.

Equation 5-2: Wet-calibration gas flow velocity

$$V_{WetCal} = WetCalFunction\left(V_{DryCal}\right)$$

where

V_{WetCal} = wet-calibration gas flow velocity (m/s) (**AvgFlow**)
V_{DryCal} = dry-calibration gas flow velocity (m/s) (**DrycalVel**)
WetCalFunction(x) = selected wet-calibration function

Wet calibration procedure using gas flow velocity

Configure the date points listed below from the MeterLink **Calibration** → **Meter Factors** menu:

Table 5-2: Data Points for wet calibration

MeterLink™ Display Name	Data points, options and guidelines
Flow calibration method	Data points affected: • CalMethod Options: • Piece-wise (2) • Polynomial (1) • None (0) Guidelines: • Only modify this value under direction of an Emerson representative.

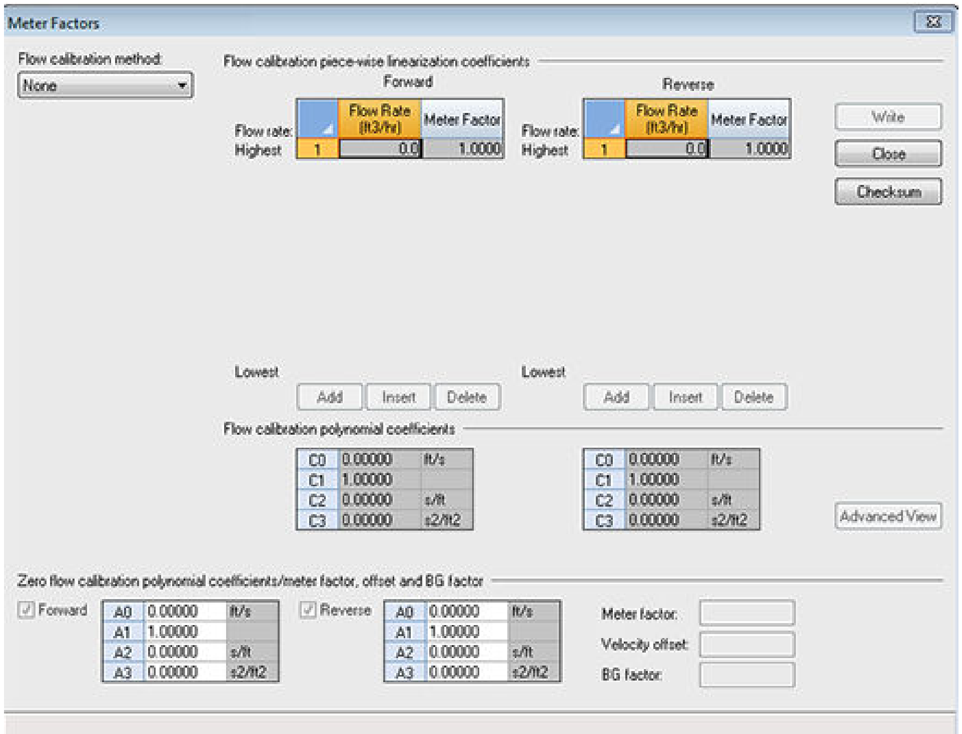
Procedure

1. Choose a Flow Calibration Method:
   - Polynomial
   - Piece-wise linear
   - None

   Note
   If set to **None**, then the wet calibration will have the same value as the dry calibration.

2. Select the **Calibration** → **Meter Factors** menu.

Figure 5-2: Calibration - Meter Factor: None



Piece-wise linearization for wet calibration

If the 12-point Piece-Wise Linearization (PWL) wet calibration method is selected, then the dry-calibration gas flow velocity is calculated as shown in Equation 5-3.

The inputs to the 12-point piece-wise linearization are the (up to) 12 pairs of volumetric flow rates and meter factors for each flow direction ([**FwdFlwRt1**, **FwdMtrFctr1**], ..., [**FwdFlwRt12**, **FwdMtrFctr12**] for forward flow; [**RevFlwRt1**, **RevMtrFctr1**], ..., [**RevFlwRt12**, **RevMtrFctr12**] for reverse flow). Refer to Calibrate meter factors to configuring these data points using MeterLink™.

NOTICE

Enter the input flow rates in descending order (highest first) with their corresponding meter factors. If these are entered in the wrong order, the meter will still work but the accuracy may be affected. The meter will not accept negative values, so only enter positive values for both forward and reverse flow rates. If fewer than 12 points are to be used, then set the unused flow rate and meter factor pairs to 0 and 1 respectively.

Equation 5-3: Wet calibration - 12-point piece-wise linearization

$$V_{WetCal} = V_{DryCal}^{LinearMeterFctr}$$

where

V_{WetCal} = wet-calibration gas flow velocity (m/s) (**AvgFlow**)
V_{DryCal} = dry-calibration gas flow velocity (m/s) (**DryCalVel**)
LinearMeterFctr = linear meter factor (dimensionless) (**LinearMeterFctr**)

Wet calibration procedure using piece-wise linearization

The linear meter factor is determined by the PWL inputs, the flow direction, and the dry-calibration gas flow velocity. If set to **Piece-wise Linear**, then the piece-wise linearization flow rate and meter factor parameters are used to calculate the meter factor to be applied.

Figure 5-3: Calibration - Meter Factor: Piece-wise linearization

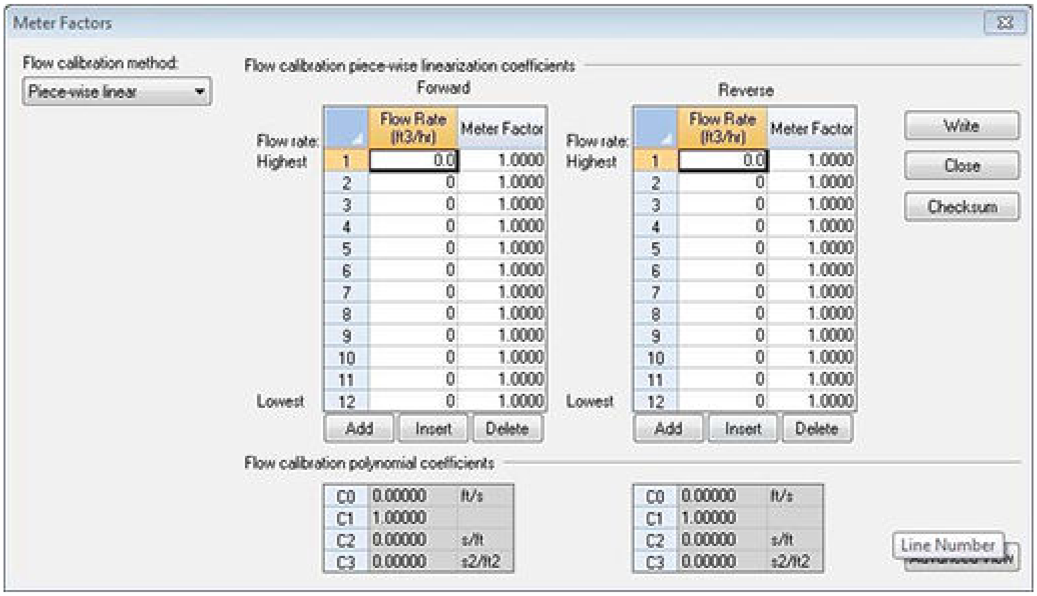


Table 5-3: Data points for Piece-wise linearization calibration

Meterlink™ Display Name	Data points, options and guidelines
Forward Flow Rate	Data points affected • FwdFlwRate1...FwdfltRate12 Options: • Enter a value (m^3/h or ft^3/h) within the range [0.200000 m^3/h]. Guidelines: • The flow rates must be entered from highest to lowest.
Forward Meter Factor	Data points affected • FwdMtrFctr1...FwdMtrFctr12 Options: • Enter a value (dimensionless) within the range [0.95, 1.05].
Reverse Flow Rate	Data points affected • RevFlwRate1...RevFltRate12 Options: • Enter a value (m^3/h or ft^3/h) within the range [0.200000 m^3/h] Guidelines: • The flow rates must be entered from highest to lowest.

Table 5-3: Data points for Piece-wise linearization calibration *(continued)*

Meterlink™ Display Name	Data points, options and guidelines
Reverse Meter Factor	Data points affected • RevMtrFctr1...RevMtrFctr12 Options: • Enter a value (dimensionless) within the range [0.95, 1.05]

Procedure

1. Select **Piece-wise linear** from the **Calibration** → **Meter Factors** menu.
2. Click the **Add** button below the table to add a new calibration point to the bottom of the table. You can add a maximum of 12 points. The calibration points must be entered from the highest flow rate to the lowest flow rate.
3. Click **Write** to apply the calibration parameters to the meter.

Third-order polynomial for wet calibration

When the Polynomial wet calibration method is selected, the meter uses a third-order polynomial on the dry-calibration velocity, as shown in Equation 5-4.

Equation 5-4: Wet calibration - third order polynomial

$$V_{WetCal} = C_0 + C_1 V_{DryCal} + C_2 V_{DryCal}^2 + C_3 V_{DryCal}^3$$

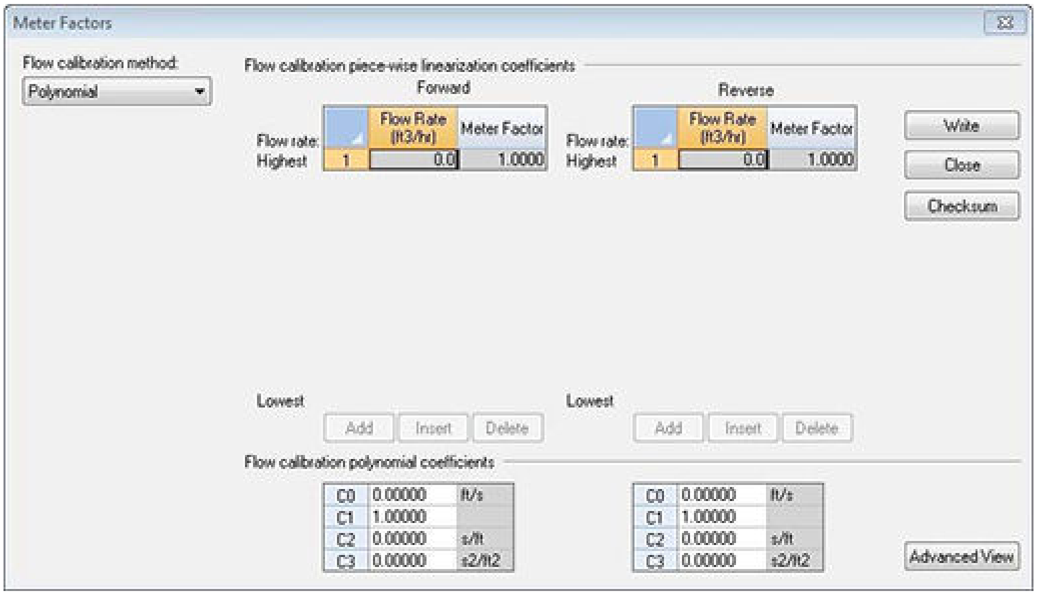
Where

V_{WetCal} = wet-calibration gas flow velocity (m/s) (**AvgFlow**)
V_{SryCal} = dry-calibration gas flow velocity (m/s) (**ADryCalVel**)
C_0 = wet-calibration 0^{th} order coefficient (m/s) (**FwdC0** or **RevC0**)
C_1 = wet-calibration 1^{st} order coefficient (dimensionless) (**FwdC1** or **RevC1**)
C_2 = wet-calibration 2^{nd} order coefficient (s/m) (**FwdC2** or **RevC2**)
C_3 = wet-calibration 3^{rd} order coefficient (s^2/m^2) (**FwdC3** or **RevC3**)

Wet calibration procedure using Third-order polynomial

If selecting **Polynomial Coefficients**, the **C** calibration coefficients are applied.

Figure 5-4: Calibration - Meter Factor: Polynomial



Three coefficients are specified for each flow direction from the MeterLink™ **Calibration** → **Meter Factors** page as shown in the table below:

Table 5-4: Data points for Polynomial wet calibration

MeterLink™ Display Name	Data points, options and guidelines
Forward C0	Data points affected • FwdC0 Options: • Enter a value (m/s or ft/s) within the range **[-1, 1 m/s].**
Forward C1	Data points affected • FwdC1 Options: • Enter a value (dimensionless) within the range **[0.95, 1.05].**
Forward C2	Data points affected • FwdC2 Options: • Enter a value (s/m or s/ft) within the range **[-0.1, 0.1 s/m].**
Forward C3	Data points affected • FwdC3 Options: • Enter a value (m/s or ft/s) within the range (s^2/m^2 or s^2/ft^2) within the range **[-0.1, 0.1 s^2/m^2].**

Table 5-4: Data points for Polynomial wet calibration *(continued)*

MeterLink™ Display Name	Data points, options and guidelines
Reverse C0	Data points affected • RevC0 Options: • Enter a value (m/s or ft/s) within the range **[-1, 1 m/s].**
Reverse C1	Data points affected • RevC1 Options: • Enter a value (dimensionless) within the range **[0.95, 1.05].**
Reverse C2	Data points affected • RevC2 Options: • Enter a value (m/s or ft/s) within the range **[-0.1, 0.1 s/m].**
Reverse C3	Data points affected • RevC3 Options: • Enter a value (s^2/m^2 or s^2/ft^2) within the range **[-0.1, 0.1 s^2/m^2].**

Procedure

1. Select **Polynomial** from the **Calibration** → **Meter Factors** menu.
2. Add the value for the forward and reverse coefficients.
3. Click **Write** to apply the parameters to the meter.

No wet calibration

If no wet calibration is selected, then the wet calibration gas flow velocity is equal to the dry calibration gas flow velocity.

Triggered delta volumes

The **triggered delta volume** feature provides the ability to measure total gas flow volume (flow- and base-condition) between two successive external event triggers.

To trigger an event, set the **DoUpdtTrigDeltaVols** data point to TRUE. This causes the meter to save the current accumulated flow- and base-condition volume values (forward and reverse). The meter then calculates the difference between these values and the corresponding values saved from the previous event trigger. Finally, the meter writes the delta volume values to the appropriate data points (**TrigDeltaPosVolFlow**, **TrigDeltaNegVolFlow**, **TrigDeltaPosVolBase**, and **TrigDeltaNegVolBase**) and sets the **DoUpdtTrigDeltaVols** data point to **FALSE** to clear the trigger and indicate the calculation completion.

The triggered delta volume functionality is retained across power cycles as the accumulated volumes values at the last event trigger are saved in non-volatile memory.

The delta volume data points are stored internally in non-volatile memory as double-precision floating point numbers. The delta volume data points can be read via Modbus as either 32-bit floating point values or as integer values (using the [overflow,lower] LONG register pair in a manner similar to reading the accumulated volumes).

Suggested user access logic

The following pseudo-code demonstrates the logic to access the triggered delta volume functionality:

- **INITIAL SET-UP:**
  Ensure Modbus units are set-up as desired: set Modbus register 10026 (**UnitsSystem**) to **0** for U.S. Customary units or to **1** for metric units.
- **Periodic Loop:**
  Wait for external event for synchronizing the start of the meter delta volumes.
  Send trigger Modbus message: set Modbus register 12199 (**DoUpdtTrigDeltaVols**) to **1** (**TRUE**).
  Read trigger Modbus register 12199 (**DoUpdtTrigDeltaVols**) in a loop until it is read as **0** (**FALSE**) indicating that the delta volumes have been updated.

Read delta volume registers (either the **FLOAT** registers or the **LONG** register pairs) in a single Modbus read. If the delta volume registers are read as **LONG** register pairs, calculate each delta volume as follows:

Equation 5-5: Triggered delta volume

$$DeltaVolume = (Overflow \times 1e9) + Lower$$

where

DeltaVolume = Triggered delta volume (forward or reverse, flow-condition or base-condition) (m^3 or ft^3) (**TrigDeltaPosVolFlow**, **TrigDeltaNegVolFlow**, **TrigDeltaPosVolBase**, **TrigDeltaNegVolBase**)
Overflow = Triggered delta volume overflow integer value (forward or reverse, flow-condition or base-condition) ($1e^9m^3$ or $1e^9ft.^3$)
Lower = Triggered delta volume lower integer value (forward or reverse, flow-condition or base-condition) (m^3 or $ft.^3$)

Repeat **PERIODIC LOOP**.

5.1.2 Configure operational parameters

Table 5-5: Configure Operational parameters

Calibration selection	Description
Analog inputs and outputs (Calibrate analog inputs and outputs)	Calibration settings for the pressure and temperature analog inputs.
Meter factors (Calibrate meter factors)	Calibration settings for the pressure and temperature analog inputs.
Flow calibration (Flow calibration)	Calibrate the meter during flowing conditions.
Frequency/Digital output sources (Configure Frequency/Digital output sources)	Outputs that can be configured as either a frequency output or a digital status.
Frequency output (Configure frequency outputs)	Configure the available frequency outputs.

Table 5-5: Configure Operational parameters *(continued)*

Calibration selection	Description
Meter Digital outputs (Configure digital inputs/ outputs)	Configure the digital outputs.
HART® outputs (Configure HART® outputs)	Configure the HART outputs.
Meter corrections (Configure meter corrections)	Configure meter corrections that include: • Profile factor the reflective path transmitter head of 3415 and 3416 meters • Temperature expansion correction (if Live or Fixed), Linear expansion coefficient • Linear expansion coefficient reference temperature • Pressure expansion correction • Pipe outside diameter • Young's modulus value (ratio of tensile stress to tensile strain) • Poisson's Ratio value (the absolute ratio of the pipe material lateral strain over axial strain)
Temperature and pressure (Configure temperature and pressure)	Temperature and Pressure - to set the scaling for analog inputs, enter fixed values, and set alarm limits for both temperature
Gas Chromatograph setup (Configure Gas Chromatograph parameters)	Configure a serial port as a Modbus master for polling a GC. Selections include: • Port • GC protocol • GC baud rate • GC comms address • GC stream number • GC heating value units • GC IP address • GC port number
AGA8 calculations (Configure AGA8 parameters)	Configure the properties necessary for the AGA8 calculations. Selections include: • Gross Method 1 • Gross Method 2 • Detail Method • Externally • GERG-2008

Table 5-5: Configure Operational parameters *(continued)*

Calibration selection	Description
Continuous flow analysis (Configure continuous flow analysis parameters)	Configure the Continuous Flow Analysis features. Selections include: • Flow limits • SOS comparison • Liquid detection • Abnormal profile • Blockage Internal bore buildup
Local Display (Configure the Local Display)	Configure the local display settings. Selections include: • Display Units • Display Items • Scroll Delay

5.2 Calibrate analog inputs and outputs

NOTICE
The **WRITE PROT.** switch on the CPU Module must be disabled or the calibration values will not be updated for a meter.

An analog input can be calibrated regardless of the corresponding input type, pressure of temperature. However, if the corresponding input type is selected as Live, then the input being calibrated is considered to be invalid and the in-use value depends upon the **FlowPOrTSrcUponAlarm** selection (see above). In this case, the appropriate data point (**FlowPressureWhileCal**, **FlowTemperatureWhileCal**) is set to the in-use value so that it can be logged in the optional log.

The offset and gain can be reset to the default values (**0** and **1**, respectively) by clicking the **Reset Defaults** button.

NOTICE
Clicking the **Reset Defaults** button writes the offset and gain immediately - the previous values cannot be restored.

Click the **Edit Scaling** button to modify the input scaling.

NOTICE
Changes made to an analog input's offset, gain, and scaling values are written to the log.

From MeterLink™, select **Calibrate** to make changes using the Analog Inputs Wizard.

Procedure

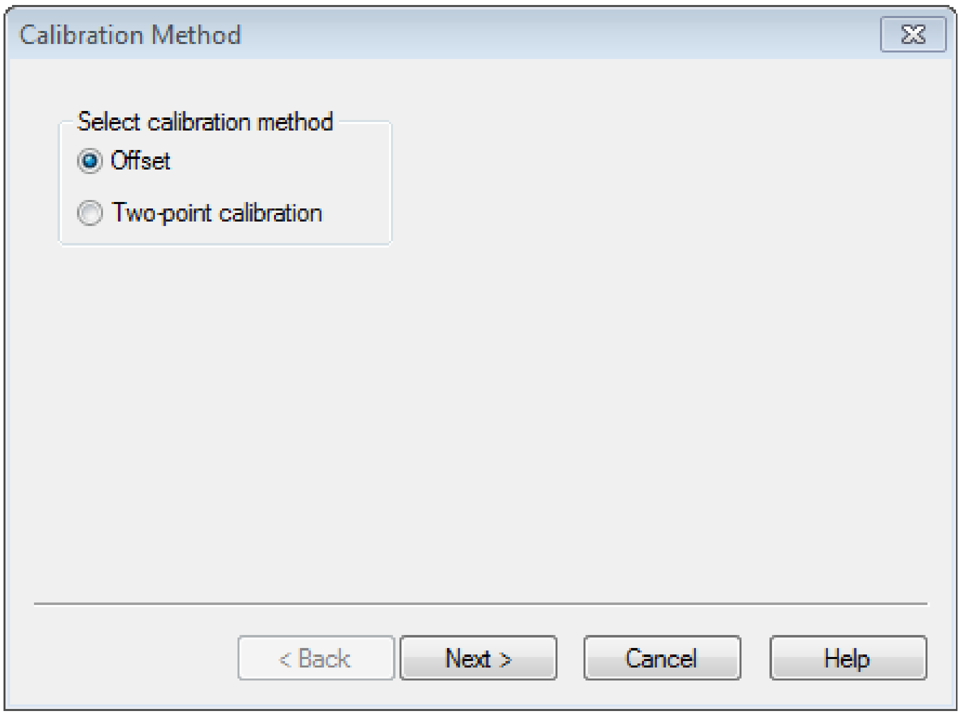
1. Choose the analog input to calibrate, either temperature or pressure.
2. Click **Next**. The **Current** → **Calibration** screen shows the current offset and gain and the input scaling (i.e., the pressures or temperatures corresponding to the minimum (4 mA) input and maximum (20 mA) inputs).
3. Click **Next** to proceed to the **Calibration** → **Method** screen.
4. Select either the offset or two-point calibration methods.
    - The **Offset** method requires a single calibration point and only affects the input's calibration offset parameter.

- The two-point calibration requires calibrating at two different points (ideally far apart in value) and affects the input's calibration offset and gain parameters.

  Depending upon the selected calibration method, either one or two screens will follow when the **Next** button is clicked.

5. The screen(s) displays the current (live) reading.
6. When the input is stable, click the **Hold** button to freeze the current reading.
7. Enter the correct value in the Actual edit box. The ***Finish*** screen shows the new calculated offset and gain values.

Figure 5-5: Offset calibration



8. Click **Finish** to write the values to the meter. If the meter is not configured to use live values from the analog input for calculation, a prompt will display asking to change the configuration to use the live input.
9. Enable the **WRITE PROT.** switch on the CPU Module to write-protect the configuration.

Table 5-6: Calibrate analog inputs and outputs

MeterLink™ Display name	Data Points, options and guidelines
Current output Output setting	Data points affected: • **AO1TestModeOutputPercent** Options: • Enter the integer percentage of full scale for the analog output within the range [0, 100 %] where 0% corresponds to the minimum output (4 mA) and 100% corresponds to the maximum output (20 mA). Guidelines • The specified test value takes effect within one batch period of clicking the **Start** button.
Current output Start (Stop) AO1	Data points affected: • **IsAO1EnableTest** Options: • Click on the **StartAO1** button to enter the test mode (TRUE). **Note** The **Start** button will become the **Stop** button after clicking on it. • Click on the **StopAO1** button to exit the test mode (FALSE). **Note** The **Stop** button will become the **Start** button after clicking on it. Guidelines • The specified test value takes effect within one batch period of clicking the **Start** button.
Current output Output setting	Data points affected: • **AO2TestModeOutputPercent** Options: • Enter the integer percentage of full scale for the analog output within the range [0, 100 %] where 0% corresponds to the minimum output (4 mA) and 100% corresponds to the maximum output (20 mA). Guidelines • The specified test value takes effect within one batch period of clicking the **Start** button. **Note** The **AO2** is only available with CPU module, part number 1-360-03-010.

Table 5-6: Calibrate analog inputs and outputs *(continued)*

MeterLink™ Display name	Data Points, options and guidelines
	Data points affected: • **IsAO2EnableTest** Options: • Click on the **StartAO2** button to enter the test mode (TRUE). **Note** The **Start** button will become the **Stop** button after clicking on it. • Click on the **StopAO2** button to exit the test mode (FALSE). **Note** The **Stop** button will become the **Start** button after clicking on it. Guidelines • The specified test value takes effect within one batch period of clicking the **Start** button.

The maximum length of time that the analog output can remain in the test mode is specified via the **NonNormalModeTimeout** data point. Note that this data point applies to other tests as well. The **NonNormalModeTimeout** data point can be changed using the MeterLink **Edit/Compare Configuration** screen. It can be set within the range **[1, 30 min]** and has a default value of 2 min.

5.3 Calibrate meter factors

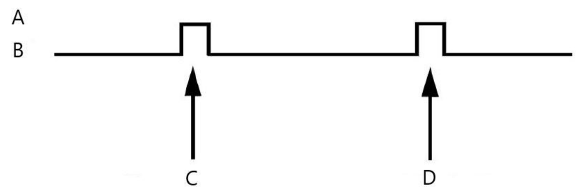
The factory calibrated flow velocity is the result of applying a third-order polynomial equation (see Third-order polynomial for wet calibration) to the average weighted flow velocity. Rosemount 3410 Series Gas Ultrasonic Flow Meters are factory calibrated and the default calibration settings are recommended.

5.3.1 Flow calibration

In a timed calibration, the meter records the volume through the meter over a user specified period of time for a calibration run.

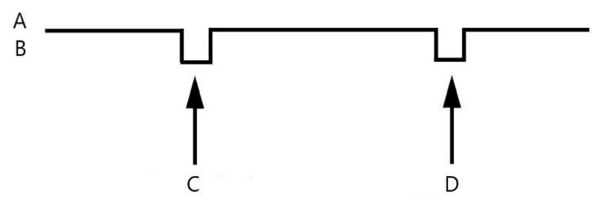
A gated calibration records the volume seen between switch closures directly from a prover for the number of passes it takes for the prover to make a run. Use the spin buttons or type in the number of passes of a prover to make a run. Calibration Gating configuration parameter selections are:

Figure 5-6: Gating configuration parameter Edge gated, active high



- *A. High*
- *B. Low*
- *C. Calibration start*
- *D. Calibration stop*

Figure 5-7: Gating configuration parameter Edge gated, active low

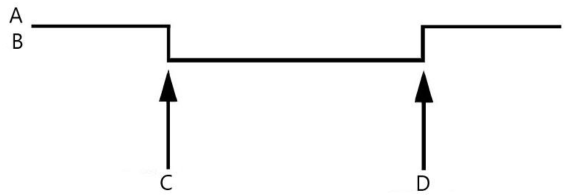


- *A. High*
- *B. Low*
- *C. Calibration start*
- *D. Calibration stop*

Figure 5-8: Gating configuration parameter State gated, active high

- *A. High*
- *B. Low*
- *C. Calibration start*
- *D. Calibration stop*

Figure 5-9: Gating configuration parameter State gated, active low



A. High
B. Low
C. Calibration start
D. Calibration stop

A Microsoft Excel® file is generated and the calibration log report can be saved or appended to an existing file.

5.3.2 Configure Frequency/Digital output sources

The meter has three user-configurable outputs that can be configured for either a **Frequency** output or **Digital** output (FODO).

- FODO1 (eight possible parameter configurations) [Type 2] [Type 4]
- FODO2 (eight possible parameter configurations) [Type 2] [Type 4]
- FODO3 (eight possible parameter configurations) [Type 2] [Type 4]
- FODO4 (eight possible parameter configurations) [Type 4]
- FODO5 (eight possible parameter configurations) [Type 4]
- FODO6 (eight possible parameter configurations) [Type 4]
  — (DI1Mode must be set to Frequency/Digital Output 6 to enable FODO6)

Frequency or Digital Outputs (FODO1, FODO6) source options ~ Group 1

- **FO1A**, **DO1A**, **FO1B**, **DO1B**, **FO2A**, **DO2A**, **FO2B**, **DO2B**
- Frequency output 1A is the A Phase of Frequency output 1 content (Uncorrected volume flow rate, Corrected volume flow rate, Average flow velocity, Average speed of sound, Energy flow rate, Mass flow rate)
- Frequency output 1B is the B Phase of Frequency output 1
- Frequency output 2A is based on frequency content (Actual - Uncorrected Flow Rate)
- Frequency output 2B is based on frequency content and Frequency 2B Phase
- Digital output 1A is based on Digital output1A content (Frequency Output 1 Validity, Flow Direction, Process Validity, and Dual Configuration Flow Range Validity)
- Digital output 1B is based on Digital output1B content (Frequency Output 1 Validity, Flow Direction, Process Validity, and Dual Configuration Flow Range Validity)
- Digital output 2A is based on Digital output 2A content (Frequency Output 2 Validity, Flow Direction, Process Validity, and Dual Configuration Flow Range Validity)
- Digital output 2B is based on Digital output 2B content (Frequency Output 2 Validity, Flow Direction, Process Validity, and Dual Configuration Flow Range Validity)

Frequency or Digital Outputs (FODO2, FODO3, FODO4, FODO5) source options ~ Group 2

- FO1A, DO1A, FO1B, DO1B, FO2A, DO2A, FO2B, DO2B
- Frequency output 1A is the A Phase of Frequency output 1 content (Uncorrected volume flow rate, Corrected volume flow rate, Average flow velocity, Average speed of sound, Energy flow rate, Mass flow rate)
- Frequency output 1B is the B Phase of Frequency output 1
- Frequency output 2A is the A Phase of Frequency output 2 content (Uncorrected volume flow rate, Corrected volume flow rate, Average flow velocity, Average speed of sound, Energy flow rate, Mass flow rate)
- Frequency output 2B is the B Phase of Frequency output 2 content
- Digital output 1A is based on Digital output1A content (Frequency Output 1 Validity, Flow Direction, Process Validity, and Dual Configuration Flow Range Validity)
- Digital output 1B is based on Digital output1B content (Frequency Output 1 Validity, Flow Direction, Process Validity, and Dual Configuration Flow Range Validity)
- Digital output 2A is based on Digital output 2A content (Frequency Output 2 Validity, Flow Direction, Process Validity, and Dual Configuration Flow Range Validity)
- Digital output 2B is based on Digital output 2B content (Frequency Output 2 Validity, Flow Direction, Process Validity, and Dual Configuration Flow Range Validity)

Mode options

- Open Collector (requires external excitation supply voltage and pull-up resistor)
- TTL (internally powered by the meter 0-5 Vdc signal)

Channel B Phase options:

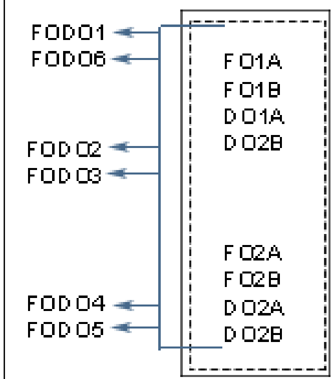
- Lag forward, Lead reverse (Phase B lags Phase A while reporting forward flow, leads Phase A while reporting reverse flow)
- Lead forward, Lag reverse (Phase B leads Phase A while reporting forward flow, lags Phase A while reporting reverse flow)

Phase A and Phase B output (based on flow direction)

- Reverse flow - output only reports flow in the reverse direction. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A.
- Forward flow - output only reports flow in the forward direction. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A.
- Absolute - output reports flow in both directions. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A.
- Bidirectional - output reports flow on Phase A only in the forward direction and on Phase B only in the reverse direction.

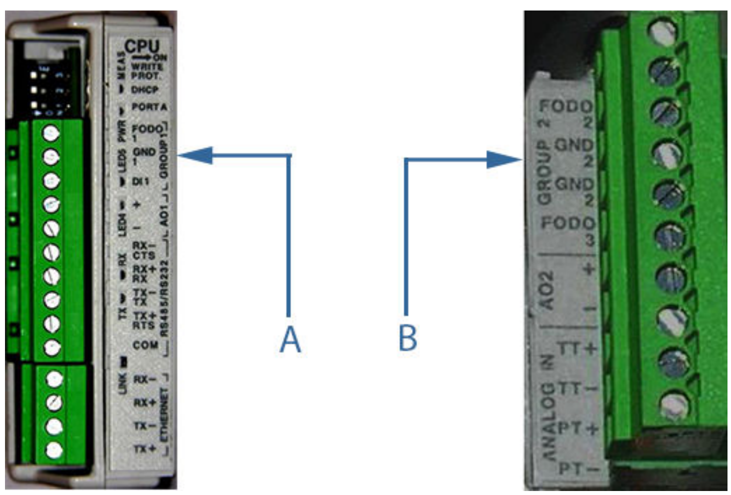
Maximum frequency for the frequency outputs

- 1000 Hz
- 5000 Hz

Frequency/Digital output		Source configuration
Frequency /Digital Output 1 Frequency /Digital Output 2 Frequency /Digital Output 3 Frequency /Digital Output 4 Frequency /Digital Output 5 Frequency /Digital Output 6	• Frequency output 1A • Frequency output 1B • Digital output 1A • Digital output 1B • Frequency output 2A • Frequency output 2B • Digital output 2A • Digital output 2B	

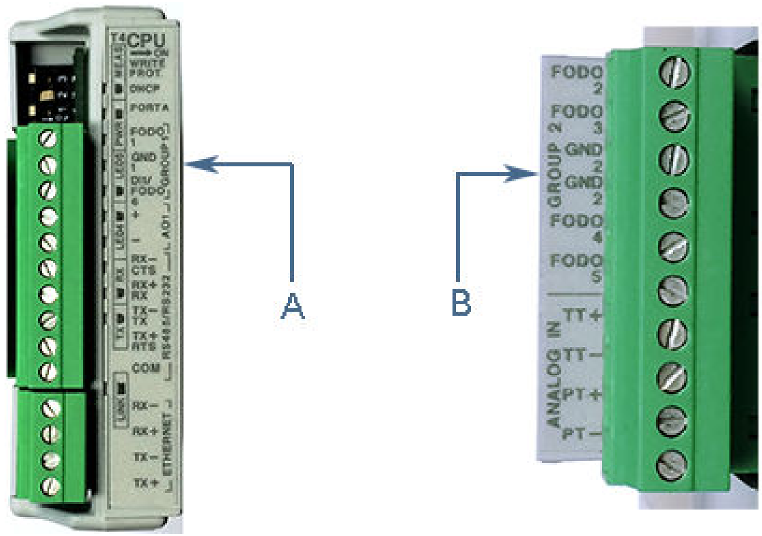
Output for FODO1 and Digital Input 1 (Group 1 on the CPU Module) share a common ground and have 50 V isolation. FODO2 and FODO3 (Group 2 on the CPU Module) share a common ground and have 50 V isolation. This allows an output to be connected to a different flow computer. The outputs are opto-isolated from the CPU Module and have a withstand voltage of at least 500 V rms dielectric.

Figure 5-10: CPU Module - Frequency/Digital outputs common ground - Type 2



A. FODO1 and digital input1 - shared common ground (Group 1)
B. FODO2 and FODO3 - shared common ground (Group 2)

Figure 5-11: CPU Module - Frequency/Digital outputs common ground - Type 4



A. FODO1 and DI1/FODO6 - shared common ground - Type 4 CPU module (Group 1)

B. FODO2, FODO3, FODO4, and FODO5 - shared common ground - Type 4 CPU Module (Group 2)

5.4 Configure frequency outputs

The Frequency Outputs allows you to configure the available frequency outputs for the meter.

If you previously configured one or more Frequency/Digital outputs, make selections for the following parameters.

Content:

- Valid outputs are based on Uncorrected (Actual) flow rates or on Corrected (Standard) flow rates. If pressure or temperature is set to **Not used**, or the Base condition correction is cleared on the Startup Page, the Corrected (Standard) option will not be available.
- Rosemount Gas Ultrasonic meters will also allow you to set the outputs for Average Flow Velocity, Average Sound Velocity, Energy Rate, and Mass Rate.

Direction:

- *Reverse*: The output only reports flow in the reverse direction. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A.
- *Forward*: The output only reports flow in the forward direction. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A.
- *Absolute*: The output reports flow in both directions. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A.
- *Bidirectional*: The output reports flow on Phase A only in the forward direction and on Phase B only in the reverse direction.

Maximum frequency output:

- Valid frequency output options are 1000 Hz and 5000 Hz.

The following fields are used to configure the frequency outputs selected to output a volumetric flow rate. The fields are only enabled if the associated output's Content is set to Uncorrected (Actual) or Corrected (Standard).

Full scale volumetric flow rate used with output:

- Enter the flow rate to be equivalent to the maximum frequency of the frequency output. This property is disabled if Frequency outputs was cleared on the Startup Page.

K-factor:

A read-only value showing the calculated K-factor from the Full scale volumetric flow rate used with frequency outputs and the Maximum frequency for frequency output. This property is disabled if Frequency outputs was cleared on the Startup Page.

Vol/pulse:

A read-only value showing the calculated inverse of the K-factor. This property is disabled if Frequency outputs was cleared on the Startup Page.

Velocity:

- Maximum scale velocity used with output: Enter the velocity to be equivalent to the maximum frequency of the frequency output. These values are only enabled if the Content is set to Average flow velocity or Average sound velocity. This property is disabled if Frequency outputs was cleared on the Startup Page.
- Minimum scale velocity used with output: Enter the velocity to be equivalent to the minimum frequency (i.e. 0Hz) of the frequency output. These values are only enabled if the Content is set to Average flow velocity or Average sound velocity. This property is disabled if Frequency outputs was cleared on the Startup Page.

Energy Rate:

The following fields are used to configure the frequency or current outputs selected to output an energy rate. The fields are only enabled if the associated output's Content is set to Energy rate.

- Full scale energy rate used with output: Enter the energy rate to be equivalent to the maximum frequency of the frequency output.
- Energy/pulse: A read-only value showing the calculated inverse of the K-factor. Each frequency output has its own register.

Mass Rate:

- The following fields are used to configure the frequency outputs selected to output a mass rate. The fields are only enabled if the associated output's Content is set to Mass rate.
- Full scale mass rate used with output: Enter the mass rate to be equivalent to the maximum frequency of the frequency output.
- Mass/pulse: A read-only value showing the calculated inverse of the K-factor. Each frequency output has its own register.

5.5 Configure digital inputs/outputs

Digital input

The Rosemount 3810 Liquid Ultrasonic Flow Meters provides one digital input (referred to as DI1). The polarity of the input is configured via the DI1IsInvPolarity data point as follows:

- FALSE - normal polarity (default setting), or

- TRUE - inverted polarity

The digital input is not configurable via the MeterLink™ Field Setup Wizard. It must be configured via the MeterLink **Tools → Edit/Compare Configuration**.

Digital input calibration

The **IsDI1UsedForCal** specifies whether digital input 1 (DI1) is used for general purpose (when set to FALSE) or for synchronizing calibration (when set to TRUE). If used for calibration, the polarity is determined by the **IsDI1ForCalActiveLow** data point select one of the following:

- FALSE - general purpose (default setting), or
- TRUE - for synchronizing calibration

The **IsDI1ForCalActiveLow** data point specifies the polarity for digital input 1 (DI1) when it is configured (via **IsDI1UsedForCal**) for use in synchronizing a calibration. See also **IsDI1ForCalStateGated**.

- FALSE = Cal Active High
- TRUE = Cal Active Low (default)

The **IsDI1ForCalStateGated** data point specifies the calibration gating for digital input 1 (**DI1**) when it is configured (via **IsDI1UsedForCal**) for use in synchronizing a calibration. When FALSE, the calibration is started/stopped via an **inactive → active** edge; when TRUE, the calibration is started via an **inactive → active** state change and stopped via an **active → inactive** state change. The active edge/state is specified via the **IsDI1ForCalActiveLow** data point.

- FALSE = Cal Edge Gated (default)
- TRUE = Cal State Gated

Digital output

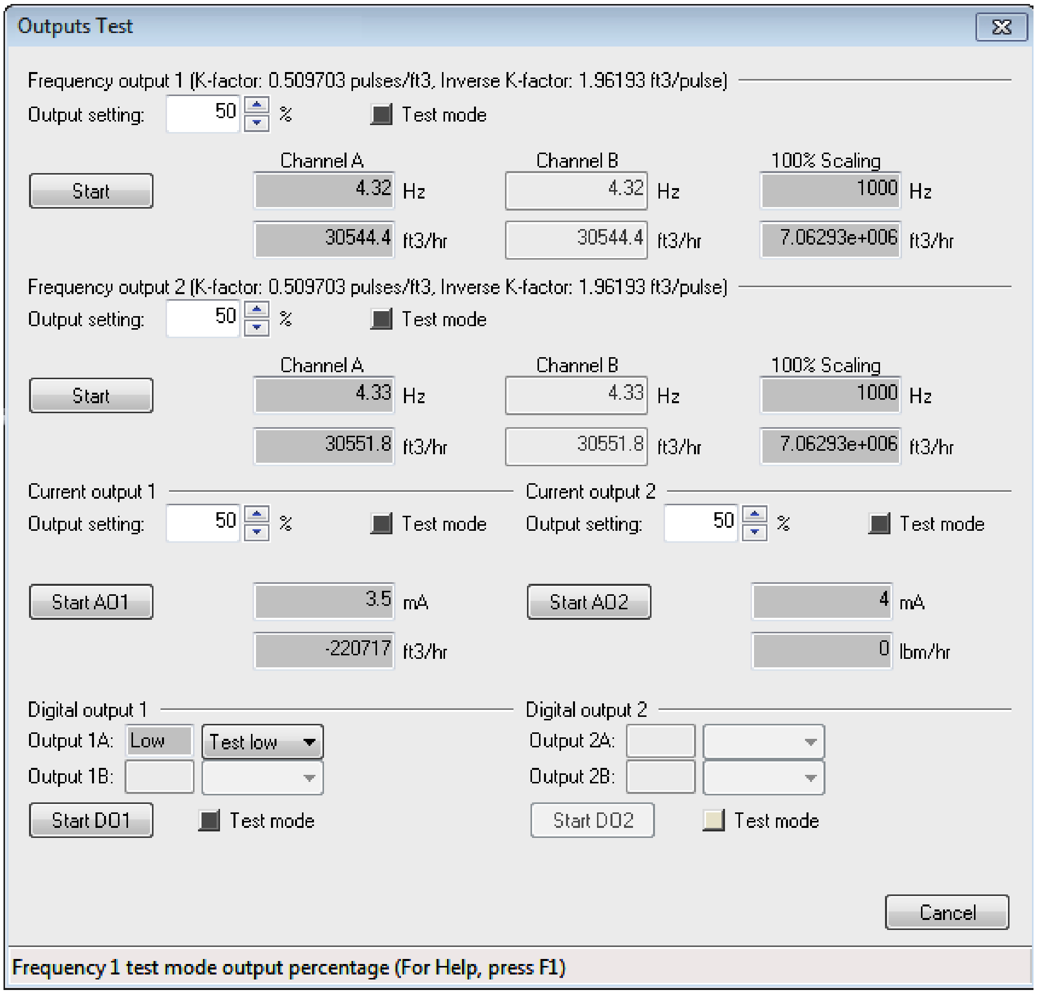
Select the configuration function for the digital output. Available options are **validity** and **direction**.

The inverted operation option is useful if the output of the ultrasonic meter is reversed from what a flow computer is expecting. This means that if the output normally outputs a HIGH for a TRUE condition, selecting this checkbox will change the output to output a LOW for a TRUE condition.

5.6 Outputs test mode

The Rosemount 3410 Series Gas Ultrasonic Flow Meters provides a mode of operation for testing the frequency, current (analog) and digital output signals. Entering, configuring, and exiting this mode is accomplished by setting data points using the MeterLink™ **Tools → Outputs Test**.

Figure 5-12: Meter Outputs Test page



Note

The AO2 is only available with CPU module, part number 1-360-03-010.

The Outputs Test dialog box allows you to monitor the live values of all the frequency, current (analog) and digital outputs. Additionally, the outputs can be set into a Test mode to force the outputs to a specific user defined value. This dialog box is only available while connected to a meter.

When the dialog box first opens, the available Outputs show the current **Live** values the outputs are driving. The LED Test mode will remain gray while not in **Test** mode.

To fix the frequency and current outputs to a user-defined value, enter the desired percentage of full-scale into the Output setting. For Rosemount 3410 Series Gas Ultrasonic Flow Meters, each available output has individual output control and can be set from 0 to 150%. The 100% Scaling indicates the full scale value for the frequency outputs and can be changed from the Field Setup Wizard.

Click the **Start** button to enter Test mode. Each output has its own start button, so each available output can be tested one at a time. The frequency and current outputs will not be updated until the end of the next batch cycle. Once the Test mode LED turns green, the output values displayed represent the values the outputs are driving under test.

The frequency outputs for both the A and B channels are displayed. If **Channel B zero on error** is selected in the Field Setup Wizard, the Channel B phase will show zero because the frequency output is considered invalid during test mode.

The K-Factor and Inverse K-Factor will be displayed for the frequency outputs configured for Volumetric flow rate. The values will be displayed next to the label for the associated frequency output.

To set the digital outputs to a known state, select the Test High or Test Low for the appropriate digital output and click the **Start** button for the digital output. Once the Test mode LED turns green, the value displayed for the outputs will represent the values the outputs are driving under test.

The timeout for each output in test mode is reset by MeterLink™ each time the values are updated. As long as this dialog is open with an output in test mode, the output will remain in test mode or until the **Stop** button is clicked to end the test.

In the event communications are lost between MeterLink and the meter (before a test mode is stopped), the meter will automatically end the test mode after the **NonNormalModeTimeout** has expired. This can be from 1 to 30 minutes depending on its settings. By default, the timeout is set to two minutes.

The Output setting can only be changed while out of Test mode. To end the Test mode, click **Stop** and wait for the end of the batch and the Test mode LED to turn gray to indicate the Outputs are driving live values.

Click **Cancel** to close the dialog box. If the meter is currently in Test mode when **Cancel** is clicked, MeterLink will first end the test mode before returning to the ***Main Screen***.

5.7 Configure HART® outputs

Configure the HART outputs of the Rosemount Ultrasonic meter. For additional information, refer to the *HART Field Device Specification Manual* (00825-0400-3240) .

5.7.1 Configure the four dynamic variables

- ***Primary -*** Set to match the Content for Current Output 1
- ***Secondary -*** Set to match the Content for Current Output 2
- ***Third -*** Select from the following variables: Uncorrected flow rate, Corrected flow rate, Average flow velocity, Average speed of sound, Energy flow rate, Mass flow rate, Pressure, and Temperature
- ***Fourth -*** Select from the following variables: Uncorrected flow rate, Corrected flow rate, Average flow velocity, Average speed of sound, Energy flow rate, Mass flow rate, Pressure, and Temperature

5.7.2 Configure the device identification

Configure the common variables in HART® devices used to identify the particular device.

- ***Tag -*** The tag name for the HART device which may be used by host systems to uniquely identify the meter. The tag may be up to 8 characters in length.
- ***Long tag -*** The specified long tag matches that of the meter. The tag may be 32 bytes in length.
- ***Date -*** A 3 byte value where the most significant byte is the day of the month (1-31), the second byte is the month of the year (1-12), and the third byte is the year-1900.

- ***Message -*** A string value that can be no more than 32 characters in length.
- ***Descriptor -*** A string value that can be no more than 16 characters in length.
- ***Final assembly number -*** A numeric value that must be between 0 and 1677215.
- ***Polling address -*** The HART address for the meter. By default, the meter is 0 but the address can range from 0 to 63.

5.7.3 Configure the HART® units

Configure the units that values will be read in over the HART interface.

- **Volume units**
- **Mass units**
- **Energy units**
- **Flow rate time units**
- **Velocity**
- **Pressure**
- **Temperature**

5.8 Configure meter corrections

Meter profile corrections are used for Rosemount 3415 and 3416 Ultrasonic Flow meters only as shown in Flow profile correction, Temperature expansion correction, and Pressure expansion correction.

5.8.1 Flow profile correction

Select the profile correction: Fixed, Calculated, or Default.

- If Live or Fixed is selected on the MeterLink™ Startup page, for both temperature and pressure enter a value from 0.9 to 1.0 for Fixed correction factor.
- If Not used was selected for either temperature or pressure on the Startup Page, then choose from Fixed or Default for a correction factor. Calculated will be disabled. Enter a value from 0.9 to 1.0 for Fixed correction factor.
- Default - The default value is 0.95.

5.8.2 Temperature expansion correction

- Linear expansion coefficient of the meter body material.
- Linear expansion coefficient reference temperature.

5.8.3 Pressure expansion correction

- Pipe outside diameter: enter the outside diameter of the meter body.
- Young's modulus: enter the Young's Modulus value (ratio of tensile stress to tensile strain).
- Poisson's ratio: enter the Poisson's Ratio value (the absolute ratio of the pipe material lateral strain over axial strain).

5.9 Configure temperature and pressure

5.9.1 Flow-condition pressure and temperature

The flow-condition pressure and temperature are used by the Rosemount 3410 Series Gas Ultrasonic Flow Meter for various calculations such as:

- Expansion correction
- Flow profile correction (JuniorSonic™ meters only)
- Calculation of base (standard) condition volumetric flow rate and volumes
- Sound velocity calculation

Configuration

The flow-condition pressure and temperature are individually configurable (via the **EnablePressureInput** and **EnableTemperatureInput** data points) to be:

- Disabled (0)
- Live (1) (4-20 mA input signal)
- Fixed (2)
- Transmitter Head 1 (3)
  — (Available only on Dual-Configuration Transmitter Head 2)

If an input is live, then the values corresponding to the minimum and maximum input (4 and 20 mA, respectively) are specified via data points (**MinInputPressure**, **MaxInputPressure**, **MinInputTemperature**, **MaxInputTemperature**).

If an input is fixed, then its value is specified via a data point (**SpecFlowPressure**, **SpecFlowTemperature**).

If an input is set to Transmitter Head 1, then its value is specified by the in use Temperature or Pressure of the Transmitter Head 1. If transmitter Head 1 is set to Live, then Transmitter Head 2 will use the same value. If Head 2 fails to read data from Head 1, then in use value will be determined by Alarm selection setting (FlowPorTSrcUponAlarm), Used last good value or Use fixed value.

Data points associated with Analog inputs shared by Head 1 to Head 2 are the following:

- **FlowPressure** (**AbsFlowPressure** to be calculated by transmitter head 2 based on **InputPressureUnit** configuration)
- **PressureValidity** (Transmitter head 2 shall internally calculate **PressureInvalid**)
- **FlowPressureSrc**
- **FlowTemperature**
- **TemperatureValidity** (Transmitter head 2 shall internally calculate **TemperatureInvalid**)
- **FlowTemperatureSrc**

Verify Gage/Absolute and Atmospheric Pressures are configured the same in each meter.

Alarm limits can be specified for each input (**LowPressureAlarm**, **HighPressureAlarm**, **LowTemperatureAlarm**, **HighTemperatureAlarm**). Additionally, the flow-condition pressure is configurable to be gauge or absolute (via the **InputPressureUnit** data point). If the pressure is gauge, then the atmospheric pressure must be specified (via the **AtmosphericPress** data point). See Configure the temperature parameters for the meter

and Configure the pressure parameters for the meter for details on configuring the flow-condition pressure and temperature.

Another data point (**FlowPOrTSrcUponAlarm**), common to both pressure and temperature, is used to specify the data source to use when the selected input data is invalid (i.e., value at or outside its alarm limits or a live input in calibration) as either:

- Last good value (0), or
- Fixed value (1).

This data point (**FlowPOrTSrcUponAlarm**) is configurable via the MeterLink™ **Field Setup Wizard** → **Temperature and Pressure** page under Alarm Selection. It is also configurable via the MeterLink **Tools** → **Edit/Compare Configuration** screen. The default is to use the last good value.

Data updates

The Rosemount 3410 Series Gas Ultrasonic Flow Meter samples the input analog signal(s) and updates the corresponding data point(s) (**LiveFlowPressure**, **LiveFlowTemperature**) once per second regardless of the input selection (disabled, live, fixed, or Transmitter Head 1).

Every five seconds, the meter updates the "in-use" flow-condition pressure and temperature values (**FlowPressure**, **AbsFlowPressure**, **FlowTemperature**) depending upon the input selection, validity of the input data, and the selected data source upon alarm according to Table 5-7.

Table 5-7: Flow-condition pressure and temperature data source

Input Type (EnablePressureInput or EnableTemperatureinput)	Data Validity (PressureValidity or TemperatureValidity)	Data Source Upon Alarm (FloePOrtSrcUponAlarm)	"In-Use" Data Source (FlowPressure or FlowTemperature)
Disabled	N/A	N/A	"In-Use" value unchanged
Live	Valid	N/A	Average of live values (**LiveFlowPressure** or **FlowTemperature**)
N/A	Invalid(1)	Last good value	"In-Use" value unchanged
		Fixed	Fixed data point (**SpecFlowPressure** or **SpecFlowTemperature**)
Fixed	Valid	N/A	Fixed data point (**SpecFlowPressure** or **SpecFlowTemperature**)
	Invalid	Last good value	"In-Use" value changed
		Fixed	Fixed data point (**SpecFlowPressure** or **SpecFlowTemperature**)
Transmitter Head 1	Head 1 Valid	N/A	Average of live values for Head 1 (**LiveFlowPressure** or **FlowTemperature**)
Transmitter Head 1	Head 1 Invalid	Last good value	"In-Use" value unchanged
Transmitter Head 1	Head 1 Invalid	Fixed	Fixed data point (**SpecFlowPressure** or **SpecFlowTemperature**) of Head 1

Table 5-7: Flow-condition pressure and temperature data source *(continued)*

Input Type (EnablePressureInput or EnableTemperaturein put)	Data Validity (PressureValidity or TemperatureValidity)	Data Source Upon Alarm (FloePOrtSrcUponAl arm)	"In-Use" Data Source (FlowPressure or FlowTemperature)
Transmitter Head 1	No shared value from Head 1	Last good value	"In-Use" value unchanged
Transmitter Head 1	No shared value from Head 1	Fixed	Fixed data point (**SpecFlowPressure** or **SpecFlowTemperature**) of Head 1

(1) Live input can be invalid due to (a) one or more live values is/are at or outside the alarm limits, or (b) the input is being calibrated.

The flow-condition absolute flow pressure is calculated as shown in Flow-condition absolute pressure.

Equation 5-6: Flow-condition absolute pressure

$$P_{abs,\,f} = P_f{+}P_{Atmosphere} InputPressureUnit = FALSE(Gage)$$

$$P_{abs,\,f} = P_f InputPressureUnit = TRUE(Absolute)$$

where

$P_{abs,f}$ = flow-condition absolute pressure (**MPaa**) (**AbsFlowPressure**)
P_f = flow-condition pressure (MPa if **InputPressureUnit**=FALSE, MPaa if **InputPressureUnit**=TRUE) (**FlowPressure**)
$P_{Atmosphere}$ = (specified) atmospheric pressure (**MPaa**) (**AtmosphericPress**)

5.9.2 Configure the temperature parameters for the meter

- **Live temperature -** If Live Analog was selected for Temperature for meter corrections on the MeterLink™ Startup Page, enter the scaling for the transmitter connected to the analog input. Minimum input is the zero scale temperature of the transmitter (i.e. 1 Volt or 4 mA). Maximum input is the full scale temperature of the transmitter (i.e. 5 Volts or 20 mA).
- **Fixed temperature -** If Fixed was selected on the MeterLink Startup Page for Temperature, it will also be enabled if a live temperature input was selected. Enter a fixed value to use for calculations if the live input goes into alarm. Enter an average temperature of the process fluid.
- **Temperature alarm -** Enter the low and high alarm limits. A temperature reading outside of these limits causes a Temperature Validity alarm. The Alarm selection determines what value to use while a live input is in alarm. This value is common with the pressure Alarm selection so when one is changed, the other will change to match.

5.9.3 Configure the pressure parameters for the meter

- ***Pressure reading -*** Select either **Gage** or **Absolute** for the type of pressure reading desired. If a live pressure transmitter is connected, select the type of reading the transmitter outputs. If **Absolute** is selected, you must also enter the Atmospheric pressure.

- ***Live pressure -*** Enter in the scaling for the transmitter connected to the analog input. Min. input is the zero scale pressure of the transmitter (i.e. 1 Volt or 4 mA). Max. input is the full scale pressure of the transmitter (i.e. 5 Volts or 20 mA).
- ***Fixed pressure -*** **Enabled if Fixed** was selected for Temperature for meter corrections on the Startup Page. It will also be enabled if a live temperature input was selected to allow you to enter a fixed value to use for calculations if the live input goes into alarm. Enter an average pressure of the process fluid.
- ***Pressure alarm -*** Enter the low and high alarm limits. A pressure reading outside of these limits causes a **Pressure Validity** alarm. The **Alarm** selection determines what value to use while a live input is in alarm. This value is common with the temperature **Alarm** selection so when one is changed, the other will change to match.

5.10 Configure Gas Chromatograph parameters

Use the **Meter** → **Field Setup Wizard** menu and enable the **View Gas Chromatograph setup** check box. Configure the following parameters to setup a port as a Modbus master for polling a GC.

- ***Port -*** Select which port will be connected to the GC. While a serial port is configured for communications to a GC, it will not act as a Modbus slave device for communications from MeterLink™ or a SCADA system. USM can also poll a gas chromatograph using Modbus TCP/IP. Choose Port as Ethernet.
- ***GC protocol -*** Select the protocol for which the GC is configured. The Rosemount Gas Ultrasonic meter uses 7 data bits, Even parity, and 1 stop bit for ASCII Modbus and 8 data bits, No parity, and 1 stop bit for RTU Modbus. This option will be enabled only when a serial port is selected.
- ***GC baud rate -*** Select the baud rate for which the GC is configured. This option will be enabled only when a serial port is selected.
- ***GC comms address/unit identifier -*** Enter the Modbus ID of the GC.
- **GC IP address -** Enter the IP address of the GC. This option is only enabled when Port is selected as Ethernet.
- **GC TCP/IP port number -** Enter Modbus TCP/IP port number of the GC. This option is only enabled when Port is selected as Ethernet.
- ***GC IP address -*** This option will be enabled only when the Ethernet is selected.
- ***GC TCP/IP port number -*** This option will be enabled only when the Ethernet is selected.
- ***GC stream number -*** Enter the stream number for the gas composition the Rosemount Gas Ultrasonic meter will read.
- ***GC heating value units -*** Select the units for which the heating value is configured in the GC.
  - — Btu/ft^3
  - — kJ/m^3
  - — kJ/dm^3
  - — MJ/m^3
  - — $kCal/m^3$
  - — kWh/m^3
- ***GC heating value type -*** Select the type of heating value the GC will return.
  - — Btu-Dry

  - Btu-Saturated
  - Btu-Actual

- ***Gas composition on GC alarm -*** Select which gas composition the Rosemount Gas Ultrasonic meter will use if the GC goes into alarm.
  - ***Fixed -*** If selected, the meter will start using the fixed gas composition stored in the meter.
  - ***Last Good Value -*** If selected, the meter will use the last gas composition collected from the GC before the GC started to report alarms.

5.10.1 Gas properties

Gas property data (composition and heating value) are used by the meter for AGA8 calculations (for converting to base or standard volumes and for mass calculation), for energy calculation, and for sound velocity calculations (sound velocity calculation and comparison).

The data are also used by JuniorSonic™ meters when the profile correction factor is to be calculated by the meter (rather than fixed or a default value). See Table 5-12 for GC registers polled by the meter. The gas property data can either be fixed (specified via data points) or optionally read from a Rosemount Gas Chromatograph (GC). Head 2 of Dual-Configuration Meters can be set to use Transmitter Head 1's Live or Fixed GC data. Reading the gas property data from a GC requires a valid GC feature key (See GC interface key). Use the Field Setup Wizard in MeterLink™ to configure these parameters.

Fixed gas property data

If the data is fixed, then the heating value and its reference temperature are specified via the **MeasVolGrossHeatingVal** and **RefTemperatureHV** data points, respectively; the gas components are specified via the data points listed in Table 5-8 below. Fixed gas property data is always assumed to be valid.

NOTICE
If the gas composition is specified from within MeterLink, the data point's unit is mole percentage, not mole fraction (as the data point name would imply).

Table 5-8: Fixed gas composition data points

Gas composition data points
MoleFractionN2Method2
MoleFractionCO2
MoleFractionH2
MoleFractionCO
MoleFractionMethane
MoleFractionEthane
MoleFractionPropane
MoleFractionIsoButane
MoleFractionNButane
MoleFractionIsoPentane
MoleFractionNPentane
MoleFractionNHexane

Table 5-8: Fixed gas composition data points *(continued)*

Gas composition data points
MoleFractionNHeptane
MoleFractionNOctane
MoleFractionNNonane
MoleFractionNDecane
MoleFractionH2S
MoleFractionHelium
MoleFractionWater
MoleFractionOxygen
MoleFractionArgon

Live (GC) gas property data

The purpose of this section is to give a brief overview of the gas property data read from a GC. Refer to MeterLink utilities for information on configuring the Rosemount 3410 Series Gas Ultrasonic Flow Meter (using the MeterLink program) for communicating with a Rosemount GC.

If the gas components are read from the GC, then the GC-reported heating value is readable via the **HeatingValueGC** data point. Note that type of heating value to be read from the GC must be specified via the **GCHeatingValueType** data point as either Btu-Dry, Btu-Saturated, or Btu-Actual. So that the correct GC register is read. Also, the heating value unit must be specified via the **GCHeatingValueUnit** data point as either Btu/ft^3, kJ/m^3, kJ/dm^3, MJ/m^3, kCal/m^3, or kWh/ m^3. The GC-reported gas composition is readable via the data points listed in Table 5-9 below:

Table 5-9: GC-reported gas composition data points

GC reported composition data points
N2GC
CO2GC
H2GC
COGC
MethaneGC
EthaneGC
PropaneGC
IsoButaneGC
NButaneGC
IsoPentaneGC
NPentaneGC
NHexaneGC
NHeptaneGC
NOctaneGC
NNonaneGC

Table 5-9: GC-reported gas composition data points *(continued)*

GC reported composition data points
NDecaneGC
H2SGC
HeliumGC
WaterGC
OxygenGC
ArgonGC
C6PlusGC (C6PlusGCComponentID)
NeoPentaneGC

The validity of the GC-read gas property data is readable via the **AreGasPropertiesInvalidGC** data point where TRUE(1) indicates invalid data and FALSE(0) indicates valid data. Refer to GC data validity for further information on how the data validity is determined.

In-Use gas property data

The "In-Use" gas property data is the actual data used by the meter for calculations.

The **GasPropertiesSrcSel** data point is used to select the gas property data source as either Fixed (0) or Live - GC (1). If the data source is Live - GC and the GC-read data is invalid, then the **GasPropertiesSrcSelGCAlarm** data point is used to select the data source as either Last good value (0) or *Fixed value* (1). When Last good value is selected, the "In-Use" gas property data is not updated with the invalid GC-read gas property data. When *Fixed value* is used, the "In-Use" gas property data is updated with the fixed gas property data.

The meter maps the appropriate input gas property data points (fixed or GC-reported as discussed above) to the corresponding "In-Use" data points (the **HeatingValueInUse** data point and the gas composition data points listed in Table 5-10).

Table 5-10: In-use gas composition data points

"In-Use" gas composition data points
N2InUse
CO2InUse
H2InUse
COInUse
MethaneInUse
EthaneInUse
PropaneInUse
IsoButaneInUse
NButaneInUse
IsoPentaneInUse
NPentaneInUse
NHexaneInUse
NHeptaneInUse

Table 5-10: In-use gas composition data points *(continued)*

"In-Use" gas composition data points
NOctaneInUse
NNonaneInUse
NDecaneInUse
H2SInUse
HeliumInUse
WaterInUse
OxygenInUse
ArgonInUse

The fixed gas component data points map directly to the corresponding "In-Use" gas component data points. The GC-reported gas component data points map directly to the corresponding "In-Use" gas component data points except for the **C6PlusGC** and **NeoPentaneGC** components. The **C6PlusGC** quantity is divided among the **NHexaneInUse**, **NHeptaneInUse**, and **NOctaneInUse** data points according to the component ID (**C_6PlusGCComponentID**) as listed in Table 5-11:

Table 5-11: C_6+ breakdown to standard components by component ID

C_6 + Component ID (C_6PlusGCComponentID)	Percentage to NHexaneInUse	Percentage to NHeptaneInUse	Percentage to NOctaneInUse
108	47.466	35.340	17.194
109	50.000	50.000	0.000
110	60.000	30.000	10.000
111	57.143	28.572	14.285

For example, if the **C_6PlusGC** mole percentage is 1 percent and its component ID is 110, then 60 percent of the C6+ mole percentage (0.60 x 1 percent = 0.60 percent) is added to **NHexaneInUse**, 30 percent (0.30 x 1 percent = 0.30 percent) is added to **NHeptaneInUse**, and 10 percent (0.10 x 1 percent = 0.10 percent) is added to **NOctaneInUse**.

The GC-reported **NeoPentane** component (**NeoPentaneGC**) quantity is added to the **IsoPentane** component (**IsoPentaneInUse**).

The validity of the "In-Use" gas property data is readable via the **AreGasPropertiesInvalidInUse** data point where TRUE (1) indicates invalid data and FALSE (0) indicates valid data. The validity of the "In-Use" gas property data is a function of the validity of the selected source data. If the source data is selected as Fixed, then the "In-Use" gas property data is valid (since the fixed data is assumed to be valid). If the source data is selected as *Live - GC*, then the "In-Use" gas property data is valid only if the GC-read gas property data is valid.

Optional gas chromatograph interface

The Rosemount 3410 Series Gas Ultrasonic Flow Meter can optionally interface with any Rosemount Gas Chromatograph (GC) that supports the SIM 2251 mode to read gas property data (such as for AGA8, sound velocity, energy rate, mass rate, and/or profile correction calculations).

NOTICE

The gas chromatograph interface is an optional feature that requires a valid GC feature key. Refer to GC interface key.

The following table lists the Gas Chromatograph SIM registers polled by the meter. Also refer to Rosemount Engineering Specification Part Number ES-17128-005 Rev. B.

Table 5-12: Gas chromatograph Sim 2251 Registers

Sim 2251 Register	Description
3034	Stream identifier
3041	Cycle time start - month (1-12)
3042	Cycle time start - day (1-31)
3043	Cycle time start - last two year digits
3044	Cycle time start - hour (0-23)
3045	Cycle time start - minutes (0-59)
3046	GC alarm bitmap 1
3047	GC alarm bitmap 2
3001 - 3016	Component codes
7001 - 7016	Mole fractions for corresponding component codes
7033	BTU (dry)
7034	BTU (sat)
7035	Specific gravity
7038	Total unnormalized mole percent
7054	BTU (actual)

Table 5-13: Supported Components IDs

Component IDs
METHANE (100)
CO2 (117)
PROPANE (102)
H2S (140)
CO (115)
IBUTANE (103)
IPENTANE (105)
NHEXANE (139)
NOCTANE (152)
NDECANE (150)
ARGON (146)
C6PLUS_COMP_ID_1 (108)
C6PLUS_COMP_ID_3 (110)
NITROGEN (114)

Table 5-13: Supported Components IDs *(continued)*

Component IDs
ETHANE (101)
H20 (144)
HYDROGEN (112)
O2 (116)
NBUTANE (104)
NPENTANE (106)
NHEPTANE (145)
NNONANE (151)
HELIUM (113)
NEO_PENTANE (107)
C6PLUS_COMP_ID_2 (109)

Note
Gas Component IDs can be configured using “Gas Chromatograph Component Data” page in Field Setup Wizard of the MeterLink™. This allows USM to read gas properties from GC system, which support different component IDs.

Gas property data

The gas property data read from the GC includes gas composition, heating value, and specific gravity (relative density).

The gas composition includes the 21 standard components plus C6+ and Neopentane (see Table 5-9 for a list of data point names). Refer to In-Use gas property data for further information on how the GC-read gas properties are mapped to the 'in-use' gas property data points.

The GC-read heating value and specific gravity are stored in the **HeatingValueGC** and **SpecificGravityGC** data points, respectively.

Data polling

The meter periodically polls the GC looking for data updates. If the meter is communicating normally with the GC, then it polls the GC every one minute looking for an update (i.e., a change in the GC analysis time). Otherwise, the meter polls the GC every 15 seconds.

When the meter determines that a GC update is available for the specified stream number, it then reads the GC data using multiple reads one second apart until all the data is read. The GC analysis time is read again at the end of the data collection to determine if another update occurred during the data collection (i.e., the data is not all from the same update). If so, the meter discards the gas property data just read and begins looking immediately for the next update.

If the meter cannot successfully communicate with the GC after four consecutive polls (15 seconds apart), then the meter indicates the communication alarm via the **IsGCComErr** data point with the **GCCommStatus** data point indicating an error code (listed in Table 5-14 below).

Table 5-14: GC Communications status list

GCComm status value	Error description
0	No error.
1	Desired stream not found.
2	GC controller is busy (error defined by Modbus protocol).
3	GC detected an illegal Modbus function code from the meter.
4	GC detected an illegal Modbus data address from the meter.
5	GC detected an illegal data value from the meter.
6	Failure in associated device (Modbus defined error).
7	GC has accepted the meter's request but is still processing.
8	A firmware logic error was detected.
9	Modbus address mismatch.
10	Modbus function code mismatch.
11	GC reports an exception code that is unrecognized.
12	The meter's Modbus request message is too long (exceeds the maximum allowable length).
13	The GC's Modbus response message is too long (exceeds the maximum allowable length).
14	GC response message has incorrect number of registers.
15	GC does not support the requested message data type.
16	GC does not support the requested data protocol.
17	The meter's Modbus request message (RTU protocol) is too long (exceeds the maximum allowable length).
18	GC response not received within the communication timeout.
19	GC response message (ASCII protocol) incomplete.
20	GC response message (RTU protocol) incomplete.
21	GC gas property data spans more than one update.
22	Server port not open. Gateway path not available or target device failed to respond.
23	GC IP address incorrect.

GC data validity

The GC-read gas property data validity is indicated by the **AreGasPropertiesInvalidGC** data point. The data is considered invalid if any of the conditions listed in Table 5-15 is true. These conditions are indicated by the MeterLink™ Monitor page Field I/O indicator.

Table 5-15: GC-read gas property invalid conditions

Indication Data Point	Condition
IsGCAlarmPresent	GC reported alarm (GC Alarm1 bits 14 and/or 15 set, GC Alarm2 bits 0, 1, 2, and/or 3 set).
IsGCWarningPresent	Not presently used - reserved for future use.

Table 5-15: GC-read gas property invalid conditions *(continued)*

Indication Data Point	Condition
IsGCCommErr	The meter is not able to communicate successfully with the GC. Refer to communication error conditions listed in Table 5-14.
IsGCDataErr	The total unnormalized gas composition mole percentage of all the gas components read from the GC is not within [85%, 115%].
	An individual gas composition mole percentage is not within [0%, 100%].
	The specific gravity is not within the range of [0.2, 0.8].
	The heating value is greater than 50 kJ/dm^3.
	Specified gas stream (**GCStreamNumber**) not found within the specified period (**GCDesiredStreamTimeout**).
	Invalid GC feature key (GC interface key) Port improperly configured (such as if configured without using the MeterLink™ Field Setup Wizard).

GC alarm handling

The following data points are included in the meter's alarm log (See Event log: alarm/audit):

- **AreGasPropertiesInvalidGC**
- **IsGCAlarmPresent**
- **IsGCCommErr**
- **GCCommStatus**
- **IsGCDataErr**

5.10.2 Configure AGA8 parameters

Configure the properties necessary for the AGA8 calculations.

How the AGA8 calculations to be performed:

- ***Internally by the meter -*** Calculates the flow mass density, the flow compressibility and the base compressibility.
- ***Externally -*** Calculations are done externally. The calculated values must then be written to the meter using MeterLink or a flow computer.

AGA8 method

- Gross Method 1
- Gross Method 2
- Detail Method - Enter the amount of each of the 21 gas components as a percentage.
- GERG-2008

Gas composition

- ***Fixed -*** Use the fixed gas composition stored in the meter for all calculations.
- ***Live GC -*** Use a gas composition collected by the meter from a gas chromatograph for all calculations. This option is only available with a GC key or is enabled with the Continuous Flow Analysis key.
- Transmitter Head 1 (Available only on Head 2 of Dual-Configuration meter)

- Configure the Gas properties for the gas chromatograph
- Base temperature
- Base pressure
- Gas composition to use on GC alarm
- Specific gravity
- Specific gravity reference temperature
- Specific gravity reference pressure
- Volumetric gross heating value
- Volumetric gross heating value reference temperature
- Molar density reference temperature
- Molar density reference pressure
- Flow mass density[(1)]
- Flow compressibility[(1)]
- Base compressibility[(1)]

5.10.3 Configure continuous flow analysis parameters

Configure the Continuous Flow Analysis features of the Rosemount 3410 Series Ultrasonic meter. This MeterLink™ Field Setup Wizard page is displayed only if the View Continuous Flow Analysis setup was selected on the Startup Page and you have a valid Continuous Flow Analysis key.

These features require that the meter baseline be set using the **Tools → Set Baseline Wizard**.

- ***Flow limits -*** Low and high flow velocity limits.
- ***SOS comparison -*** Compares the meter average speed of sound to the AGA 10 calculated speed of sound. SOS comparison is also performed when AGA8 method is Detail Method or GERG-2008.
- ***Liquid detection -*** Identifies when liquids may be present in the bottom of the meter run base on the meter's flow characteristics.
- ***Abnormal profile -*** Identifies if the meter flow profile has shifted from the original baseline profile of the meter.
- ***Blockage -*** Identifies a possible blockage of an upstream flow conditioner.
- ***Internal bore buildup -*** Indicates that the flow characteristics have changed, indicating a build up on the internal bore of the meter.

Set baseline parameters

Select the direction to baseline and what data to use to perform the baseline. The wizard will step you through setting a baseline in one direction.

It is necessary to baseline the meter in both directions if the meter will be operating in a bi-directional application. For meters only operating in a uni-directional application, the meter only needs one baseline. The status message displayed on the Meter monitor screen

(1) If a flow computer or SCADA system is used to write these values to the meter, they do not have to be entered at this time.

about the baseline not being set can simply be acknowledged to clear the alarm for a flow direction you do not want to baseline.

Setting baselines in two directions is only necessary if the meter is installed in a bi-directional application. Flow through the meter in one direction can be quite different from flow through a meter in the opposite direction. This could be because of flow conditioners, thermowells, or elbows.

- Select baseline flow direction - forward or reverse
- Select baseline data source:
  - ***1-minute averages from the meter -*** The preferred option when setting the baseline for a new meter. The meter must be under typical flowing conditions when the baseline is set.
  - ***Maintenance log -*** If the meter has already been installed in the field for a period of time and a MeterLink™ maintenance log is available from the initial startup that was taken during normal flowing conditions.
  - ***Manual entry -*** Manually enter data for each of the parameters. This could be used to modify a single parameter for a baseline already set or it could be to enter data from a historical record from when the meter was first put into service.

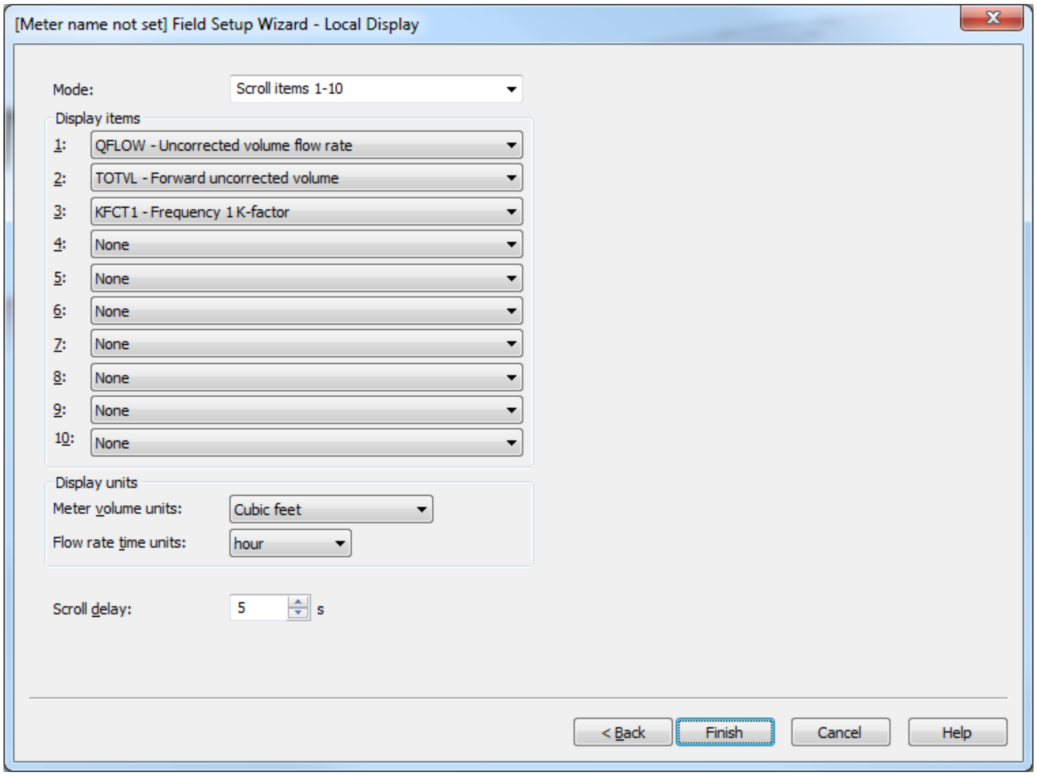
Configure the Local Display

Configure the parameters for the local display.

Use the dropdown arrow in the Display Items list box and select or modify the parameters that will be displayed; the Display items, the Display units and the Scroll delay.

Important
When connected to a meter with the local display option, reverse flow direction is indicated with a minus sign (negative) before the value(s) shown on the local display.

Figure 5-13: Field Setup Wizard - Local Display



Mode

Select **Scroll items 1-10** or **Uncorrected volume** only. The default value is Scroll items 1-10. Scroll items 1-10 mode, allows selection of up to ten data points to be displayed on the local display. In Uncorrected volume only mode, the display will only alternate between the forward and reverse uncorrected volume in units of cubic meters in compliance with OIML R-137-1 and the European MID directive. Depending on the size of the meter, the value displayed in the Uncorrected volume only mode will be X 10 cubic meters or X 100 cubic meters as indicated on the display in the bottom line.

Display items and display units

Display units - Meter volume units displayed are either U.S. Customary or Metric. The Meter volume units displayed reflect the meter's units selected on the **File → Program Settings** dialog (e.g. U.S. Customary or Metric units). Configure the Meter volume units for U.S. Customary selections:

- Cubic feet
- Thousand cubic feet

Or

Metric unit selections are:

- Cubic meters
- Thousand cubic meters

Configure the Flow rate time units:

- Second

- Hour
- Day

Note
Display units preceded by a plus or minus sign indicate forward and reverse flow direction, as shown in the table below.

Table 5-16: Local display labels, descriptions, and valid units

Local display labels, descriptions, and valid units
QFLOW - Uncorrected volume flow rate — ACF - Actual Cubic Feet — ACM - Actual Cubic Meters — MACF - Thousand Actual Cubic Feet — MACM - Thousand Actual Cubic Meters
TDYVL - Current day's forward uncorrected volume — +ACF - Actual Cubic Feet — +ACM - Actual Cubic Meters — +MACF - Thousand Actual Cubic Feet — +MACM - Thousand Actual Cubic Meters
TDYVL - Current day's reverse uncorrected volume — -ACF - Actual Cubic Feet — -ACM - Actual Cubic Meters — -MACF - Thousand Actual Cubic Feet — -MACM - Thousand Actual Cubic Meters
YSTVL - Previous day's forward uncorrected volume — +ACF - Actual Cubic Feet — +ACM - Actual Cubic Meters — +MACF - Thousand Actual Cubic Feet — +MACM - Thousand Actual Cubic Meters
YSTVL- Previous day's forward uncorrected volume — -ACF - Actual Cubic Feet — -ACM - Actual Cubic Meters — -MACF - Thousand Actual Cubic Feet — -MACM - Thousand Actual Cubic Meters
TOTVL - Forward uncorrected volume — +ACF - Actual Cubic Feet — +ACM - Actual Cubic Meters — +MACF - Thousand Actual Cubic Feet — +MACM - Thousand Actual Cubic Meters

Table 5-16: Local display labels, descriptions, and valid units *(continued)*

Local display labels, descriptions, and valid units
TOTVL - Reverse uncorrected volume — -ACF - Actual Cubic Feet — -ACM - Actual Cubic Meters — -MACF - Thousand Actual Cubic Feet — -MACM - Thousand Actual Cubic Meters
QBASE - Corrected volume flow rate — SCF - Standard Cubic Feet — SCM - Standard Cubic Meters — MSCF - Thousand Standard Cubic Feet — MSCM - Thousand Standard Cubic Meters
TDYVL- Current days forward corrected volume — +SCF - Standard Cubic Feet — +SCM - Standard Cubic Meters — +MSCF - Thousand Standard Cubic Feet — +MSCM - Thousand Standard Cubic Meters
TDYVL- Current days reverse corrected volume — -SCF - Standard Cubic Feet — -SCM - Standard Cubic Meters — -MSCF - Thousand Standard Cubic Feet — -MSCM - Thousand Standard Cubic Meters
YSTVL - Previous days forward corrected volume — +SCF - Standard Cubic Feet — +SCM - Standard Cubic Meters — +MSCF - Thousand Standard Cubic Feet — +MSCM - Thousand Standard Cubic Meters
YSTVL - Previous days reverse corrected volume — -SCF - Standard Cubic Feet — -SCM - Standard Cubic Meters — -MSCF - Thousand Standard Cubic Feet — -MSCM - Thousand Standard Cubic Meters
TOTVL - Forward uncorrected volume — +SCF - Standard Cubic Feet — +SCM - Standard Cubic Meters — +MSCF - Thousand Standard Cubic Feet — +MSCM - Thousand Standard Cubic Meters

Table 5-16: Local display labels, descriptions, and valid units *(continued)*

Local display labels, descriptions, and valid units
TOTVL - Reverse uncorrected volume — -SCF - Standard Cubic Feet — -SCM - Standard Cubic Meters — -MSCF - Thousand Standard Cubic Feet — -MSCM - Thousand Standard Cubic Meters
VEL - Average flow velocity — Ft/S - Feet per Second — M/S - Meters per Second
SOS - Average sound velocity — Ft/S - Feet per Second — M/S - Meters per Second
TEMP - Flow-condition temperature — DEGF - Degrees Fahrenheit — DEGC - Degrees Celsius
PRESS - Flow-condition pressure — PSI - Pound per square inch — MPA - Megapascals
FRQ1A - Frequency channel 1A — HZ - Hertz
FRQ1B - Frequency channel 1B — HZ - Hertz
KFCT1 - Frequency 1K-factor — CF - Cubic Feet — CM - Cubic Meters — MCF - Thousand Cubic Feet — MCM - Thousand Cubic Meters
FRQ2A - Frequency channel 2A — HZ - Hertz
FRQ2B - Frequency channel 2B — HZ - Hertz
KFCT2 - Frequency 2K-factor — CF - Cubic Feet — CM - Cubic Meters — MCF - Thousand Cubic Feet — MCM - Thousand Cubic Meters
AO1- Analog Output 1 current — MA- Miliamperes

Table 5-16: Local display labels, descriptions, and valid units *(continued)*

Local display labels, descriptions, and valid units
AO2 - Analog Output 2 current — MA- Miliamperes

Scroll delay - Time interval for the selected display items to be shown on the Local Display. Use the spin buttons to increase or decrease the time interval.

5.11 Configure continuous flow analysis parameters

Configure the Continuous Flow Analysis features of the Rosemount 3410 Series Ultrasonic meter. This MeterLink™ Field Setup Wizard page is displayed only if the View Continuous Flow Analysis setup was selected on the Startup Page and you have a valid Continuous Flow Analysis key.

These features require that the meter baseline be set using the **Tools → Set Baseline Wizard**.

- ***Flow limits -*** Low and high flow velocity limits.
- ***SOS comparison -*** Compares the meter average speed of sound to the AGA 10 calculated speed of sound. SOS comparison is also performed when AGA8 method is Detail Method or GERG-2008.
- ***Liquid detection -*** Identifies when liquids may be present in the bottom of the meter run base on the meter's flow characteristics.
- ***Abnormal profile -*** Identifies if the meter flow profile has shifted from the original baseline profile of the meter.
- ***Blockage -*** Identifies a possible blockage of an upstream flow conditioner.
- ***Internal bore buildup -*** Indicates that the flow characteristics have changed, indicating a build up on the internal bore of the meter.

5.11.1 Set baseline parameters

Select the direction to baseline and what data to use to perform the baseline. The wizard will step you through setting a baseline in one direction.

It is necessary to baseline the meter in both directions if the meter will be operating in a bi-directional application. For meters only operating in a uni-directional application, the meter only needs one baseline. The status message displayed on the Meter monitor screen about the baseline not being set can simply be acknowledged to clear the alarm for a flow direction you do not want to baseline.

Setting baselines in two directions is only necessary if the meter is installed in a bi-directional application. Flow through the meter in one direction can be quite different from flow through a meter in the opposite direction. This could be because of flow conditioners, thermowells, or elbows.

- Select baseline flow direction - forward or reverse
- Select baseline data source:
  - ***1-minute averages from the meter -*** The preferred option when setting the baseline for a new meter. The meter must be under typical flowing conditions when the baseline is set.

— ***Maintenance log -*** If the meter has already been installed in the field for a period of time and a MeterLink™ maintenance log is available from the initial startup that was taken during normal flowing conditions.

— ***Manual entry -*** Manually enter data for each of the parameters. This could be used to modify a single parameter for a baseline already set or it could be to enter data from a historical record from when the meter was first put into service.

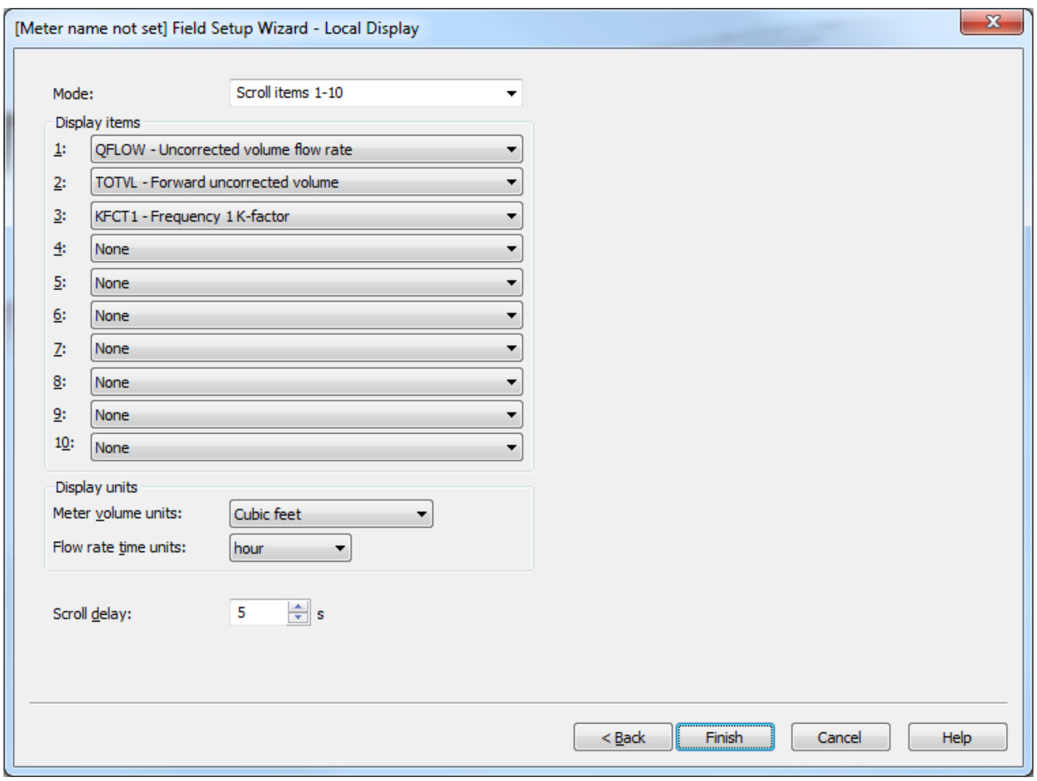
5.12 Configure the Local Display

Configure the parameters for the local display.

Use the dropdown arrow in the Display Items list box and select or modify the parameters that will be displayed; the Display items, the Display units and the Scroll delay.

Important
When connected to a meter with the local display option, reverse flow direction is indicated with a minus sign (negative) before the value(s) shown on the local display.

Figure 5-14: Field Setup Wizard - Local Display



Mode

Select **Scroll items 1-10** or **Uncorrected volume** only. The default value is Scroll items 1-10. Scroll items 1-10 mode, allows selection of up to ten data points to be displayed on the local display. In Uncorrected volume only mode, the display will only alternate between the forward and reverse uncorrected volume in units of cubic meters in compliance with OIML R-137-1 and the European MID directive. Depending on the size of the meter, the value displayed in the Uncorrected volume only mode will be X 10 cubic meters or X 100 cubic meters as indicated on the display in the bottom line.

Display items and display units

Display units - Meter volume units displayed are either U.S. Customary or Metric. The Meter volume units displayed reflect the meter's units selected on the **File** → **Program Settings** dialog (e.g. U.S. Customary or Metric units). Configure the Meter volume units for U.S. Customary selections:

- Cubic feet
- Thousand cubic feet

Or

Metric unit selections are:

- Cubic meters
- Thousand cubic meters

Configure the Flow rate time units:

- Second
- Hour
- Day

Note
Display units preceded by a plus or minus sign indicate forward and reverse flow direction, as shown in the table below.

Table 5-17: Local display labels, descriptions, and valid units

Local display labels, descriptions, and valid units
QFLOW - Uncorrected volume flow rate — ACF - Actual Cubic Feet — ACM - Actual Cubic Meters — MACF - Thousand Actual Cubic Feet — MACM - Thousand Actual Cubic Meters
TDYVL - Current day's forward uncorrected volume — +ACF - Actual Cubic Feet — +ACM - Actual Cubic Meters — +MACF - Thousand Actual Cubic Feet — +MACM - Thousand Actual Cubic Meters
TDYVL - Current day's reverse uncorrected volume — -ACF - Actual Cubic Feet — -ACM - Actual Cubic Meters — -MACF - Thousand Actual Cubic Feet — -MACM - Thousand Actual Cubic Meters
YSTVL - Previous day's forward uncorrected volume — +ACF - Actual Cubic Feet — +ACM - Actual Cubic Meters — +MACF - Thousand Actual Cubic Feet — +MACM - Thousand Actual Cubic Meters

Table 5-17: Local display labels, descriptions, and valid units *(continued)*

Local display labels, descriptions, and valid units
YSTVL- Previous day's forward uncorrected volume — -ACF - Actual Cubic Feet — -ACM - Actual Cubic Meters — -MACF - Thousand Actual Cubic Feet — -MACM - Thousand Actual Cubic Meters
TOTVL - Forward uncorrected volume — +ACF - Actual Cubic Feet — +ACM - Actual Cubic Meters — +MACF - Thousand Actual Cubic Feet — +MACM - Thousand Actual Cubic Meters
TOTVL - Reverse uncorrected volume — -ACF - Actual Cubic Feet — -ACM - Actual Cubic Meters — -MACF - Thousand Actual Cubic Feet — -MACM - Thousand Actual Cubic Meters
QBASE - Corrected volume flow rate — SCF - Standard Cubic Feet — SCM - Standard Cubic Meters — MSCF - Thousand Standard Cubic Feet — MSCM - Thousand Standard Cubic Meters
TDYVL- Current days forward corrected volume — +SCF - Standard Cubic Feet — +SCM - Standard Cubic Meters — +MSCF - Thousand Standard Cubic Feet — +MSCM - Thousand Standard Cubic Meters
TDYVL- Current days reverse corrected volume — -SCF - Standard Cubic Feet — -SCM - Standard Cubic Meters — -MSCF - Thousand Standard Cubic Feet — -MSCM - Thousand Standard Cubic Meters
YSTVL - Previous days forward corrected volume — +SCF - Standard Cubic Feet — +SCM - Standard Cubic Meters — +MSCF - Thousand Standard Cubic Feet — +MSCM - Thousand Standard Cubic Meters

Table 5-17: Local display labels, descriptions, and valid units *(continued)*

Local display labels, descriptions, and valid units
YSTVL - Previous days reverse corrected volume — -SCF - Standard Cubic Feet — -SCM - Standard Cubic Meters — -MSCF - Thousand Standard Cubic Feet — -MSCM - Thousand Standard Cubic Meters
TOTVL - Forward uncorrected volume — +SCF - Standard Cubic Feet — +SCM - Standard Cubic Meters — +MSCF - Thousand Standard Cubic Feet — +MSCM - Thousand Standard Cubic Meters
TOTVL - Reverse uncorrected volume — -SCF - Standard Cubic Feet — -SCM - Standard Cubic Meters — -MSCF - Thousand Standard Cubic Feet — -MSCM - Thousand Standard Cubic Meters
VEL - Average flow velocity — Ft/S - Feet per Second — M/S - Meters per Second
SOS - Average sound velocity — Ft/S - Feet per Second — M/S - Meters per Second
TEMP - Flow-condition temperature — DEGF - Degrees Fahrenheit — DEGC - Degrees Celsius
PRESS - Flow-condition pressure — PSI - Pound per square inch — MPA - Megapascals
FRQ1A - Frequency channel 1A — HZ - Hertz
FRQ1B - Frequency channel 1B — HZ - Hertz
KFCT1 - Frequency 1K-factor — CF - Cubic Feet — CM - Cubic Meters — MCF - Thousand Cubic Feet — MCM - Thousand Cubic Meters
FRQ2A - Frequency channel 2A — HZ - Hertz

Table 5-17: Local display labels, descriptions, and valid units *(continued)*

Local display labels, descriptions, and valid units
FRQ2B - Frequency channel 2B — HZ - Hertz
KFCT2 - Frequency 2K-factor — CF - Cubic Feet — CM - Cubic Meters — MCF - Thousand Cubic Feet — MCM - Thousand Cubic Meters
AO1- Analog Output 1 current — MA- Miliamperes
AO2 - Analog Output 2 current — MA- Miliamperes

Scroll delay - Time interval for the selected display items to be shown on the Local Display. Use the spin buttons to increase or decrease the time interval.

5.13 Configure users

Rosemount 3410 Series Firmware v1.60 and later require user authentication to connect to the meter with MeterLink™. Meters ship from the factory with a single default user named administrator. The default password is **Administrator-XXXXX** where XXXXX is the non-zero padded CPU serial number which can be found on a label on the CPU Module. It is highly recommended to change this password on meter startup for cybersecurity reasons. For added security, the default username, administrator, can be changed as well.

See Manage users for more details on how to add, change, and delete users.

6 Logs/reports

6.1 Archive logs

The Rosemount 3410 Series Gas Ultrasonic Flow Meters provides five types of data logs (daily, hourly, audit, alarm, and system logs).

From Rosemount 3410 Series Firmware v1.42 and later, the meter can store up to 1825 daily records (5 years) and 4320 hourly records (180 days).

Each log type is discussed in detail below followed by MeterLink™ instructions to read (and optionally save) meter log records (Options for reading daily and/or hourly log records).

6.1.1 Daily and Hourly log data points actions

Five different log data point actions are supported by the daily and hourly logs: snapshot, average, flow-gated (average), totalize, and macro as described below:

SNAPSHOT Causes the data point's value at the log time to be recorded.

AVERAGE Causes the data point's average value over the log interval (day or hour) to be recorded.

FLOW_GATED Average value of the data point over the log interval (day or hour) to be recorded while the volumetric flow rate (**QFlow**) is above the volumetric flow rate threshold (**QCutOff**). If the volumetric flow rate does not exceed the threshold during the log interval, then the flow gated average of the data point is the same as the average value of the data point over the log interval to be recorded.

FLOW_ANALYSIS_GATED Average of the data point over the log interval (day or hour) to be recorded while the average flow velocity (**AvgFlow**) is between the diagnostic flow analysis limits (**FlowAnalysisLowFlowLmt** and **FlowAnalysisHighFlowLmt**). If the average flow velocity is not within the limits during the interval, then the flow analysis gated average of the data point is the same as the average value of the data point over the log interval to be recorded.

TOTALIZE Causes the data point's accumulated value over the log interval (day or hour) to be recorded.

MACRO Causes the (boolean) data point's 'latched' value over the log interval (day or hour) to be recorded. A (boolean) data point's latched value indicates if the point was ever TRUE during the log interval (where a TRUE value is represented by a 1 and a FALSE value is represented by a 0). This allows a group of boolean data points to be grouped into a single integer value where each bit represents the latched value of a single boolean data point.

Daily log

The Rosemount 3410 Series Gas Ultrasonic Flow Meter stores a daily log record once per day at the specified contract hour.

(Refer to the MeterLink Help files for information on specifying the **ContractHour** data point).

The user can select whether old, unread records can be overwritten by new records when the log becomes full via the data point **DoOverwriteUnreadDailyLog.** This point can be modified using the MeterLink **Tools** → **Edit/Compare Configuration** screen. The default is to overwrite old, unread records. Refer to Options for reading daily and/or hourly log records for information on reading records and marking records as read. The data point **IsDailyLogFull** indicates whether or not the daily log is full and cannot overwrite old, unread records.

The data points included in the daily log and the corresponding log action are as shown in the table below. Data points required by the API Chapter 21 standard are marked with an asterisk (*). For information on a *particular* data point, consult MeterLink™ online help (see the help topic for any data point in MeterLink. Click **Help** → **Gas 3410 Series Registers Reference**, select the **Index** tab, start typing the data point name until the desired point is highlighted, and then click the **Display** button).

Table 6-1: Daily log data points

Data point	Content	Log action
DailySMVResult		SNAPSHOT
PosVolFlow		TOTALIZE and SNAPSHOT
NegVolFlow		TOTALIZE and SNAPSHOT
AccumFlowTime		TOTALIZE
DailyMacro1		MACRO

Table 6-1: Daily log data points *(continued)*

Data point		Content	Log action
	bit 0	IsQFlowInvalid	
	bit 1	IsQBaseInvalid	
	bit 2	IsMassRateInvalid	
	bit 3	IsEnergyRateInvalid	
	bit 4	IsEstimatedFlowVelocityInUse	
	bit 5	IsTooFewOperChords	
	bit 6	IsFwdBaselineNotSet	
	bit 7	IsRevBaselineNotSet	
	bit 8	IsGCDataErr	
	bit 9	Unused	
	bit 10	IsAcqModuleIncompatible	
	bit 11	IsHourlyLogFull	
	bit 12	IsDailyLogFull	
	bit 13	IsAuditLogFull	
	bit 14	IsAlarmLogFull	
	bit 15	IsSystemLogFull	
	bit 16	IsXdcrFiringSyncError	
	bit 17	IsColocMeterCommErr	
	bit 18	IsGCCommErr	
	bit 19	IsGCAlarmPresent	
	bit 20	IsElecVoltOutOfRange	
	bit 21	IsElecTempOutOfRange	
	bit 22	DidCnfgChksumChg	
	bit 23	DidPowerFail	
	bit 24	IsAcqModuleError	
	bit 25	IsAcqMode	
	bit 26	DidColdStart	
	bit 27	IsCorePresent	
	bit 28	WatchDogReset	
	bit 29	DI1	
	bit 30	IsWarmStartReq	
	bit 31	IsClkInvalid	
DailyMacro2			MACRO

Table 6-1: Daily log data points *(continued)*

Data point		Content	Log action
	bit 0	Unused	
	bit 1	Unused	
	bit 2	Unused	
	bit 3	AreGasPropertiesInvalidInUse	
	bit 4	IsSndVelCompErr	
	bit 5	IsReverseFlowDetected	
	bit 6	IsAbnormalProfileDetected	
	bit 7	IsLiquidDetected	
	bit 8	IsBoreBuildupDetected	
	bit 9	IsBlockageDetected	
	bit 10	IsDiagnosticSndSpdRangeErr	
	bit 11	Unused	
	bit 12	IsColocMeterSndSpdRangeErr	
	bit 13	IsColocMeterQFlowRangeErr	
	bit 14	DidWarmStart	
	bit 15	DidResetUsers	
	bit 16	IsAnyLogFull	
	bit 17	TemperatureInvalid	
	bit 18	PressureInvalid	
	bit 19	Unused	
	bit 20	IsChordLengthMismatched	
	bit 21	IsXdcrMaintenanceRequired	
	bit 22	IsSNRTooLow	
	bit 23	IsPeakSwitchDetected	
	bit 24	IsHardFailedD	
	bit 25	IsHardFailedC	
	bit 26	IsHardFailedB	
	bit 27	IsHardFailedA	
	bit 28	IsMeterVelAboveMaxLmt	
	bit 29	IsAvgSoundVelRangeErr	
	bit 30	IsMeasSndSpdRange	
	bit 31	Unused	
DailyMacro3			MACRO
	bits 0 - 3 bits 4 - 7 bits 8 - 11 bits 12 - 15 bits 16 -19 bits 20 - 23 bits 24 - 27 bits 28 - 31	IsChordLengthMismatched<A..D> Unused IsBatchInactive<A..D> Unused IsXdcrMaintenanceRequired<A..D> Unused IsFailedForBatch<A..D> Unused	
DailyMacro4			

Table 6-1: Daily log data points *(continued)*

Data point		Content	Log action
	bits 0 – 3	DidDltTmChkFail<A..D>	
	bits 4 - 7	Unused	
	bits 8 - 11	IsSigQltyBad<A..D>	
	bits 12 - 15	Unused	
	bits 16 -19	DidExceedMaxNoise<A..D>	
	bits 20 - 23	Unused	
	bits 24 - 27	IsSNRTooLow<A..D>	
	bits 28 - 31	Unused	
DailyMacro5			MACRO
	bits 0 - 3	DidTmDevChkFail<A..D>	
	bits 4 - 7	Unused	
	bits 8 - 11	IsSigDistorted<A..D>	
	bits 12 - 15	Unused	
	bits 16 - 19	IsPeakSwitchDetected<A..D>	
	bits 20 - 23	Unused	
	bits 24 - 27	IsSigClipped<A..D>	
	bits 28 -31	Unused	
DailyMacro6			
	bits 0 - 3	IsMeasSndSpdRange<A..D>	
	bits 4 - 7	Unused	
	bits 8 - 11	IsStackingIncomplete<A..D>	
	bits 12 - 31	Unused	
ProfileFactor			FLOW_ANALYSIS_GATED
SwirlAngle			FLOW_ANALYSIS_GATED
Symmetry			FLOW_ANALYSIS_GATED
CrossFlow			FLOW_ANALYSIS_GATED
Turbulence<A..D>			FLOW_ANALYSIS_GATED
SndVel<A..D>			FLOW_GATED
SpdSndSpread			AVERAGE
AvgSndVel			FLOW_GATED
SndVelDiff<A..D>			FLOW_GATED
AGA10SndVel			FLOW_GATED
SndVelCompErr			FLOW_ANALYSIS_GATED
ColocMeterTH2VsTH1AvgSndVelPctDiff			FLOW_GATED
FlowVel<A..D>			FLOW_GATED
AvgFlow			FLOW_GATED
FlowVelRatio<A..D>			AVERAGE
PctGood<A1..D2>			AVERAGE
Gain<A1..D2>			AVERAGE
SNR<A1..D2>			AVERAGE

Table 6-1: Daily log data points *(continued)*

Data point	Content	Log action
NoiseAmplitude<A1..D2>		AVERAGE
EnergyRate		FLOW_GATED
PosEnergy		TOTALIZE and SNAPSHOT
NegEnergy		TOTALIZE and SNAPSHOT
MassRate		FLOW_GATED
PosMass		TOTALIZE and SNAPSHOT
NegMass		TOTALIZE and SNAPSHOT
PosVolBase		TOTALIZE and SNAPSHOT
NegVolBase		TOTALIZE and SNAPSHOT
QFlow		FLOW_GATED
ColocMeterTH2VsTH1QFlowPctDiff		FLOW_GATED
QBase		FLOW_GATED
FlowTemperature		FLOW_GATED
ExpCorrTemperature		FLOW_GATED
FlowPressure		FLOW_GATED
ExpCorrPressure		FLOW_GATED
AbsFlowPressure		FLOW_GATED
CorrectionFactor		FLOW_GATED
RhoMixFlow		FLOW_GATED
ZFlow		FLOW_GATED
ZBase		FLOW_GATED
MethaneInUse		FLOW_GATED
N2InUse		FLOW_GATED
CO2InUse		FLOW_GATED
EthaneInUse		FLOW_GATED
PropaneInUse		FLOW_GATED
WaterInUse		FLOW_GATED
H2SInUse		FLOW_GATED
H2InUse		FLOW_GATED
COInUse		FLOW_GATED
OxygenInUse		FLOW_GATED
IsoButaneInUse		FLOW_GATED
NButaneInUse		FLOW_GATED
IsoPentaneInUse		FLOW_GATED
NPentaneInUse		FLOW_GATED
NHexaneInUse		FLOW_GATED

Table 6-1: Daily log data points *(continued)*

Data point	Content	Log action
NHeptaneInUse		FLOW_GATED
NOctaneInUse		FLOW_GATED
NNonaneInUse		FLOW_GATED
NDecaneInUse		FLOW_GATED
HeliumInUse		FLOW_GATED
ArgonInUse		FLOW_GATED
HeatingValueInUse		FLOW_GATED
SpecificGravityInUse		FLOW_GATED
CnfgChksumValue		SNAPSHOT
CnfgChksumDate		SNAPSHOT

Hourly log

The Rosemount 3410 Series Gas Ultrasonic Flow Meter meter stores an hourly log record once per hour on the hour. The user can select whether old, unread records can be overwritten by new records when the log becomes full via the data point **DoOverwriteUnreadHourlyLog**.

This point can be modified using the MeterLink™ **Tools** → **Edit/Compare Configuration** screen. The default is to overwrite old, unread records. Refer to Options for reading daily and/or hourly log records for information on reading records and marking records as read. The data point **IsHourlyLogFull** indicates whether or not the hourly log is full and cannot overwrite old, unread records.

The data points included in the hourly log and the corresponding log action are as shown in the table below. Data points required by the API Chapter 21 standard are marked with an asterisk (*). For information on a *particular* data point, consult MeterLink online help.

Table 6-2: Hourly log data points

Data point	Content	Log action
HourlySMVResult		SNAPSHOT
PosVolFlow		TOTALIZE and SNAPSHOT
NegVolFlow		TOTALIZE and SNAPSHOT
AccumFlowTime		TOTALIZE
HourlyMacro1		MACRO

Table 6-2: Hourly log data points *(continued)*

Data point		Content	Log action
	bit 0	IsQFlowInvalid	
	bit 1	IsQBaseInvalid	
	bit 2	IsMassRateInvalid	
	bit 3	IsEnergyRateInvalid	
	bit 4	IsEstimatedFlowVelocityInUse	
	bit 5	IsTooFewOperChords	
	bit 6	IsFwdBaselineNotSet	
	bit 7	IsRevBaselineNotSet	
	bit 8	IsGCDataErr	
	bit 9	Unused	
	bit 10	IsAcqModuleIncompatible	
	bit 11	IsHourlyLogFull	
	bit 12	IsDailyLogFull	
	bit 13	IsAuditLogFull	
	bit 14	IsAlarmLogFull	
	bit 15	IsSystemLogFull	
	bit 16	IsXdcrFiringSyncError	
	bit 17	IsColocMeterCommErr	
	bit 18	IsGCCommErr	
	bit 19	IsGCAlarmPresent	
	bit 20	IsElecVoltOutOfRange	
	bit 21	IsElecTempOutOfRange	
	bit 22	DidCnfgChksumChg	
	bit 23	DidPowerFail	
	bit 24	IsAcqModuleError	
	bit 25	IsAcqMode	
	bit 26	DidColdStart	
	bit 27	IsCorePresent	
	bit 28	WatchDogReset	
	bit 29	DI1	
	bit 30	IsWarmStartReq	
	bit 31	IsClkInvalid	
HourlyMacro2			MACRO

Table 6-2: Hourly log data points *(continued)*

Data point		Content	Log action
	bit 0	Unused	
	bit 1	Unused	
	bit 2	Unused	
	bit 3	AreGasPropertiesInvalidInUse	
	bit 4	IsSndVelCompErr	
	bit 5	IsReverseFlowDetected	
	bit 6	IsAbnormalProfileDetected	
	bit 7	IsLiquidDetected	
	bit 8	IsBoreBuildupDetected	
	bit 9	IsBlockageDetected	
	bit 10	IsDiagnosticSndSpdRangeErr	
	bit 11	Unused	
	bit 12	IsColocMeterSndSpdRangeErr	
	bit 13	IsColocMeterQFlowRangeErr	
	bit 14	DidWarmStart	
	bit 15	DidResetUsers	
	bit 16	IsAnyLogFull	
	bit 17	TemperatureInvalid	
	bit 18	PressureInvalid	
	bit 19	Unused	
	bit 20	IsChordLengthMismatched	
	bit 21	IsXdcrMaintenanceRequired	
	bit 22	IsSNRTooLow	
	bit 23	IsPeakSwitchDetected	
	bit 24	IsHardFailedD	
	bit 25	IsHardFailedC	
	bit 26	IsHardFailedB	
	bit 27	IsHardFailedA	
	bit 28	IsMeterVelAboveMaxLmt	
	bit 29	IsAvgSoundVelRangeErr	
	bit 30	IsMeasSndSpdRange	
	bit 31	Unused	
HourlyMacro3			MACRO
	bits 0 - 3	IsChordLengthMismatched<A..D>	
	bits 4 - 7	Unused	
	bits 8 - 11	IsBatchInactive<A..D>	
	bits 12 - 15	Unused	
	bits 16 -19	IsXdcrMaintenanceRequired<A..D>	
	bits 20 - 23	Unused	
	bits 24 - 27	IsFailedForBatch<A..D>	
	bits 28 - 31	Unused	
HourlyMacro4			MACRO

Table 6-2: Hourly log data points *(continued)*

Data point		Content	Log action
	bits 0 - 3 bits 4 - 7 bits 8 - 11 bits 12 - 15 bits 16 -19 bits 20 - 23 bits 24 - 27 bits 28 - 31	DidDltTmChkFail<A..D> Unused IsSigQltyBad<A..D> Unused DidExceedMaxNoise<A..D> Unused IsSNRTooLow<A..D> Unused	
HourlyMacro5			MACRO
	bits 0 - 3 bits 4 - 7 bits 8 - 11 bits 12 - 15 bits 16 -19 bits 20 - 23 bits 24 - 27 bits 28 - 31	DidTmDevChkFail<A..D> Unused IsSigDistorted<A..D> Unused IsPeakSwitchDetected<A..D> Unused IsSigClipped<A..D> Unused	
HourlyMacro6			MACRO
	bits 0 - 3 bits 4 - 7 bits 8 - 11 bits 12 - 31	IsMeasSndSpdRange<A..D> Unused IsStackingIncomplete<A..D> Unused	
ProfileFactor			FLOW_ANALYSIS_GATED
SwirlAngle			FLOW_ANALYSIS_GATED
Symmetry			FLOW_ANALYSIS_GATED
CrossFlow			FLOW_ANALYSIS_GATED
Turbulence<A..D>			FLOW_ANALYSIS_GATED
SndVel<A..D>			FLOW_GATED
SpdSndSpread			AVERAGE
AvgSndVel			FLOW_GATED
SndVelDiff<A..D>			FLOW_GATED
AGA10SndVel			FLOW_GATED
SndVelCompErr			FLOW_ANALYSIS_GATED
ColocMeterTH2VsTH1AvgSndVelPctDiff			FLOW_GATED
FlowVel<A..D>			FLOW_GATED
AvgFlow			FLOW_GATED
FlowVelRatio<A..D>			FLOW_GATED

Table 6-2: Hourly log data points *(continued)*

Data point	Content	Log action
PctGood<A1..D2>		AVERAGE
Gain<A1..D2>		AVERAGE
SNR<A1..D2>		AVERAGE
NoiseAmplitude<A1..D2>		AVERAGE
EnergyRate		FLOW_GATED
PosEnergy		TOTALIZE and SNAPSHOT
NegEnergy		TOTALIZE and SNAPSHOT
MassRate		FLOW_GATED
PosMass		TOTALIZE and SNAPSHOT
NegMass		TOTALIZE and SNAPSHOT
PosVolBase		TOTALIZE and SNAPSHOT
NegVolBase		TOTALIZE and SNAPSHOT
QFlow		FLOW_GATED
ColocMeterTH2VsTH1QFlowPctDiff		FLOW_GATED
QBase		FLOW_GATED
FlowTemperature		FLOW_GATED
ExpCorrTemperature		FLOW_GATED
FlowPressure		FLOW_GATED
ExpCorrPressure		FLOW_GATED
AbsFlowPressure		FLOW_GATED
CorrectionFactor		FLOW_GATED
RhoMixFlow		FLOW_GATED
ZFlow		FLOW_GATED
ZBase		FLOW_GATED
MethaneInUse		FLOW_GATED
N2InUse		FLOW_GATED
CO2InUse		FLOW_GATED
EthaneInUse		FLOW_GATED
PropaneInUse		FLOW_GATED
WaterInUse		FLOW_GATED
H2SInUse		FLOW_GATED
H2InUse		FLOW_GATED
COInUse		FLOW_GATED

Table 6-2: Hourly log data points *(continued)*

Data point	Content	Log action
OxygenInUse		FLOW_GATED
IsoButaneInUse		FLOW_GATED
NButaneInUse		FLOW_GATED
IsoPentaneInUse		FLOW_GATED
NPentaneInUse		FLOW_GATED
NHexaneInUse		FLOW_GATED
NHeptaneInUse		FLOW_GATED
NOctaneInUse		FLOW_GATED
NNonaneInUse		FLOW_GATED
NDecaneInUse		FLOW_GATED
HeliumInUse		FLOW_GATED
ArgonInUse		FLOW_GATED
HeatingValueInUse		FLOW_GATED
SpecificGravityInUse		FLOW_GATED
CnfgChksumValue		SNAPSHOT
CnfgChksumDate		SNAPSHOT

Audit log

The Rosemount 3410 Series Gas Ultrasonic Flow Meters stores an audit log record whenever any parameter affecting the flow measurement is modified. The audit log record indicates which data point changed, the date and time of the change, and both the **as-found** and **as-left** values.

The meter can store up to 3000 audit records. The user can select whether old, unread records can be overwritten by new records when the log becomes full via the data point **DoOverwriteUnreadAuditLog**. This point can be modified using the MeterLink™ **Tools → Edit/Compare Configuration** screen. The default is to overwrite old, unread records. Refer to Options for reading audit, alarm, and/or system log records for information on reading records and marking records as read. The data point **IsAuditLogFull** indicates whether or not the audit log is full and cannot overwrite old, unread records.

The data points monitored and collected for the audit log are as shown in Audit log through Event log: alarm/audit below. The points are grouped and, within each group, are listed alphabetically.

The groupings are as follows:

- AGA8
- Baseline
- Calculated Sound Velocity
- Calibration
- Chord Proportions
- Co-located meter
- Communications

- Data Logging
- Expansion Correction
- Flow analysis
- Frequency, Digital, and Analog Signals
- Gas chromatograph
- General
- Indicators
- Local display
- Meter Information
- Pressure and Temperature
- Reynolds Number Calculation
- Signal Processing
- Tracking

For information on a particular data point, consult MeterLink™ online help.

Table 6-3: Audit log AGA 8 group monitored data points

Data group	Data Point
	HCH_Method PBase RefPressureGr RefPressureMolarDensity RefTemperatureGr RefTemperatureHV RefTemperatureMolarDensity Tbase

Table 6-4: Audit log Calculated Sound Velocity group monitored data points

Data group	Data Point
	AGA10Key IsGasCompositionValidationEnabled IsSndVelCompEnabled SndVelCompErrLimit

Table 6-5: Audit log Baseline group monitored data points

Data group	Data Point
	FwdBaselineAvgFlow FwdBaselineComment FwdBaselineCrossFlow FwdBaselineFlowPressure FwdBaselineFlowTemperature FwdBaselineProfileFactor FwdBaselineSwirlAngle FwdBaselineSymmetry FwdBaselineTime FwdBaselineTurbulence<A..D> RevBaselineAvgFlow RevBaselineComment RevBaselineCrossFlow RevBaselineFlowPressure RevBaselineFlowTemperature RevBaselineProfileFactor RevBaselineSwirlAngle RevBaselineSymmetry RevBaselineTime RevBaselineTurbulence<A..D>

Table 6-6: Audit log calibration group monitored data points

Data group	Data Point
	AvgDly<A..D> CalFlag CalMethod DltDly Fwd<A0..A3> Fwd<C0..C3> FwdFlwRt<1..12> FwdMtrFctr<1..12> MeterHousingLength<A..D> L<A..D> PipeDiam Rev<A0..A3> Rev<C0..C3> RevFlwRt<1..12> RevMtrFctr<1..12> SystemDelay Wt<A..D> X<A..D> XdcrAssyComponent4SerialNumber XdcrAssyComponent4Length XdcrAssyComponent3SerialNumber XdcrAssyComponent3Length XdcrAssyComponent2SerialNumber XdcrAssyComponent2Length XdcrAssyComponent1SerialNumber XdcrAssyComponent1Length

Table 6-7: Audit log Chord proportions group monitored data points

Data group	Data Point
	LowFlowLmt NumVals PropUpdtSeconds ResetProp

Table 6-8: Audit log collocated meter group monitored data point

Data group	Data Point
	ColocMeterIPAddress ColocMeterMode ColocMeterQFlowErrLimit ColocMeterRunningAverageInterval ColocMeterSndSpdErrLimit IsColocMeterClockSyncEnabled IsColocMeterQFlowRangeCheckEnabled IsColocMeterSndSpdRangeCheckEnabled

Table 6-9: Audit log communication group monitored data point

Data group	Data Point
	BaudPort<A..C> CommTCPMaxDatagramSizePort<A..C> CommTCPTimeoutPort<A..C> CommTimeoutPort<A..C> CommRspDlyPort<A..C> DriveSelectionPort<A..C> Eth1AltMapfilePt Eth1AltModbusPort Eth1AltModbusReadWriteMode Eth1DfltGatewayAddr Eth1IPAddr Eth1MapfilePt Eth1ModbusID Eth1ModbusReadWriteMode Eth1SubnetMask FTPServerControlPort HTTPServerPort IsHWFlowControlEnabledPortA IsTelnetServerEnabled MaxConnDBAPI ModbusIDPort<A..D> PortAMapfilePt PortBMapfilePt PortCMapfilePt ProtocolPort<A..C> PTPDomainNumber ReadWriteModePort<A..C> RTSOffDelayPortA RTSOnDelayPortA

Table 6-10: Audit log data logging group monitored data point

Data group	Data Point
	AlarmTurnOffHysterisisCount AlarmTurnOffHysterisisTimeSpan ContractHour DailyLogInterval DoOverwriteUnreadAlarmLog DoOverwriteUnreadAuditLog DoOverwriteUnreadDailyLog DoOverwriteUnreadHourlyLog DoOverwriteUnreadSystemLog HourlyLogInterval IsAuditLogFixedDataPointsEnabled

Table 6-11: Audit log Expansion correction group monitored data point

Data group	Data Point
	EnableExpCorrPress EnableExpCorrTemp LinearExpansionCoef PipeOutsideDiameter PoissonsRatio RefPressExpCoef RefTempLinearExpCoef YoungsModulus

Table 6-12: Audit log Flow analysis group monitored data point

Data group	Data Point
	AbnormalProfileDetectionLmt BlockageCrossFlowLmt BlockageSymmetryLmt BlockageTurbulenceLmt<A..D> ContinuousFlowAnalysisKey DiagnosticChordRunningAvgSeconds DiagnosticSndSpdErrLimit FlowAnalysisHighFlowLmt FlowAnalysisLowFlowLmt IsAbnormalProfileDetectionEnabled IsBlockageDetectionEnabled IsBoreBuildupDetectionEnabled IsDiagnosticChordEnabled IsDiagnosticSndSpdDetectionEnabled IsLiquidDetectionEnabled IsReverseFlowDetectionEnabled LiquidDetectionSDevCrossFlowLmt LiquidDetectionSDevProfileFactorLmt LiquidDetectionSDevSymmetryLmt ReverseFlowDetectionZeroCut ReverseFlowVolLmt SwirlAngleLmt

Table 6-13: Audit log frequency, digital and analog group monitored data point

Data group	Data Point
	AO1ActionUponInvalidContent AO1Content AO1CurrentTrimGain AO1CurrentTrimZero AO1Dir AO1FullScaleEnergyRate AO1FullScaleMassRate AO1FullScaleVolFlowRate AO1MaxVel AO1MinVel AO1TestModeOutputPercent AO1TrimCurrent AO1TrimGainExtMeasCurrent AO1TrimZeroExtMeasCurrent AO1ZeroScaleEnergyRate AO1ZeroScaleMassRate AO1ZeroScaleVolFlowRate AO2ActionUponInvalidContent AO2Content AO2CurrentTrimGain AO2CurrentTrimZero AO2Dir AO2FullScaleEnergyRate AO2FullScaleMassRate AO2FullScaleVolFlowRate AO2MaxVel AO2MinVel AO2TestModeOutputPercent AO2TrimCurrent AO2TrimGainExtMeasCurrent AO2TrimZeroExtMeasCurrent AO2ZeroScaleEnergyRate AO2ZeroScaleMassRate AO2ZeroScaleVolFlowRate DI1IsInvPolarity DI1Mode DO1AContent ... DO1BContent DO1AIsInvPolarity ... DO1BIsInvPolarity DO1PairTestEnable DO2AContent ... DO2BContent DO2AIsInvPolarity... DO2BIsInvPolarity DO2PairTestEnable FODO1Mode FODO1Source FODO2Mode FODO2Source

Table 6-14: Audit log frequency, digital and analog group monitored data point (continued)

	FODO3Mode FODO3Source FODO4Mode FODO4Source FODO5Mode FODO5Source FODO6Mode FODO6Source Freq1BPhase Freq1Content Freq1Dir Freq1FeedbackCorrectionPcnt Freq1FullScaleEnergyRate Freq1FullScaleMassRate Freq1FullScaleVolFlowRate Freq1MaxFrequency Freq1MaxVel Freq1MinVel Freq1TestModeOutputPercent Freq1ZeroScaleEnergyRate Freq1ZeroScaleMassRate Freq1ZeroScaleVolFlowRate Freq2BPhase Freq2Content Freq2Dir Freq2FeedbackCorrectionPcnt Freq2FullScaleEnergyRate Freq2FullScaleMassRate Freq2FullScaleVolFlowRate Freq2MaxFrequency Freq2MaxVel Freq2MinVel Freq2TestModeOutputPercent Freq2ZeroScaleEnergyRate Freq2ZeroScaleMassRate Freq2ZeroScaleVolFlowRate IsAO1EnableTest IsAO2EnableTest IsDI1ForCalActiveLow IsDI1ForCalStateGated IsFreq1BZeroedOnErr IsFreq1EnableTest IsFreq2BZeroedOnErr IsFreq2EnableTest

Table 6-15: Audit log gas chromatograph group monitored data point

Data group	Data Point
	GasPropertiesSrcSel GasPropertiesSrcSelGCAlarm GCBaud GCCommTimeout GCDesiredStreamTimeout GCHeatingValueType GCHeatingValueUnit GCIPAddr GCKey GCModbusID GCProtocol GCSerialPort GCStreamNumber GCTCPPort

Table 6-16: Audit log general group monitored data point

Data group	Data Point
	AlarmDef AsyncEnable AvgSoundVelHiLmt AvgSoundVelLoLmt ChordalConfig ChordInactv<A..D> DampEnable DeviceNumber DitherEnable FlowDir IsPlaybackSimulationEnabled MaxNoDataBatches MeterMaxVel MinChord MinPctGood NonNormalModeTimeout PeakSwitchDetectModeSimFileName PerfStatusSuppressLmt RTCSecondsSinceEpochSet SevereFlowConditionFactor SevereFlowConditionLmt1 SevereFlowConditionLmt2 SpecCorrectionFactor SSMax SSMin UnitsSystem UserChanged VelHold VolFlowRateTimeUnit VolUnitMetric VolUnitUS WallRoughness XdcrFiringSync XdcrMaintenanceGainRange XdcrMaintenanceSNRRange XdcrType ZeroCut

Table 6-17: Audit log HART® data group monitored data point

Data group	Data Point
	HARTDate HARTDensityUnit HARTDescriptor HARTDeviceFinalAssyNum HARTEnergyUnit HARTHeatingValueUnit HARTLengthUnit HARTLongTag HARTMassUnit HARTMessage HARTMicroLengthUnit HARTMinNumPreambles HARTNumPreambleBytesFromSlave HARTPollingAddress HARTPressureUnit HARTQVContent HARTRateTimeUnit HARTSlot0Content HARTSlot1Content HARTSlot2Content HARTSlot3Content HARTTag HARTTemperatureUnit HARTTVContent HARTTVVelUnit HARTViscosityUnit HARTVolUnit HARTYoungsModulusPressureUnit IsHARTSlaveEnabled

Table 6-18: Audit log indicators group monitored data point

Data group	Data Point
	CnfgChksumDate CnfgChksumValue DidCnfgChksumChg DidColdStart DidPowerFail DidWarmStart DoWarmStart IsConfigProtected IsCorePresent IsProgrammingStarted MeterResetTime WatchDogReset

Table 6-19: Audit log local display group monitored data point

Data group	Data Point
	LocalDisplayFlowRateTimeUnit LocalDisplayItem<1..10> LocalDisplayMode LocalDisplayScrollDelay LocalDisplayVolUnitMetric LocalDisplayVolUnitUS

Table 6-20: Audit log meter information group monitored data point

Data group	Data Point
	Address City CPUBdBootLoaderSwVer CPUBdSwVer FileSysVer MeterModel MeterName MeterNominalSize MeterSerialNumber OSVer StateAndCountry StationName UserScratch1 UserScratch2

Table 6-21: Audit log pressure and temperature group monitored data point

Data group	Data Point
	AtmosphericPress EnablePressureInput EnableTemperatureInput FlowPOrTSrcUponAlarm FlowPressureWhileCal FlowTemperatureWhileCal HighPressureAlarm HighTemperatureAlarm InputPressureUnit LiveFlowPressureCalCtrl LiveFlowPressureGain LiveFlowPressureOffset LiveFlowTemperatureCalCtrl LiveFlowTemperatureGain LiveFlowTemperatureOffset LowPressureAlarm LowTemperatureAlarm MaxInputPressure MaxInputTemperature MinInputPressure MinInputTemperature

Table 6-22: Audit log Reynolds number calculation group monitored data point

Data group	Data Point
	Viscosity

Table 6-23: Audit log signal processing group monitored data point

Data group	Data Point
	BatchPercentSmoothing BatchSize CRange DltChk EmRateActual EmRateDesired Filter FireSeq GainHighLmt GainLowLmt MaxHoldTm MaxNoise MinHoldTime MinSigQlty NegSpan Pk1Pct Pk1Thrsh Pk1Wdth PosSpan SampInterval SampPerCycle SetXdcrType SndSpdChkMaxVel SndSpdChkMinVel SNRatio SpecBatchUpdtPeriod StackEmRateActual StackEmRateDesired StackSize TmDevFctr1 TmDevLow1 XdcrFreq XdcrNumDriveCycles

Table 6-24: Audit log tracking group monitored data point

Data group	Data Point
	ResetTrkParam Tamp TampHi TampLo TampSen TampWt Tspe TspeHi TspeLmt TspeLo TspeSen TspeWt Tspf TspfHi TspfLo TspfMatch TspfSen TspfWt

Table 6-25: Audit Log Fixed data points

Fixed value configuration data points, which are written by external client like flow computer at regular interval of time, can be enabled by setting `IsAuditLogFixedDataPointsEnabled` as TRUE. By default, `IsAuditLogFixedDataPointsEnabled` is set to FALSE which disables audit logging of following data points.

Data group	Data Point
AGA 8	ArgonComponentIndex COComponentIndex CO2ComponentIndex C6PlusComponentIndex C6PlusDecaneFrac C6PlusHeptaneFrac C6PlusHexaneFrac C6PlusNonaneFrac C6PlusOctaneFrac EthaneComponentIndex GCDisabled HeliumComponentIndex H2ComponentIndex H2SComponentIndex IsC6PlusAutoDetectionEnabled IsoButaneComponentIndex IsoPentaneComponentIndex MeasVolGrossHeatingVal MethaneComponentIndex MoleFractionArgon MoleFractionCO MoleFractionCO_2 MoleFractionEthane MoleFractionHelium MoleFractionH_2 MoleFractionH_2S MoleFractionIsoButane MoleFractionIsoPentane MoleFractionMethane MoleFractionNButane MoleFractionNDecane MoleFractionNHeptane MoleFractionNHexane MoleFractionNNonane MoleFractionNOctane MoleFractionNPentane MoleFractionN_2Method$_2$ MoleFractionOxygen MoleFractionPropane MoleFractionWater NeoPentaneComponentIndex NButaneComponentIndex NDecaneComponentIndex NHeptaneComponentIndex NHexaneComponentIndex NNonaneComponentIndex NOctaneComponentIndex NPentaneComponentIndex N2ComponentIndex OxygenComponentIndex

Table 6-26: Audit Log Fixed data points *(continued)*

Data Group	Data point
AGA 8	PropaneComponentIndex SpecFlowPressure SpecFlowTemperature SpecificGravity SpecRhoMixFlow SpecZBase SpecZFlow WaterComponentIndex

Determining meter power-up and power-down times

The audit log can be used to determine the meter start (or re-start) time and the meter power-down time by examining the **MeterResetTime** record(s). The **MeterResetTime** record time stamp indicates (to within a few seconds) the time that the meter was started. The **As-left** value indicates the time (to within a few seconds) that the meter was powered-down.

6.1.2 Event log: alarm/audit

The meter monitors several data points with respect to each point's alarm limit(s). Non-boolean data points can have low and high alarm limits. Boolean data points only have a single alarm limit (i.e., either TRUE or FALSE).

The Rosemount 3410 Series Gas Ultrasonic Flow Meter stores an alarm log record whenever any monitored data point's alarm status (cleared or set) changes. The alarm log record indicates the data point, date and time, alarm status, corresponding alarm limit, and data point value.

The meter can store up to 3000 alarm records. The user can select whether old, unread records can be overwritten by new records when the log becomes full via the data point **DoOverwriteUnreadAlarmLog**. This point can be modified using the MeterLink™ **Tools** → **Edit/Compare Configuration** screen. The default is to overwrite old, unread records.

Refer to Options for reading audit, alarm, and/or system log records for information on reading records and marking records as read. The data point **IsAlarmLogFull** indicates whether or not the alarm log is full and cannot overwrite old, unread records.

The user-settable data points **AlarmTurnOffHysterisisCount** and **AlarmTurnOffHysterisisTimeSpan** are used to prevent very repetitive alarms from filling up the alarm log. When an alarm is set **AlarmTurnOffHysterisisCount** times within **AlarmTurnOffHysteresisTimeSpan** seconds, then the alarm is suppressed until the alarm frequency drops below the specified rate (counts per time span) at which point the next alarm clearing "unsuppresses" the alarm. The alarm log records indicate when an alarm suppression is started and ended. The default values are 8 occurrences in 240 seconds.

The data points monitored for the alarm log are as shown in the tables below. Note that the alarm limits are themselves data points. The user-settable alarm limits are listed by data point name. Non-settable alarm limits are listed by data point value.

Table 6-27: Alarm log monitored data points

Data point	Low alarm limit	High alarm limit
GainA1, GainA2, GainB1, GainB2, GainC1, GainC2, GainD1, GainD2	GainLowLmt	GainHighLmt
AvgSndVel	AvgSoundVelLoLmt	AvgSoundVelHiLmt
SpecFlowPressure	LowPressureAlarm	HighPressureAlarm
SpecFlowTemperature	LowTemperatureAlarm	HighTemperatureAlarm
LiveFlowPressure	LowPressureAlarm	HighPressureAlarm
LiveFlowTemperature	LowTemperatureAlarm	HighTemperatureAlarm
AvgFlow	MeterMaxNegVel	MeterMaxVel
SysTemp	-40 °C	100 °C
SysVoltage1V	0.90 V	1.10 V
SysVoltage1V2	1.08 V	1.32 V
SysVoltage2V5	2.225 V	2.775 V
SysVoltage3V3	2.937 V	3.663 V

Table 6-28: Alarm log Boolean alarm limit

Data point	Boolean alarm unit
IsClkInvalid	TRUE
SpecFlowTemperature	TRUE
SpecFlowPressure	TRUE
PressureInvalid	TRUE
TemperatureInvalid	TRUE
AGA8BaseCalcStatus	TRUE
AGA8BaseCalcValidity	FALSE
AGA8FlowCalcStatus	TRUE
AGA8FlowCalcValidity	FALSE
IsAcqModuleError	TRUE
AvgFlow	TRUE
IsMeterVelAboveMaxLmt	TRUE
AvgSndVel	TRUE
IsAvgSoundVelRangeErr	TRUE
QMeterValidity	FALSE
QFlowValidity	FALSE
QBaseValidity	FALSE
DidColdStart	TRUE
IsMeasSndSpdRange<A..D>	TRUE

Table 6-28: Alarm log Boolean alarm limit *(continued)*

Data point	Boolean alarm unit
IsAcqMode	TRUE
IsTooFewOperChords	TRUE
IsHardFailed<A..D>	TRUE
Freq1DataValidity	FALSE
Freq2DataValidity	FALSE
SysTemp	TRUE
SysVoltage2V5	TRUE
SysVoltage3V3	TRUE
IsHourlyLogFull	TRUE
IsDailyLogFull	TRUE
IsAuditLogFull	TRUE
IsSystemLogFull	TRUE
IsAcqModuleIncompatible	TRUE
LiveFlowPressure	TRUE
LiveFlowTemperature	TRUE
IsSndVelCompErr	TRUE
EnergyRateValidity	FALSE
AreGasPropertiesInvalidInUse	TRUE
AreGasPropertiesInvalidInUseLatched	TRUE
AreGasPropertiesInvalidGC	TRUE
GCCommStatus	TRUE
IsGCCommErr	TRUE
IsGCDataErr	TRUE
IsGCAlarmPresent	TRUE
MassRateValidity	FALSE
AO1IsSaturated	TRUE
AO2IsSaturated	TRUE
AO1DataValidity	FALSE
AO2DataValidity	FALSE
AreSwComponentsCompatible	TRUE
IsAcqModuleErrorLatched	TRUE
IsAcqModeLatched	TRUE
IsTooFewOperChordsLatched	TRUE
TemperatureInvalidLatched	TRUE
PressureInvalidLatched	TRUE
IsMeterVelAboveMaxLmtLatched	TRUE

Table 6-28: Alarm log Boolean alarm limit *(continued)*

Data point	Boolean alarm unit
IsAvgSoundVelRangeErrLatched	TRUE
IsBlockageDetected	TRUE
IsBlockageDetectedLatched	TRUE
IsBoreBuildupDetected	TRUE
IsBoreBuildupDetectedLatched	TRUE
IsLiquidDetected	TRUE
IsLiquidDetectedLatched	TRUE
IsAbnormalProfileDetected	TRUE
IsAbnormalProfileDetectedLatched	TRUE
IsReverseFlowDetected	TRUE
ReverseFlowVol	TRUE
IsFwdBaselineNotSet	TRUE
IsRevBaselineNotSet	TRUE
IsReverseFlowDetectedLatched	TRUE
IsSndVelCompErrLatched	TRUE
SysVoltage1V2	TRUE
SysVoltage1V	TRUE
SysVoltageAcqModule1V2	TRUE
SysVoltageAcqModule2V5	TRUE
SysVoltageAcqModule3V3	TRUE
SysTempAcqModule	TRUE
IsDiagnosticSndSpdRangeErr	TRUE
IsDiagnosticSndSpdRangeErrLatched	TRUE
IsXdcrFiringSyncError	TRUE
IsColocMeterCommErr	TRUE
IsColocMeterCommErrLatched	TRUE
IsColocMeterSndSpdRangeErr	TRUE
IsColocMeterSndSpdRangeErrLatched	TRUE
IsColocMeterQFlowRangeErr	TRUE
IsColocMeterQFlowRangeErrLatched	TRUE
IsChordLengthMismatched<A..D>	TRUE
DidResetUsers	TRUE

System log

The meter logs all system messages in the system log.

The meter can store up to 3000 system records. The user can select whether old, unread records can be overwritten by new records when the log becomes full via the data point **DoOverwriteUnreadSystemLog**.

This point can be modified using the MeterLink™ **Tools → Edit/Compare Configuration** screen. The default is to overwrite old, unread records. Refer to Options for reading audit, alarm, and/or system log records for information on reading records and marking records as read. The data point **IsSystemLogFull** indicates whether or not the system log is full and cannot overwrite old, unread records.

Repetitive system messages are prevented from filling up the system log. When a particular system message occurs three times within 60 seconds, that system message is suppressed until the message occurs less than three times within 60 seconds.

Note
The system log records indicate when a system message suppression is started and ended.

6.1.3 Reading log records

Rosemount 3810 Series Ultrasonic Flow Meter log records are read using the MeterLink **Logs/Reports → Meter Archive Logs** screen.

There are three log groups:

- Daily
- Hourly
- Event (audit, alarm, and systems logs)

Select the desired log group(s) via the **Collect daily log/Collect hourly log/Collect event log** check boxes. If the event group is selected, the audit, alarm, and system logs are individually selectable. Whenever any log is collected, the current meter configuration is also collected.

6.1.4 Options for reading daily and/or hourly log records

The options for reading daily and hourly log records are the same. The MeterLink **Logs/Reports → Meter Archive Logs** screen indicates the number of daily records that are available to read. Select the log type(s) to be collected via the **Collect daily log and/or Collect hourly log** check boxes.

Select whether to collect all log records or the last specified number of daily records. Also, select whether to collect all log data or just the data points required by the API Chapter 21 standard. Table 6-1 lists the daily log data points and Table 6-2.

For both tables, data points required by the API Chapter 21 standard are marked with an asterisk (*).

6.1.5 Options for reading audit, alarm, and/or system log records

The options for reading audit, alarm, and system log records are the same. The MeterLink™ **Logs/Reports → Meter Archive Logs** screen indicates the number of records available for each log type. Select whether to collect either all the records or just the last specified number of daily records for the selected log type.

6.1.6 Collecting and viewing log records

Three log formats are available:

- **Microsoft Excel** - This is the recommended format for collecting/saving log records in order to get the full benefits of the data logging feature. This option, however, is only available if Microsoft® Excel® is installed on the PC. The Excel® file generated by this utility has up to six worksheets depending upon the logs collected, including:
  - — Daily Log
  - — Hourly Log
  - — Alarm Log
  - — Audit Log
  - — System Log
  - — Meter Config

  The collected log data is also displayed on the screen.
- **Comma-separated values** - This format creates a file with data separated by commas. Each log record collected is put on a separate line in the file. Each log type is separated by a blank line. The meter configuration follows the log data separated by a blank line. The collected log data is also displayed on the screen.
- **Don't log to file** - This option will not save any of the collected log data to a file but will display it on the screen.

  1. After selecting the desired log type(s) and the log format, click on the **Collect** button to initiate the log data collection.
     - If a format that saves the data to a file is selected, then a Save As dialog box is opened to allow specifying the file name. A default file name is suggested but can be modified. A comment may also be entered to be included with the data file.
  2. If a log type to be read is configured so that unread records are not over-written, then MeterLink™ queries the user as to whether or not that log's records will be marked as 'read'.
  3. Once the data collection is completed, the data is displayed in the Meter Archive Logs dialog box one log type at a time. Select the log type to be displayed via the **View log** box. The data may be sorted by selecting either Oldest first or Newest first in the **Sort order** box.

6.1.7 Reading Hourly and Daily log records over Modbus

Log Registers

Flow computers/RTUs can read hourly and daily log records in the meter via the Modbus protocol. Reading a single hourly or daily log record requires multiple polls since the log record data cannot fit in a single Modbus response. Meter supports reading one hourly or daily log record at a time. Multiple clients can read an hourly or daily log record simultaneously.

Hourly and daily log record data is split into groups and each group is mapped to a Modbus register. Meter includes a series of registers for reading hourly and daily log record. To read a complete log record, a Modbus client should read all log registers defined for the log record one after the other.

Table 6-29:

Register #	Register Description	Gas 1-path	Gas 2-path	Gas 4-path
7201	Hourly Log Register for Common data points	Yes	Yes	Yes
7202	Hourly Log Register for Gas composition data points	Yes	Yes	Yes
7203	Hourly Log Register for Chord A data points	Yes	Yes	Yes
7204	Hourly Log Register for Chord B data points	Yes (1)	Yes	Yes
7205	Hourly Log Register for Chord C data points	NA	NA	Yes
7206	Hourly Log Register for Chord D data points	NA	NA	Yes
7207 - 7210	Reserved			
7211	Hourly Log Register for Volume snapshot data	Yes	Yes	Yes
7212 – 7224	Reserved for future use			
7226	Daily Log Register for Common data points	Yes	Yes	Yes
7227	Daily Log Register for Gas composition data points	Yes	Yes	Yes
7228	Daily Log Register for Chord A data points	Yes	Yes	Yes
7229	Daily Log Register for Chord B data points	Yes (1)	Yes	Yes
7230	Daily Log Register for Chord C data points	NA	NA	Yes
7231	Daily Log Register for Chord D data points	NA	NA	Yes
7232 - 7235	Reserved			
7236	Daily Log Register for Volume snapshot data	NA	NA	NA
7237 - 7249	Reserved for future use			

*(1) If **IsDiagnosticChordEnabled** is **TRUE**.*

Data contents of each group are documented in the ***Hourly and daily archive log registers*** section of the Modbus map PDF available at 3410 Modbus Map Reference Manual (00821-0100-3104).

Units System data point configuration must be appropriately set to the unit, US Customary or Metric units, in which log data must be read. Meter includes the log sequence number, date, and timestamp in the response of each Modbus log register read operation which helps to know whether multiple sequential polls are done for the same log record or not. Date in the response is a 32-bit integer value in YYYYMMDD format and timestamp is also a 32-bit integer value in HHMMSS format.

Below is an example to read hourly log register for chord A data.

Note
Request and response data in the examples is in RTU data format.

Request

For reading log registers function code 03 is used.

Request register #7203 (1C23 hex) for the hourly log register for Chord A data points.

Field: **Quantity of registers** must specify the log index in hourly log table whose data must be read.

Below command is requesting the hourly log register for Chord A data for log index 30 from the hourly log table from slave device with address 32.

20 03 1C23 001E 3529

20: Slave address

03: Function code

1C23: Hourly log register for Chord A data (1C23 hex = 7203 decimal)

001E: Log index of 30

3529: CRC

Response

Meter's response to the hourly log register for Chord A data read is as below.

20 03 3C 00 00 10 FF 01 34 D8 1B 00 01 11 70 3D 47 D5 FE 44 B8 EE CB BF E4 31 CD 40 BF 5A CC 3F 80 AD 46 00 64 00 64 42 C7 14 CC 42 C7 14 CC 42 68 58 05 42 66 00 18 3B C7 D6 BB 3B E0 A9 04 72 11

20: Slave address

03: Function code

3C: Data bytes to follow in the response excluding CRC bytes (3C hex = 60 decimal)

00 00 10 FF: Sequence number

01 34 D8 1B: Date

00 01 11 70: Time

3D 47 D5 FE: TurbulenceA

44 B8 EE CB: SndVelA

BF E4 31 CD: SndVelDiffA

40 BF 5A CC: FlowVelA

3F 80 AD 46: FlowVelRatioA

00 64: PctGoodA1

00 64: PctGoodA2

42 C7 14 CC: GainA1

42 C7 14 CC: GainA2

42 68 58 05: SNRA1

42 66 00 18: SNRA2

3B C7 D6 BB: NoiseAmplitudeA1

3B E0 A9 04: NoiseAmplitudeA2

72 11: CRC

Meter shall respond with zero for requests to read log registers that are not applicable to the device type. For example, if reading hourly log register for Chord C data (7205) is requested on 3412 meter, then meter will respond with 0.

Exception Response

If a log register read request is made for a log index at which there is no log record in the log table, or if the log index is invalid, then meter will return error response: **Illegal data value**.

20 83 03

20: Slave address

83: Function code

03: Exception code **Illegal Data Value**

Log Index Registers

Flow computers/RTUs can also read the log index of the most recently generated hourly or daily log record in the meter. Log index is the index of a circular buffer where the most recently generated log record is written. Meter supports maximum of 4320 hourly log records and 1825 daily log records. Hence the hourly log index can have values from 1 to 4320 and daily log index from 1 to 1825. Meter has two Modbus registers to read log index for hourly and daily log table.

Register #	Register Description
7200	Hourly Log Index Register
7225	Daily Log Index Register

Client can periodically read this index and store it locally, so that it can know when it has new log records to read from the meter. Knowing the log index of the most recently generated log record, client can read any available log record from the meter. If meter returns log index as zero it means that the log table is empty i.e., there are no log records for the log type in the meter.

Below is an example to read the daily log index register. Note that request and response data in the examples is in RTU data format.

Request

For reading the log index registers, function code 03 is used.

Request register #7225 (1C39 hex) for the daily log index register.

Field: **Quantity of register**s must specify 1 since the log index register is **INT** type.

Below command is requesting the log index of most recently generated daily log record in the daily log table from slave device with address 32.

20 03 1C39 0001 5526

20: Slave address

03: Function code

1C39: Daily log index (1C39 hex = 7225 decimal)

0001: 1 register to read

5526: CRC

Response

Meter's response to the daily log index register read is as below.

20 03 02 027E 8503

20: Slave address

03: Function code

02: Bytes to follow in response excluding CRC

027E: Read log index of the most recently generated daily log record in the meter (027E hex = 638 decimal)

8503: CRC

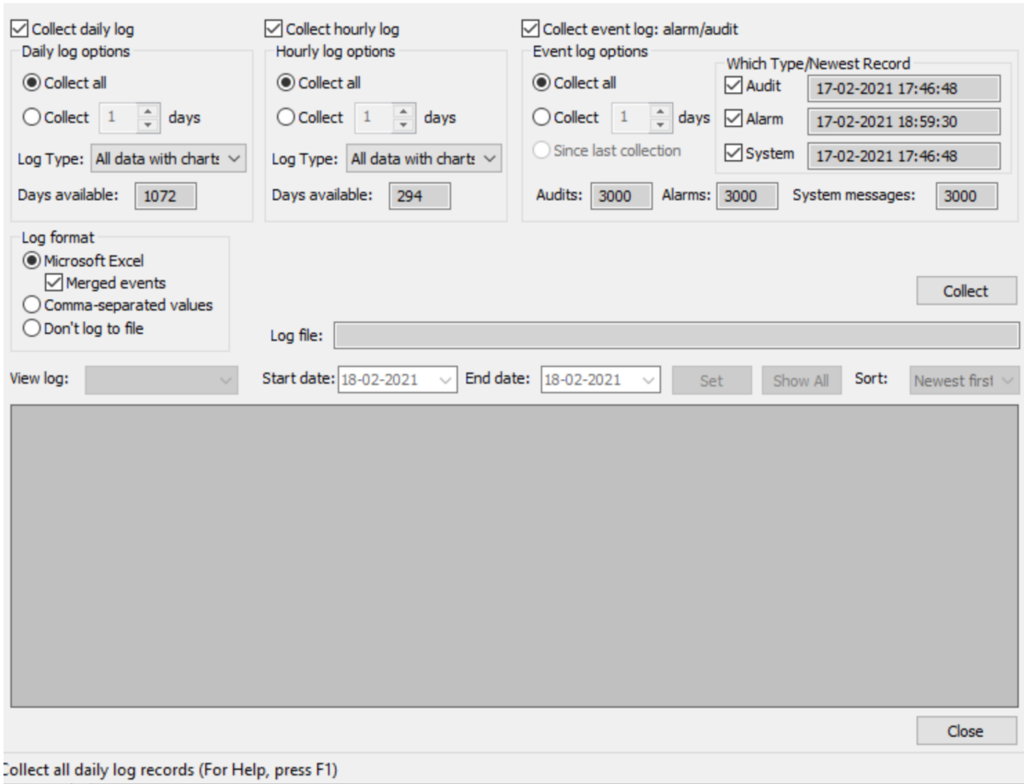
6.1.8 Collect meter archive logs

Collect meter archive logs allows you to collect historical log information from an ultrasonic meter. This dialog box is only available while connected to a meter.

Select the checkboxes for the types of logs you will collect. All of the logs will be collected into a single Archive log file. The Log format can be selected as either Microsoft® Excel®, Comma-separated values, and **Don't log to file**. The **Don't log to file** option will not save any of the log data to file but will only display it on the screen.

The meter configuration is always collected and included into the archive log file. Select the desired log options and click **Collect**. MeterLink™ opens a Save As dialog box to allow you to choose a name for the Archive log. A default name based on the Meter Name, type of logs collected, and PC date and time is suggested. Change the name or default location if desired.

Figure 6-1: Meter Archive Logs



6.1.9 Reading Hourly and Daily log records over Modbus (only available in firmware v1.70 and later)

Log Registers

Flow computers/RTUs can read hourly and daily log records in the meter via the Modbus protocol. Reading a single hourly or daily log record requires multiple polls since the log record data cannot fit in a single Modbus response. Meter supports reading one hourly or daily log record at a time. Multiple clients can read an hourly or daily log record simultaneously.

Hourly and daily log record data is split into groups and each group is mapped to a Modbus register. Meter includes a series of registers for reading hourly and daily log record. To read a complete log record, a Modbus client should read all log registers defined for the log record one after the other.

Register #	Register Description	Gas 1-path	Gas 2-path	Gas 4-path
7201	Hourly Log Register for Common data points	Yes	Yes	Yes
7202	Hourly Log Register for Gas composition data points	Yes	Yes	Yes

Register #	Register Description	Gas 1-path	Gas 2-path	Gas 4-path
7203	Hourly Log Register for Chord A data points	Yes	Yes	Yes
7204	Hourly Log Register for Chord B data points	Yes	Yes	Yes
7205	Hourly Log Register for Chord C data points	Yes	Yes	Yes
7206	Hourly Log Register for Chord D data points	Yes	Yes	Yes
7207 - 7210	Undefined			
7211	Hourly Log Register for Accumulator snapshot data	Yes	Yes	Yes
7212 – 7224	Reserved for future use			
7226	Daily Log Register for Common data points	Yes	Yes	Yes
7227	Daily Log Register for Gas composition data points	Yes	Yes	Yes
7228	Daily Log Register for Chord A data points	Yes	Yes	Yes
7229	Daily Log Register for Chord B data points	Yes	Yes	Yes
7230	Daily Log Register for Chord C data points	Yes	Yes	Yes
7231	Daily Log Register for Chord D data points	Yes	Yes	Yes
7232 - 7235	Undefined			
7236	Daily Log Register for Accumulator snapshot data	Yes	Yes	Yes
7237 - 7249	Reserved for future use			

Data contents of each group are documented in the ***Hourly and daily archive log register***s section of the Modbus map PDF available at 3410 Modbus Map Reference Manual (00821-0100-3104).

UnitsSystem data point configuration must be appropriately set to the unit, US Customary or Metric units, in which log data must be read. Meter includes the log sequence number, date, and timestamp in the response of each Modbus log register read operation which helps to know whether multiple sequential polls are done for the same log record or not. Date in the response is a 32-bit integer value in YYYYMMDD format and timestamp is also a 32-bit integer value in HHMMSS format.

Below is an example to read hourly log register for chord A data. Note that request and response data in the examples is in RTU data format.

Request

For reading log registers function code 03 is used.

Request register #7203 (1C23 hex) for the hourly log register for Chord A data points.

Field “Quantity of registers” must specify the log index in hourly log table whose data must be read.

Below command is requesting the hourly log register for Chord A data for log index 30 from the hourly log table from slave device with address 32.

20 03 1C23 001E 3529

20: Slave address

03: Function code

1C23: Hourly log register for Chord A data (1C23 hex = 7203 decimal)

001E: log index of 30

3529: CRC

Response

Meter’s response to the hourly log register for Chord A data read is as below.

20 03 3C 00 00 10 FF 01 34 D8 1B 00 01 11 70 3D 47 D5 FE 44 B8 EE CB BF E4 31 CD 40 BF 5A CC 3F 80 AD 46 00 64 00 64 42 C7 14 CC 42 C7 14 CC 42 68 58 05 42 66 00 18 3B C7 D6 BB 3B E0 A9 04 72 11

20: Slave address

03: Function code

3C: Data bytes to follow in the response excluding CRC bytes (3C hex = 60 decimal)

00 00 10 FF: Sequence number

01 34 D8 1B: Date

00 01 11 70: Time

3D 47 D5 FE: TurbulenceA

44 B8 EE CB: SndVelA

BF E4 31 CD: SndVelDiffA

40 BF 5A CC: FlowVelA

3F 80 AD 46: FlowVelRatioA

00 64: PctGoodA1

00 64: PctGoodA2

42 C7 14 CC: GainA1

42 C7 14 CC: GainA2

42 68 58 05: SNRA1

42 66 00 18: SNRA2

3B C7 D6 BB: NoiseAmplitudeA1

3B E0 A9 04: NoiseAmplitudeA2

72 11: CRC

Meter shall respond with zero for requests to read log registers that are not applicable to the device type. For example, if reading hourly log register for Chord C data (7205) is requested on 3412 meter, then meter will respond with 0.

Exception Response

If a log register read request is made for a log index at which there is no log record in the log table, or if the log index is invalid, then meter will return error response "Illegal data value".

20 83 03

20: Slave address

83: Function code

03: Exception code "Illegal Data Value"

Log Index Registers

Flow computers / RTUs can also read the log index of the most recently generated hourly or daily log record in the meter. Log index is the index of a circular buffer where the most recently generated log record is written. Meter supports maximum of 4320 hourly log records and 1825 daily log records. Hence the hourly log index can have values from 1 to 4320 and daily log index from 1 to 1825. Meter has two Modbus registers to read log index for hourly and daily log table.

Register #	Register Description
7200	Hourly Log Index Register
7225	Daily Log Index Register

Client can periodically read this index and store it locally, so that it can know when it has new log records to read from the meter. Knowing the log index of the most recently generated log record, client can read any available log record from the meter. If meter returns log index as zero it means that the log table is empty i.e., there are no log records for the log type in the meter.

Below is an example to read the daily log index register. Note that request and response data in the examples is in RTU data format.

Request

For reading the log index registers function code 03 is used.

Request register #7225 (1C39 hex) for the daily log index register.

Field "Quantity of registers" must specify 1 since the log index register is INT type.

Below command is requesting the log index of most recently generated daily log record in the daily log table from slave device with address 32.

20 03 1C39 0001 5526

20: Slave address

03: Function code

1C39: Daily log index (1C39 hex = 7225 decimal)

0001: 1 register to read

5526: CRC

Response

Meter’s response to the daily log index register read is as below.

20 03 02 027E 8503

20: Slave address

03: Function code

02: Bytes to follow in response excluding CRC

027E: Read log index of the most recently generated daily log record in the meter (027E hex = 638 decimal).

8503: CRC

6.2 Smart Meter Verification

The Rosemount 3410 Series Firmware v1.50 and later, supports Smart Meter Verification feature. Smart Meter Verification is a performance-diagnostic tool for Rosemount Ultrasonic Flow Meters as it delivers confidence in measurement integrity and performance by helping you to quickly identify and resolve meter or process issues. Using meter’s hourly logs, the meter can generate Scheduled or On-Demand reports to monitor performance indicators like speed of sound, speed of sound spread, swirl angle, crossflow, profile factor, symmetry, turbulence, etc. over a period. No additional hardware or feature keys are required to use this feature. The feature is supported on 3414 (Gas 4-Path), 3418 (Gas 8-Path), 3415 (4-path head only), 3416 (4-path head only) and 3417. The meter can store 20 Smart Meter Verification reports in non-volatile memory of the meter. This includes a maximum of five On-Demand reports.

6.2.1 Smart Meter Verification report types

Smart Verification reports can be created in two ways.

MeterLink™ Software v1.80 and later, is required to collect Smart Meter Verification reports.

- Scheduled – Meter automatically generates reports. This is enabled by default and generated at midnight (where midnight is understood to be the start of the day) of the first day of every month using data from hourly log records of the previous calendar month.
- On-Demand – MeterLink™ can request meter to generate a report. This is created with hourly log records between the user specified start date and end date.

6.2.2 Replacing Smart Meter Verification reports

1. When an **On-Demand** report is created and five already exist, the oldest created **On-Demand** report will be deleted instead of the oldest created of all reports.
2. When a new **On-Demand** report is created and 20 total reports already exist, but five **On-Demand** reports do not exist, the oldest created report will be deleted. The deleted report could be either be **Scheduled** or **On-Demand**.
3. When a **Scheduled** report is created and 20 total reports already exist, the oldest created report will be deleted. The deleted report could be either **Scheduled** or **On-Demand**.

6.2.3 Smart Meter Verification report result

The report result is based on whether any alarm(s) is/are active during the report period. Rosemount Ultrasonic Meter alarms are divided in two groups, Meter and Process. These two groups have further subgroups for alarms:

- Alarms which represent issue with meter functioning like electronics, transducer, uncorrected volumetric flow rate measurement etc. are grouped under Meter group.
- Alarms which indicate a process issue like corrected volumetric flow rate calculation, gas composition, pressure and temperature etc. are grouped under Process group.

Mapping of alarms in groups and subgroups, where **W** is a **Warning** and **F** is a **Fail**:

Table 6-30: Report result

Meter alarm group		Process alarm group	
Alarm subgroup	**Alarm**	**Alarm subgroup**	**Alarms**
Configuration	IsWarmStartReq(F) IsChordLengthMismatched<A..H>(F) DidCnfgChksumChg(W)	Base-condition volumetric flow rate	QBaseValidity(W)
Electronics	DidColdStart(F) IsCorePresent(F) WatchDogReset(F) IsAcqModuleError(F) IsAcqModuleIncompatible(F) IsXdcrFiringSyncError(W) IsClkInvalid(W) IsColocMeterCommErr(W) DidPowerFail(F) IsElecTempOutOfRange(W) IsElecVoltOutOfRange(W) IsHourlyLogFull(W) IsDailyLogFull(W) IsAuditLogFull(W) IsAlarmLogFull(W) IsSystemLogFull(W) DidWarmStart(W) DidResetUsers(W)	Flow rate diagnostics	IsColocMeterQFlowRangeErr(W) IsReverseFlowDetected(W)
Flow-condition volumetric flow rate	IsTooFewOperChords(F) IsEstimatedFlowVelocityInUse(W) QFlowValidity(F)	Gas composition/ pressure/ temperature	PressureInvalid(W) TemperatureInvalid(W) AreGasPropertiesInvalidInUse(W) IsGCCommErr(W) IsGCDataErr(W) IsGCAlarmPresent(W)

Table 6-30: Report result *(continued)*

Meter alarm group		Process alarm group	
Alarm subgroup	**Alarm**	**Alarm subgroup**	**Alarms**
Performance	IsFailedForBatch<A..H>(W) IsHardFailed<A..H>(W) DidDltTmChkFail<A..H>(W) IsSigQltyBad<A..H>(W) DidExceedMaxNoise<A..H>(W) IsSNRTooLow<A..H>(W) DidTmDevChkFail<A..H>(W) IsSigDistorted<A..H>(W) IsPeakSwitchDetected<A..H>(W) IsSigClipped<A..H>(W)	Speed of sound diagnostics	IsSndVelCompErr(W) IsColocMeterSndSpdRangeErr(W) IsDiagnosticSndSpdRangeErr(W) IsAvgSoundVelRangeErr(W)
Speed of sound path spread	IsMeasSndSpdRange<A..H>(W)	Velocity diagnostics	IsMeterVelAboveMaxLmt(W) IsFwdBaselineNotSet(W) IsRevBaselineNotSet(W) IsBlockageDetected(W) IsBoreBuildupDetected(W) IsLiquidDetected(W) IsAbnormalProfileDetected(W) IsSevereFlowConditionDetected(W)
Transducers	IsAcqMode(F) IsBatchInactive<A..H>(W) IsXdcrMaintenanceRequired<A..H>(W)		

If result of all alarm subgroups is **Pass**, then overall report result shall be **Pass**. If at least one alarm subgroup result is **Warning** and no alarm subgroup result is **Fail**, then overall report result shall be **Warning**. If at least one alarm subgroup result is **Fail**, then overall report result shall be Fail.

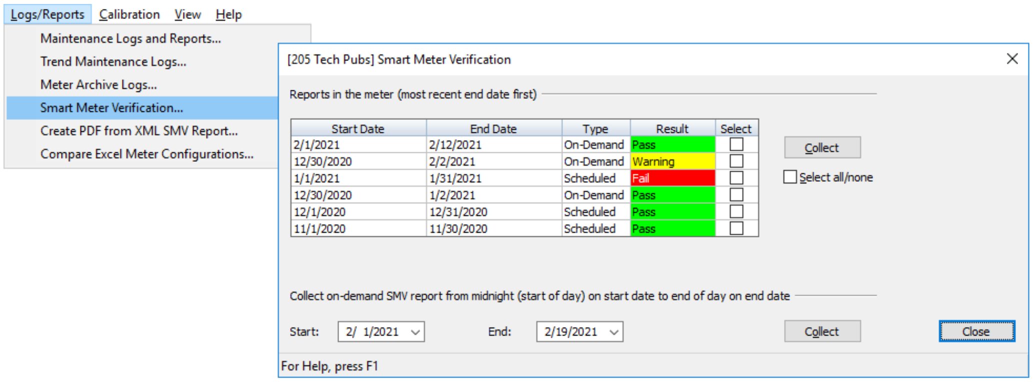
- A **Pass** result represents that no alarms were present during the report period. The meter and/or process conditions were within specified limits.
- A **Warning** result represents that alarms occurred during the report period that indicate that the meter or process conditions may have an impact on measurement accuracy.
- A **Fail** result represents alarms occurred during the report period that could indicate a loss of measurement validity or a reduction in measurement accuracy.

6.2.4 Collect Smart Meter Verification report

Collect Smart Meter Verification reports using Smart Meter Verification under the Logs/Reports menu in MeterLink.

Select the checkbox for the report to be collected. Alternatively, select **Select all/none** to collect reports from the meter. Click **Collect** under **Reports in the meter** and MeterLink™ will retrieve report and generate the PDF report.

Figure 6-2: MeterLink's Smart Meter Verification Dialog



6.2.5 Create On-Demand Smart Meter Verification report

Create an ***On-Demand Smart Meter Verification*** report using Smart Meter Verification under the Logs/Reports menu in MeterLink™.

At the bottom of the dialog enter the **Start** date and the **End** date as report period. Click **Collect** under **Collect on-demand SMV Report...** and the meter will generate the report and MeterLink will retrieve it and generate the PDF report. See Figure 6-2.

6.2.6 Daily Smart Meter Verification results on Modbus

Flow computers/RTUs can read daily Smart Meter Verifications results via the Modbus protocol. Registers include the result date (month, day, year), an overall **Pass**, **Warning**, or **Fail** result, and a **Pass**, **Fail**, or **Warning** result for each of the 11 meter and process condition alarm "subgroup" categories. The results are calculated at midnight using hourly log records of the previous day. The following registers are used to read daily SMV results on Modbus.

Table 6-31: Verification results

Register	Data point	Description	Type	Value
7424 / 15424	SMVDailyResultMonth	Daily SMV result month	int	Not calculated (0) or month of year
7425 / 15425	SMVDailyResultDay	Daily SMV result day	int	Not calculated (0) or day of month
7426 / 15426	SMVDailyResultYear	Daily SMV result year (2 digit)	int	Not calculated (0) or 2-digit year
7427 / 15427	DailyResult	Daily SMV result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)
7428 / 15428	DailyFlowVolFlowRateResult	Daily SMV flow-condition volumetric flow rate group result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)
7429 / 15429	DailyElectronicsResult	Daily SMV electronics group result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)
7430 / 15430	DailySpdSndPathSpreadResult	Daily SMV speed of sound path spread group result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)

Table 6-31: Verification results *(continued)*

Register	Data point	Description	Type	Value
7431 / 15431	DailyPerformanceResult	Daily SMV performance group result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)
7432 / 15432	DailyTransducersResult	Daily SMV transducers group result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)
7433 / 15433	DailyConfigurationResult	Daily SMV configuration group result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)
7434 / 15434	DailyBaseVolFlowRateResult	Daily SMV base-condition volumetric flow rate group result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)
7435 / 15435	DailyVelocityDiagnosticsResult	Daily SMV velocity diagnostics group result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)
7436 / 15436	DailySpdSndDiagnosticsResult	Daily SMV speed of sound diagnostics group result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)
7437 / 15437	DailyFlowRateDiagnosticsResu lt	Daily SMV flow rate diagnostics group result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)
7438 / 15438	DailyGasCompPresTempResul t	Daily SMV Gas composition/ pressure/temperature group result	int	Not calculated (0), Pass (1), Warning (2), Fail (3)

7 Commands

7.1 Tools commands

The MeterLink™ Tools menu commands provides the following utilities for the meter's health status, monitoring operational conditions, establishing a baseline of the meter's flow characteristics, updating the meter's program components and monitoring communications between MeterLink and the meter.

Table 7-1: MeterLink™ Tools menu

Command	Description
Edit/Compare Configuration	Open, edit, and compare configurations from files and meters.
Waveform Viewer	Collect, view, save, print ultrasonic waveforms from meter or file.
Gas SOS Calculator	Calculate speed of sound for a known gas composition.
Outputs Test	Test frequency, current, and digital outputs by fixing them to a set value.
Transducer Swap-Out	Adjust path length parameters when changing out transducers, stalks, holders, or mounts.
Set Baseline Wizard	Establishes the baseline for the meter's flow characteristics that can be used to monitor the heath of the meter run using Continuous Flow Analysis features.
Program Download	Upgrade the program components in Rosemount Ultrasonic meters.
Communications Analyzer	Monitor communications between MeterLink and a meter.
Locate Meter	Selecting this command will prompt: **Are you sure you want to locate the meter by displaying a pattern on its local display?** 1. • Click **Yes** to set the meter to display the 0-0-0-0 test pattern. • Click **No** to cancel the operation. **Note** As long as the **Locate Meter** dialog is open, the meter shall continue to display the test pattern. 2. Click **Close** to close the **Locate Meter** dialog and return the meter display back to normal operation.
Warm Start Meter	Selecting this command will prompt you: **Do you want to warm start the meter and disconnect from it now?** • Click Yes to force the meter to restart itself. A warm start is the same restart as when power is removed and reapplied to the meter. No configuration or archive log history is lost. Some configuration changes require a restart of the meter for the changes to take effect. • Click No to close the dialog.

Table 7-1: MeterLink™ Tools menu *(continued)*

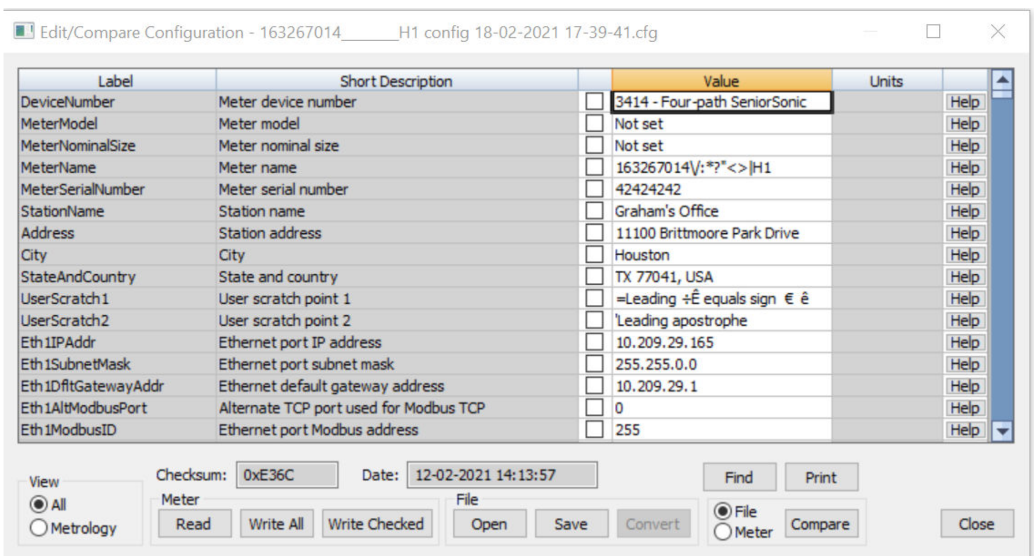
Command	Description
Set Transducer Type	1. Select the appropriate transducer type and click **Write** to reconfigure the meter for that transducer type. The “transducer type” may be a set of transducer types with compatible default tracking parameters. If any of the changes require a warm start, a message will be displayed indicating this. 2. • Click **Yes** to warm start the meter so the changes will take effect. It is highly recommended not to use this dialog unless a Emerson Flow service representative has instructed you to do so and has given you specific instructions on what actions to perform. • Click **Cancel** to close this dialog without making any changes to the meter configuration.
Reset Tracking	Displays the current tracking parameter values for Tspf, Tspe, and Tamp and allows the user to change them if needed. Click **Reset Tracking** to write any tracking parameter changes to the meter and reset the tracking operation in the meter. Emerson recommends not using this dialog unless a Emerson Flow service representative has instructed you to do so and has given you specific instructions on what actions to perform.
Reset Velocity Estimation	1. Selecting this command will prompt you, **Are you sure you want to reset chord proportions used for velocity estimation to their default values?** • Click Yes to return the chord proportions back to default values. • Click No to close this dialog without making any changes to the meter configuration. **Note** It is recommended not to use this dialog unless a Emerson Flow service representative has instructed you to do so and has given you specific instructions on what actions to perform.

Table 7-1: MeterLink™ Tools menu *(continued)*

Command	Description
Override Velocity Estimation Update Time	In normal operation, the meter must run for a period of time (PropUpdateSeconds) with no performance issues before it will begin to update chord proportions. This information is used to compensate for chord failures that may occur at a later point in time. However, there are times, such as during a flow calibration, that it is not desirable to wait the period of time before updates begin. Running the Override Velocity Estimation Update Time will force the meter to require only 24 consecutive batches before updates to the proportions are allowed. Any restart of the meter will force the meter to wait (PropUpdateSeconds) again before updates are allowed. During a flow calibration, it is necessary to run this command after every restart if a **chord failure test** is required at the end of the test. 1. To run this command, enter the **Passcode** 2. Click **Override**. 3. Click **Cancel** to close this dialog without making any changes to the meter configuration. **Note** This command will be disabled if unsupported in the meter.

7.1.1 Edit/Compare configuration parameters

Figure 7-1: Edit/compare configuration parameters



Dialog options include:

- View and edit configurations collected from the meter or opened from a file
- Write all or a portion of changed parameters of a configuration to a connected meter
- Comparing and converting legacy configurations
- Save and Print configurations

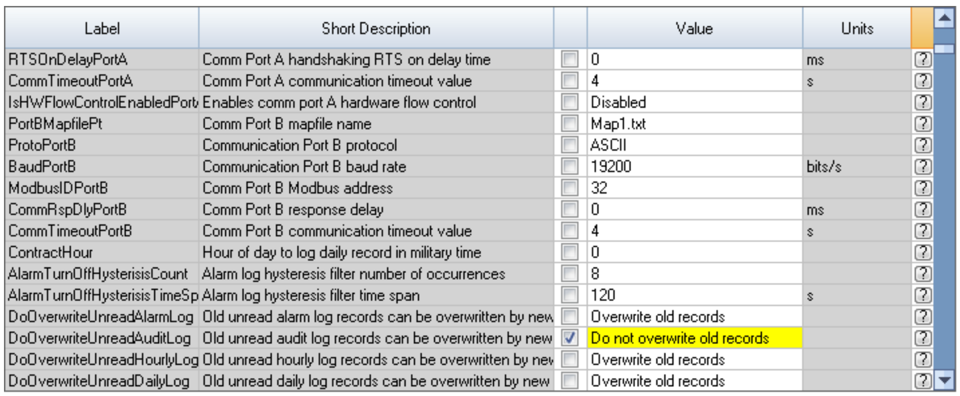
- **Find** button is used to find a data point using an alphabetically sorted list of data point labels

Procedure

1. Click **Read** to collect and display a configuration from a connected meter.
2. Click **ALL** to display the meter's extended configuration or Metrology to display only the metrology portion of the configuration.
3. Double-click the **Value** to change a parameter and select the option from the drop-down list, or if a caret is displayed, enter the value Figure 7-2.

   When changing a data register, the Value displayed in the dialog turns yellow and the check box is selected. You can later choose to only **Write Checked** values to the meter.

   Figure 7-2: Edit/compare configuration parameter changes

Label	Short Description		Value	Units
RTSOnDelayPortA	Comm Port A handshaking RTS on delay time	☐	0	ms
CommTimeoutPortA	Comm Port A communication timeout value	☐	4	s
IsHWFlowControlEnabledPort	Enables comm port A hardware flow control	☐	Disabled	
PortBMapfilePt	Comm Port B mapfile name	☐	Map1.txt	
ProtoPortB	Communication Port B protocol	☐	ASCII	
BaudPortB	Communication Port B baud rate	☐	19200	bits/s
ModbusIDPortB	Comm Port B Modbus address	☐	32	
CommRspDlyPortB	Comm Port B response delay	☐	0	ms
CommTimeoutPortB	Comm Port B communication timeout value	☐	4	s
ContractHour	Hour of day to log daily record in military time	☐	0	
AlarmTurnOffHysterisisCount	Alarm log hysteresis filter number of occurrences	☐	8	
AlarmTurnOffHysterisisTimeSp	Alarm log hysteresis filter time span	☐	120	s
DoOverwriteUnreadAlarmLog	Old unread alarm log records can be overwritten by new	☐	Overwrite old records	
DoOverwriteUnreadAuditLog	Old unread audit log records can be overwritten by new	☑	Do not overwrite old records	
DoOverwriteUnreadHourlyLog	Old unread hourly log records can be overwritten by nev	☐	Overwrite old records	
DoOverwriteUnreadDailyLog	Old unread daily log records can be overwritten by new	☐	Overwrite old records	

4. Click the **Question mark** icon in the final cell of the data point row to display the additional information.
5. Click **Write All** to write the full configuration to a meter. Depending on the View selected, the displayed configuration may not be the full configuration.
6. Click **Write Checked** to write only the values with a selected check box next to the value and are visible in the currently selected view.
7. Select any values to write and clear any values you don't want to write to the meter before clicking **Write Checked**.
8. Open a configuration in the editor and select **Meter** or select **File** to compare it to a configuration saved as a file.
9. Click **Compare** to either read the configuration from the meter or open the Open dialog box to select the configuration to compare to the one in the editor.

   Once the configurations are selected, a dialog displays, providing options to further customize the compare operation.

Figure 7-3: Compare Configurations Options dialog

- ***Exclude registers that are typically different:*** Includes items that could change regularly such as **SpecFlowPressure**, **SpecFlowTemperature**, Gas composition, etc. A complete list is defined in **reg_list_compare_config_exclude.txt** found under the installation directory for MeterLink™.
- ***Include read-only registers:*** Includes, in the compare, read-only registers stored in the collected configurations. This includes points like firmware version, K-factors, etc.

10. Click **Save** to save the configuration file. A default filename is provided based on the meter name, time, and date the configuration was collected. Keep the default name or change it. The file is saved, by default, to the Data folder directory defined under **Program Settings**. You may change the directory location if desired.
11. Click **Print** to print the configuration currently opened in the editor. Only the registers in the currently selected view will be printed. You can also click the print icon,  , on the tool bar to print the opened configuration.
12. Use **Convert** to download the configuration from a legacy Rosemount Ultrasonic meter to later generation of electronics.
    a) First connect to the legacy electronics.
    b) Collect and save the configuration using the Edit/Compare Configuration dialog box. Upgrade the electronics on the meter.
    c) Connect to the new meter electronics and open the Edit/Compare Configuration dialog.
    d) Open the configuration collected from the legacy electronics. The **Convert** button is enabled.
    e) Click **Convert** to read the configuration from the new meter.
    f) Modify it with the data from the legacy configuration.

    Note
    MeterLink™ displays this modified configuration in the dialog. At this point, MeterLink has not written anything to the new meter. All the values highlighted in yellow are values from the legacy configuration.

    g) Click **Write Checked** to write the changed portion of the configuration to the new meter.
    h) If any data point failed to be written, you must correct the invalid value and click **Write Checked** again until the configuration is written without any errors.

Note
Once the configuration is written, choose whether or not to compare the displayed configuration with the configuration in the meter by selecting **Meter** and clicking **Compare**. This will verify everything was written correctly.

7.1.2 Waveform viewer

View the transducer waveforms

Rosemount 3410 Series Gas Ultrasonic Flow Meters include a feature for streaming transducer waveforms that can be viewed using the MeterLink **Tools** → **Waveform Viewer** screen.

The speed at which the waveforms update is dependent upon the type of connection between the PC and the meter. With an Ethernet connection and MeterLink™, several updates per second are possible. With a serial connection, updates may occur only every 15 to 30 seconds.

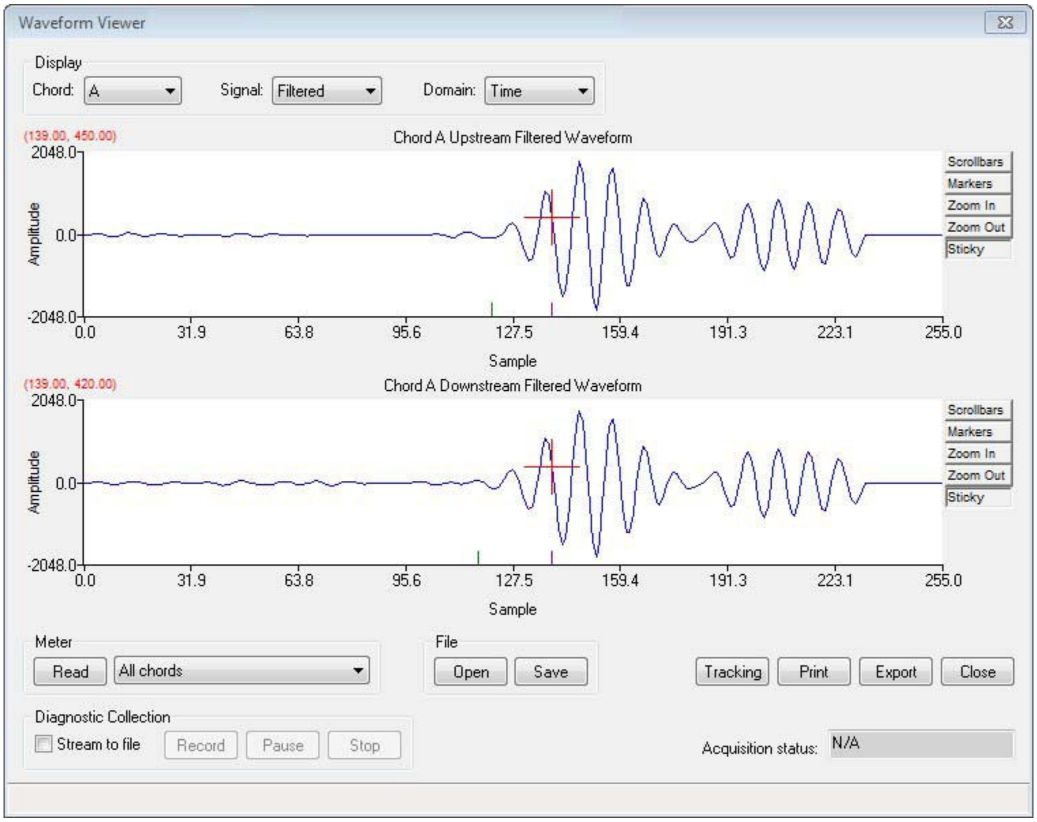
Up to three types of waveform signals can be displayed per chord:

- ***Raw -*** The sampled waveform received by the transducer (with gain applied)
- ***Stacked -*** The result of applying stacking to the raw signal(s). Note that when stacking is not used (**StackSize** is set to 1), the stacked signal is the same as the raw signal.
- ***Filtered -*** The result of applying the bandpass filter on the stacked signal. This waveform is only available when the filter is enabled (via the **Filter** data point).

For diagnostic purposes, the transducer waveform signals can be stored to a file using the **Diagnostic Collection - Stream to file** checkbox. This utilizes the Rosemount 3410 Series Gas Ultrasonic Flow Meter's patented "snapshot-and-playback" feature to accurately record the flow signals that can then be later reproduced for detailed analysis.

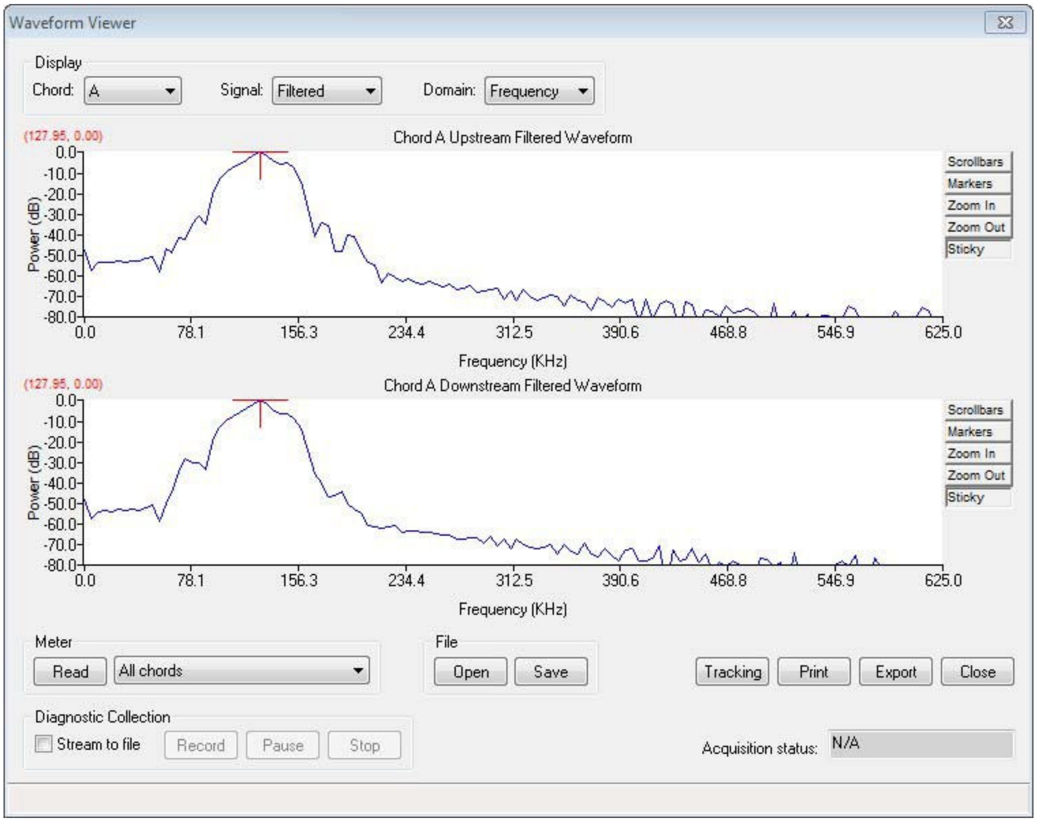
Waveforms are displayed in the time domain (e.g., the waveform signal is plotted against time).

Figure 7-4: Waveform viewer - time domain



The waveforms may also be displayed in the frequency domain. In this mode, a Fast Fourier Transform is taken of the waveform so that the frequency content of the waveform can be displayed. This can be useful in noisy environments to see the frequency of the noise and if it is in the range of the transducer signal.

Figure 7-5: Waveform viewer - frequency domain



Zero crossing and first motion markers

Two markers display along the horizontal axis for either the Stacked or Filtered waveform. If filtering is on, the markers will be on the Filtered waveform. If filtering is off, the markers will be on the Stacked waveform. The green marker shows the point where the first motion is detected. The purple marker shows the zero crossing which is the point that the meter uses as the arrival point of the signal.

Navigate the waveform viewer

Procedure

1. Select the waveforms to collect from the Meter box and click **Read**. Selections include:
   - All Chords
   - Chord A
   - Chord B
   - Chord C
   - Chord D
2. MeterLink™ starts to continuously stream waveforms from the meter.
3. Click **Save** while streaming waveforms or click **Stop** to open a Save As dialog box to allow you to choose a name for the Waveform file.

A default name based on the Meter Name, the type of waveform collected, and PC date and time is suggested.

4. Change the name or default location if desired. Click **Save** to accept the file name and save the last set of waveforms collected.
5. Click **Open** and select the Waveform filename from the Open dialog box to view a previously saved waveform.
6. Click **Tracking** to display the transducer's raw, filtered or stacked signal **Tracking Parameters** dialog for the selected chord.

Note
This dialog displays the parameter's label, value and units. Some of the Tracking parameters included are Gain, Hold time, Time (stamp), Maximum Signal Quality, Peak width, Peak Position, and Peak Zero Crossing for upstream and downstream signals. These parameters are used in the diagnostics of field conditions.

7. Click **Export** to save the waveforms displayed to Microsoft® Excel® format.

Note
The Excel file will contain three worksheets. The first worksheet called Charts contains charts for each of the waveforms collected. The second worksheet called Raw Data contains the waveform data to make the charts. The third worksheet called Tracking contains the tracking parameters for the chord.

8. Click **Close** to exit the Waveform Viewer.
9. Use Diagnostic Collection set of controls feature to capture a waveform snapshot to be played back on a simulator.

Note
This U.S. Patented feature is useful to allow Rosemount to reproduce any field specific conditions.

   a) Click the **Stream to file** checkbox and wait for the waveforms to start streaming to the screen. The meter is returning raw waveforms just as they are received without any stacking or filtering.

   b) Click **Record** to start saving all of the raw waveforms to file. The collection of waveforms can be paused and resumed without having to start a new file. Clicking **Stop** gives you the option to save the data collected to file. The file will have a .strm extension. There is no utility in MeterLink to playback these files. The files are only for use internally by Rosemount on special diagnostic tools. Clearing the **Stream to file** checkbox stops the streaming mode and returns the Waveform Viewer back to its normal mode of operation.

Note
The file created with the Diagnostic collection grows quite rapidly. Typically when connected via Ethernet to the meter, the file can easily take up 2.5 megabytes per minute. If the file must be e-mailed, many mail servers only allow 10 to 20 megabyte files or approximately 4 to 8 minutes of data.

10. Use the Chart utilities to control the waveform display. The controls for the waveform chart utility include:
    - *Scrollbar* - Enables horizontal and vertical scrollbars on the chart.
    - *Markers* - Displays markers for the series in order to see the data points collected.
    - *Zoom In* - Zooms in on both the horizontal and vertical scales centered on the cursor.

- *Zoom Out* - Zooms out on both the horizontal and vertical scales centered on the cursor.
- *Sticky* - Forces the cursor to stick to the waveform trace.
- *Other keyboard commands* - Use the keyboard commands as a shortcut to access the desired function. Right-click the mouse over the chart to display these commands or enter the keyboard command (Table 7-2).

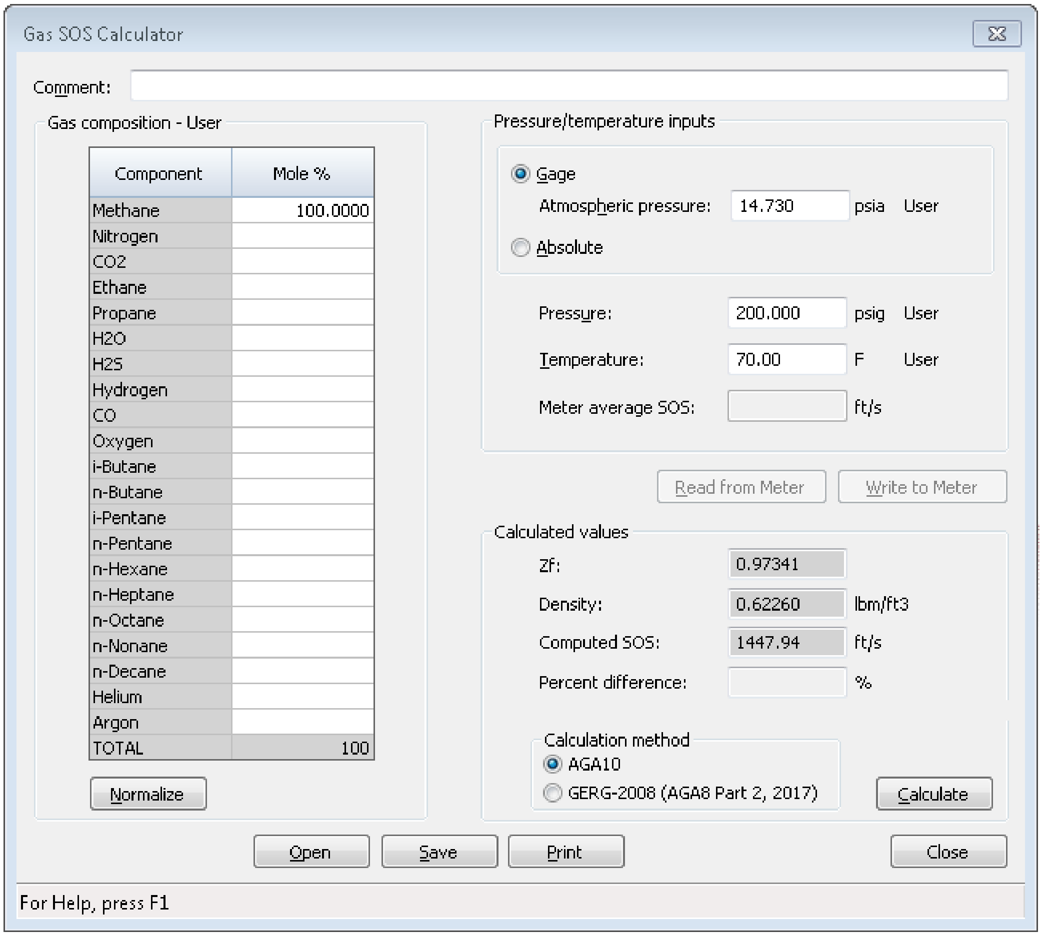
Table 7-2: Waveform chart keyboard commands

Function	Keystroke	Description
Save State	Ctrl + Home	Save the current zoom settings. These settings can be recalled with the Restore State command. Any saved settings are lost once the utility is closed.
Restore State	Home	Restores the last saved zoom settings.
Cursor to Nearest Point	F8	Moves the cursor to the nearest point displayed.
Toggle Coarse/Fine Cursor	F4	Toggles the cursor between and fast and slow moving cursor. The cursor is physically larger for the fast moving cursor.
Toggle Lines/Markers	F9	Toggles off the lines connecting the collected data and forces on the markers.
Toggle Mouse Position Tip	Ctrl+F4	Turns on tool tip showing the coordinates at which the mouse pointer in pointing.
Toggle Nearest Point Tip	Ctrl+F9	Turns on tool tip showing the coordinates of the nearest data point to the mouse pointer.
Print	Ctrl+P	Prints the displayed chart.
Copy to clipboard	Ctrl+C	Copies the displayed chart to the Windows clipboard as table data.
Paste from clipboard	Ctrl+V	Paste data from the Windows clipboard to the chart utility. The data must be in the appropriate format to correctly paste as a new series to the chart. Copy data from the chart to a text file to see the appropriate format.
Waveform Zoom	Ctrl+I	Turns on/off the zoom feature while in Waveform Read or Stream to file mode.

7.1.3 Gas SOS calculator

The SOS Calculator dialog box allows you to calculate a Speed of Sound (SOS) for a given gas composition and operating conditions.

Figure 7-6: Gas SOS Calculator



The SOS calculations are selectable as either AGA-10 (AGA Report No. 10 - May 2003) or GERG-2008 (AGA-8 Part 2, 2017). You do not need to be connected to a meter to use this utility. The units for the values displayed are defined in the **File** → **Program Settings** dialog.

Calculate SOS for the gas composition

Procedure

1. Enter the gas composition as percentages into the Gas composition inputs table.

   Note
   If you are connected to a Rosemount Gas Ultrasonic meter running AGA8 Detailed Method, the "In Use" gas composition is read from the meter and displayed in Gas composition inputs. It also indicates if the values are **Fixed** or **Live** from a GC, and if Live from a GC, the GC Start Cycle Time of the composition will be displayed.

2. Click **Normalize** to adjust the percentages so that the TOTAL gas composition equals 100%.

Note
The normalize operation maintains the ratios between the different components.

Note
If connected to a meter with pressure or temperature set to **Fixed** or **Live**, the values are read from the meter and entered in the Pressure/temperature inputs. If not connected, enter the Pressure and Temperature for the gas. Pressure can be entered as either absolute or gauge.

3. Select the desired pressure type. If **Gage** is selected for pressure type, enter in the Atmospheric pressure.

Note
The label after the units for Pressure and Temperature is set as follows:

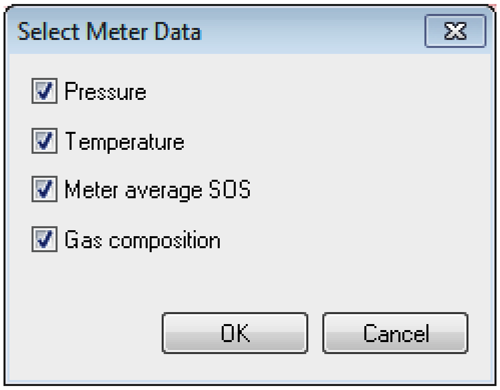
- *User*: The value was entered manually or imported from a saved file.
- *Fixed*: The value was read from a meter with the value set as Fixed.
- *Live*: The value was read from a meter with the value read from a Live sensor.
- *Frozen*: Indicates the value is frozen on the last good reading before going either into alarm or calibration.

Note
If you are connected to a meter, the Meter average SOS will always be read from the meter and displayed.

4. While connected to a meter, click **Read from Meter** to open a prompt window asking which information is to be updated for Pressure, Temperature, Meter average SOS, and Gas Composition.

Note
Only available options will be enabled.

Figure 7-7: Select Meter Data dialog



5. In addition to reading values from a meter, click **Write to Meter** to display a dialog to give you the option to write Pressure, Temperature, and Gas Composition to the meter.

Note
Only available options will be enabled. Pressure and Temperature must be set to **Fixed** in the meter to enable the selections to write these values to the meter.

Likewise, to enable the Gas Composition selection, a meter must be configured for AGA 8 Detailed Method. If no options are available, the **Write to Meter** button will be grayed out.

6. Once the gas composition and operating conditions are entered, click **Calculate** to compute the Compressibility (Zf), Density, and Computed SOS.
   If connected to a meter the Percent difference will show the percent error from the Average meter SOS to the Computed SOS.
7. Enter a **Comment** to associate with the SOS calculation.
   The comment is included in saved gas composition files and print outs.
8. Click **Save** to save the meter name if connected to a meter, Company Name as set under **File → Program Settings**, Date, and Time based on the PC clock, Comment, Gas composition inputs, Pressure/temperature inputs, and Calculated values to a comma-separated values (.csv) file.
9. Click **Open** to select a saved gas composition file to bring into the SOS Calculator. Only the Gas composition inputs, Pressure/temperature inputs, and Comment are imported from a saved file.
10. Click **Calculate** to compute the calculated values.

Note
The SOS Calculator can open the comma-separated value files exported from MON2020 or MON2000 Software for Gas Chromatographs Calculation Results screen. If you have customized any of the component names in the gas chromatograph you will need to modify the SOS Calculator's map file. MeterLink™ lists any component names that cannot be processed.

11. Click **Print** to print the Meter name if connected to a meter, Company name as set under Program Settings, Date and Time based on the PC clock, Comment, Gas composition inputs, Pressure/temperature inputs, and Calculated values.
12. If the SOS Calculator was launched from Maintenance Logs and Reports, click **Finish** to accept the calculation and finish creating the Maintenance log. Click **Cancel** to skip the computed SOS and continue making the Maintenance log.
13. If the SOS Calculator was launched from the **Tools → SOS Calculator** menu, click **Close** to return to the Main window of MeterLink.

7.1.4 Outputs test

The Outputs Test dialog box allows you to monitor the live values of all the frequency, current and digital outputs. Additionally, the outputs can be set into a Test mode to force the outputs to a specific user defined value. This dialog box is only available while connected to a meter.

Refer to Outputs test mode in this manual for additional information about the Outputs Test Mode.

7.1.5 Transducer swap-out

The transducer swap-out utility allows you to update parameters such as path lengths, delay times, and delta times for chord. This is necessary anytime transducers, mounts, holders, or stalks have to be replaced for a chord.

Refer to the (Rosemount 3410 Series Gas Ultrasonic Flow Meters Maintenance and Troubleshooting Manual 00809-0200-3104, Sections 3.3 - 3.6) for detailed instructions for replacing the transducers, mounts and stalks and setting the parameters for the pairs of transducers you replaced.

7.1.6 Baseline viewer

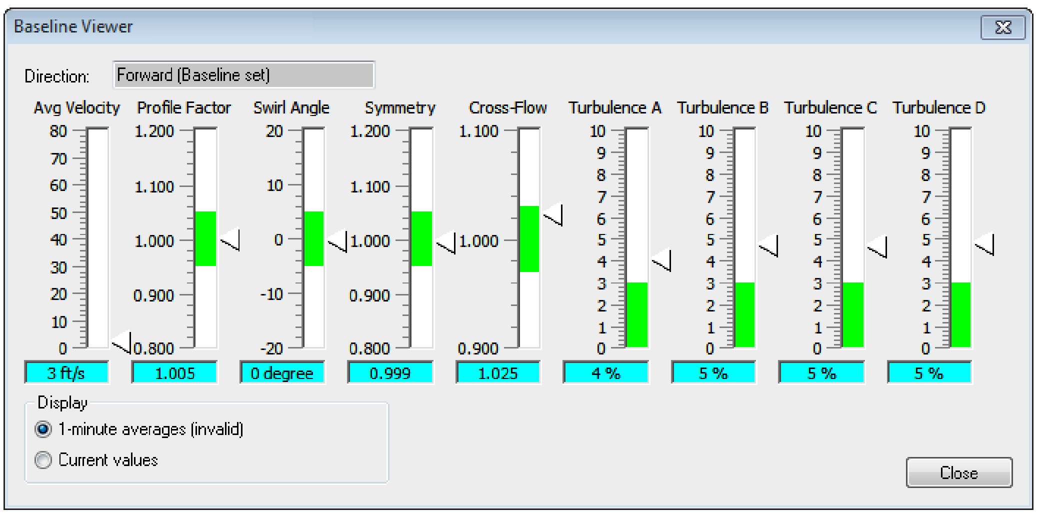
Use the Baseline viewer to monitor the meter's flow direction and flow characteristics including:

- Flow Velocity
- Profile Factor
- Swirl Angle
- Symmetry
- Cross-flow
- Path Turbulences

Access the Baseline viewer from the **Meter → Monitor (Detailed)** dialog while connected to your meter.

Note
You must have a valid Continuous Flow Analysis key to enable this feature. See Set baseline parameters to configure the baseline parameters for your meter using the **Tools → Set Baseline Wizard** menu.

Figure 7-8: Baseline viewer



The Baseline viewer indicates the current flow direction, forward or reverse, and gauges display the flow characteristics of the meter. The Baseline viewer dialog displays a horizontal "green zone" that indicates the expected value range. As an example, Figure 7-8 depicts out-of-range values for turbulence on all four chords.

Read the baselines viewer gauge values

Table 7-3 describes the values for each gauge and how the green zones are defined.

Table 7-3: Baseline viewer gauge values

Value	Description
Avg Velocity	Displays the average flow velocity for the meter. This gauge contains no green zone.

Table 7-3: Baseline viewer gauge values *(continued)*

Value	Description
Profile Factor	Displays the velocity flow profile factor for the meter. The profile factor is calculated from the chordal velocities as ((VelocityB+VelocityC)/(VelocityA+VelocityD)). The green zone is centered on the profile factor set in the baseline ± the percentage defined by Profile factor limit configurable in the **Field Setup Wizard** on the Continuous Flow Analysis page.
Swirl Angle	Displays the swirl angle in degrees for the meter. The green zone is centered on the swirl angle set in the baseline ± 5%.
Symmetry	Displays the symmetry for the meter. The symmetry is calculated from the chordal velocities as ((VelocityA+VelocityB)/(VelocityC+VelocityD)). The green zone is centered on the Symmetry set in the baseline ± the percentage defined by Symmetry limit configurable in the **Field Setup Wizard** on the Continuous Flow Analysis page.
Cross-Flow	Displays the cross-flow for the meter. The cross-flow is calculated from the chordal velocities as ((VelocityA+VelocityC)/(VelocityB+VelocityD)). The green zone is centered on the cross-flow set in the baseline ± the percentage defined by Cross-flow limit configurable in the **Field Setup Wizard** on the Continuous Flow Analysis page.
Turbulence A through D	Displays the percent turbulence values for each path of the meter. The green zone extends for 0% to the Chord turbulence limit configurable in the **Field Setup Wizard** on the Continuous flow analysis page.

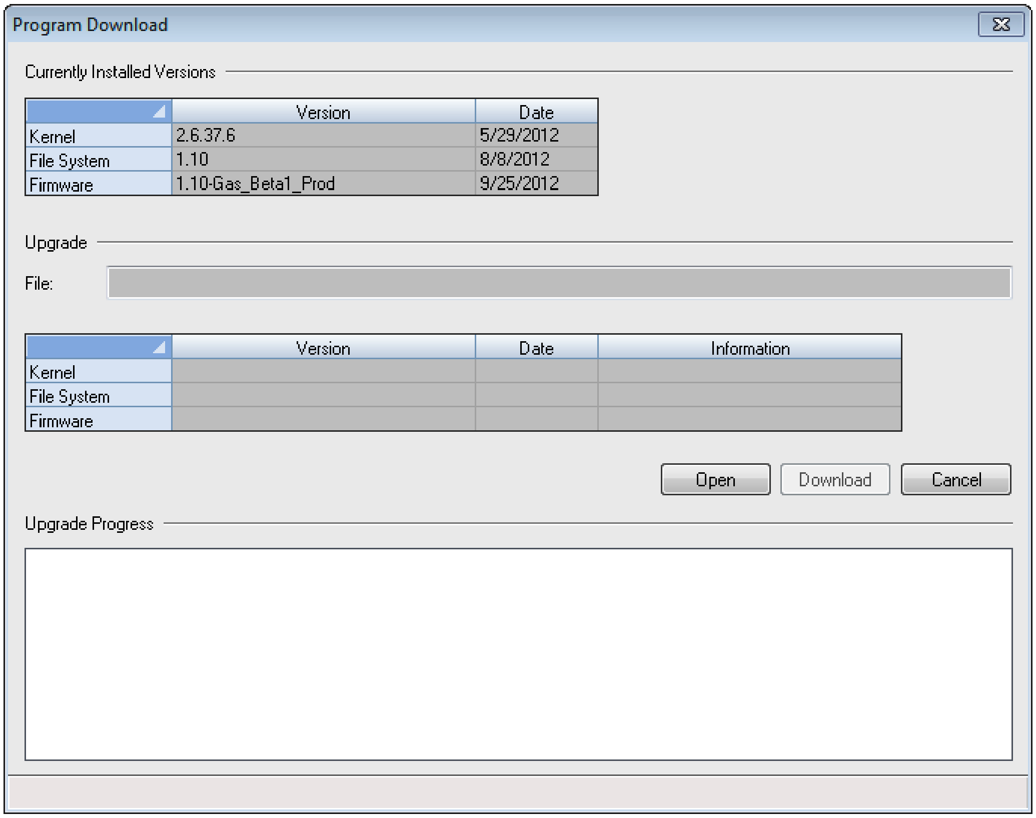
Display	Description
1-minute averages	Selecting 1-minute averages will make the gauges display a one minute rolling average. Next to this selection will be an indication if the one minute average values are valid or invalid. For the averages to be valid, the meter must meet the following criteria for at least one full minute: flowing in only one direction, no chord failures or inactive chords present and flowing within the Flow limits configurable in the **Field Setup Wizard** on the Continuous Flow Analysis page.
Current values	Displays the most recently calculated values.

7.1.7 Upgrade program components

Use the MeterLink™ **Tools** → **Program Download** dialog to upgrade the program components in Rosemount Ultrasonic meter. When the dialog is first opened, the Currently Installed Versions table will show the currently installed program components in the meter.

The firmware to download to a meter is available as a compressed file with a .zip extension. MeterLink unzips the file when it is opened.

Figure 7-9: Program download dialog



Procedure

1. Click **Open** to display an ***Open Download File*** dialog and select the desired file and click **Open**.
   The filename displays in the File edit box under Upgrade. The version and date of the components to download display in the table under Upgrade. All of the components will be identified as if they are older, newer, or the same as what is currently installed in the meter.
2. MeterLink only downloads components that are different than what is currently installed in the meter. At least one component must be different for download before the **Download** button is enabled.
3. Click **Download** to initiate the download process. MeterLink collects the configuration from the meter and displays a message where it was saved. If the upgrade requires the database to be reset, then it will be necessary to use the Edit/ Compare Configuration dialog to write this configuration back down to the meter after the program download is complete (Edit/Compare configuration parameters). After the configuration is saved, a progress bar will appear showing the status of the file download. After the files have been transferred successfully to the meter, the meter will start the upgrade process and the status will be shown down below Upgrade Progress.
4. The meter will have to restart to install the firmware. MeterLink will prompt you with a message that it must disconnect from the meter. Once the firmware upgrade is complete you will be able to reconnect to the meter with MeterLink.

5. MeterLink prompts you with a message that it must disconnect from the meter. Once the firmware upgrade is complete you will be able to reconnect to the meter with MeterLink.

   Important
   When the meter restarts, it takes about two minutes before you will be able to reconnect depending on the firmware upgrade being performed. If the database does need to be re-initialized, it could take up to five minutes.

6. Reconnect to the meter and repeat the Program Download process after the program downloads. If all the program components are successfully updated, they will show to be the same date and version as the Currently Installed Versions and the **Download** button will be disabled. If one or more components are still not updated, click **Download** to continue the upgrade process. Repeat the process to ensure all components are updated.

   CAUTION
   POWER LOSS DURING PROGRAM DOWNLOAD
   The meter's program may be lost if the meter loses power in the middle of a program download. If connection to the meter is unsuccessful after a failed program download, contact Emerson Flow Support for assistance.

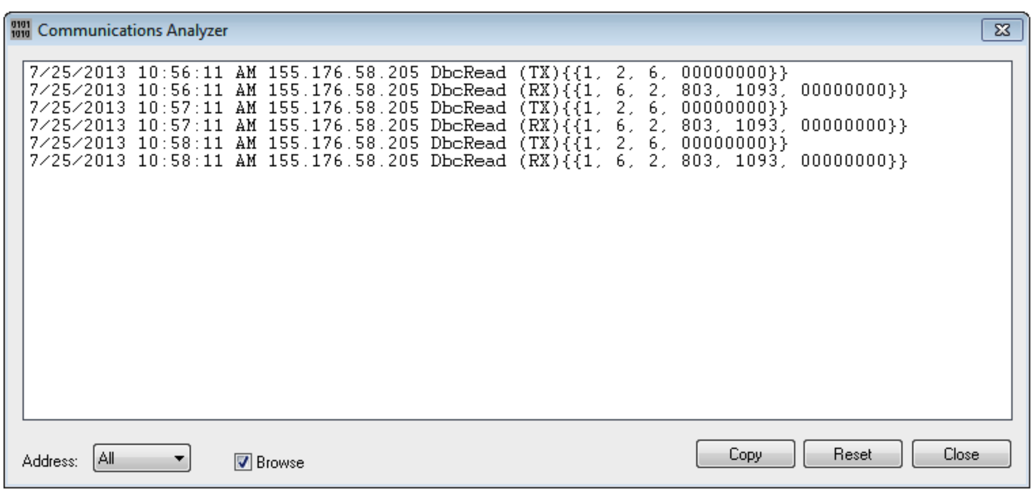
7.1.8 Communications analyzer

The Communications Analyzer is a Windows® application that displays "messages" transmitted to and received from an addressable device, such as a Modbus slave, by another Windows application.

The messages are display from the oldest (at the top of the list) to the newest (at the bottom of the list). The Communications Analyzer date and time stamps each message displayed. After 4096 messages have been displayed, the oldest messages are cleared from the list as new messages are added.

The Address combo box filters new messages so that only those with the selected address (1-32) are displayed. By default, all addresses are displayed. The address filter does not affect messages already displayed, only new messages.

Figure 7-10: Communications analyzer



Procedure

1. Check **Browse** to disable automatic scrolling.

   Note
   This is useful if you want to look at a certain message while new message are being added to the list.

2. Click **Copy** to copy the messages to your clipboard so that they can be pasted into another Windows application, e.g. Notepad.
3. Click **Reset** to clear the list of displayed messages.

A Conversion factors

A.1 Conversion factors per unit of measurement

The following table includes conversion factors for many of the metric and U.S. Customary units of measure used with Rosemount Ultrasonic Gas Flow Meters and MeterLink™.

Table A-1: Conversion Factors per unit of measurement

Conversion Factors	Unit of Measurement
(°F-32)x(5/9) -->°C (°C+273.15) -->K	
1	K/°C
5/9	°C/°F
10^{-6}	MPa/Pa
0.006894757	MPa/psi
0.1	MPa/bar
0.101325	MPa/atm
0.000133322	MPa/mmHg
0.3048	m/ft
10^3	dm^3/m^3
10^{-6}	m^3/cc (=m^3/cm^3)
$(0.3048)^3$	m^3/ft^3
$(0.0254)^3$	m^3/in^3
3600	s/h
86400	s/day
10^3	g/kg
0.45359237	kg/lbm
4.1868	kJ/kcal
1.05505585262	kJ/BtuIT
10^{-3}	Pas·s/cPoise 1.488
1.488	Pas·s/(lb/(ft·s))

B Miscellaneous equations

B.1 K-Factor and Inverse K-Factor

Equation B-1: Frequency Volumetric Flow Rate K-Factor

$$KFactor = \frac{(MaxFrq)(3600s/hr)}{FreqQFullScale}$$

and

Equation B-2: Frequency Volumetric Flow Rate Inverse K-Factor

$$InvKFactor = \frac{FreqQFaullScale}{(MaxFreq)(3600s/hr)}$$

where

KFactor = frequency "K-Factor" (pulses/m^3 or pulses/ft^3) (**Freq1KFactor** and **Freq2KFactor**)
InvKFactor = frequency "Inverse K-Factor" (m^3/pulse or ft^3/pulse) (**Freq1InvKFactor** and **Freq2InvKFactor**
FreqQFullScale = frequency full-scale volumetric flow rate (m^3/h or ft^3/h) (**Freq1FullScaleVolFlowRate** and **Freq2FullScaleVolFlowRate**)
MaxFreq = maximum frequency (Hz = pulses/s) (Either 1000 or 5000 Hz) (**Freq1MaxFrequency** and **Freq2MaxFrequency**)

B.1.1 Volumetric Flow Rate

Equation B-3: Volumetric Flow Rate - U.S. Customary units

$$Q_{ft^3/hr} = V_{ft/s} \times 3600 s/hr \times \left[\frac{\pi D^2 in}{4}\right] \times \left[\frac{1ft}{12in}\right]^2$$

$$= V_{ft/s} \times D^2 in \times \left[\frac{3600 \times \pi \; s \; ft^2}{4 \times 12^2 hr \; in^2}\right]$$

$$= V_{ft/s} \times D^2 in \times 19.63495 \left(\left(s \; ft^2\right) / \left(hr \; in^2\right)\right)$$

where

$Q_{ft}{}^3$/hr = volumetric flow rate (ft^3/h) (**QMeter**)
$V_{ft/s}$ = gas flow velocity (ft/s) (**AvgFlow**)
π = geometric constant, pi (dimensionless) (3.14159265...)
D_{in} = pipe inside diameter (in) (**PipeDiam**)

Equation B-4: Volumetric Flow Rate - Metric Units

$$Q_{m^3/hr} = V_{m/s} \times 3600 s/hr \times \left[\frac{\pi D^2 m}{4}\right]$$

$$= V_{m/s} \times D^2{}_m \times \left[\frac{3600 \times \pi}{4} (s/hr)\right]$$

$$= V_{m/s} \times D^2{}_m \times 20827.433 \; (s/hr)$$

where

$Q_{m^3/ft}$ = volumetric flow rate (m^3/h) (**QMeter**)
$V_{m/s}$ = gas flow velocity(m/s) (**AvgFlow**)
π = geometric constant, pi (dimensionless) (3.14159265...)
D_m = pipe inside diameter (m) (**PipeDiam**)

B.2 Calculation of Chord L dimension

The chord **L** dimension is calculated from the meter housing length as well as the transducer pair lengths, mount lengths, holder lengths, and stalk lengths as shown in Equation B-5**L**. The transducer lengths are etched on the transducers. Likewise, the lengths of the mounts, stalk assemblies, and transducer holders are also etched on the individual components. The length of the meter body is found on the original calibration sheet supplied with the meter.

Equation B-5L: Chord L Dimension

$$L_{chord} = L_{MeterHousing} + L_{Mount1} + L_{Mount2} \\ -L_{Xdrc1} - L_{Stalk1} - L_{Hldr1} \\ -L_{Xdrc2} - L_{Stalk2} - L_{Hldr}$$

where

L_{chord} = chord "L" dimension (in) (**LA... LD**)
$L_{MeterHousing}$ = meter housing length (in.)
L_{Mount1} = transducer 1 mount length (in.)
L_{Mount2} = transducer 2 mount length (in.)
L_{Xdr1} = transducer 1 length (in.)
L_{Xdr2} = transducer 2 length (in.)
L_{Stalk1} = transducer 1 stalk length (in.)
L_{Stalk2} = transducer 2 stalk length (in.)
L_{Hldr1} = transducer 1 holder length (in.)
L_{Hldr2} = transducer 2 holder length (in.)

C Troubleshooting communication, mechnical, and electrical

C.1 Communications troubleshooting

Q1: Why won't the CPU Module LINK LED come on when connecting to the meter via the Ethernet?

A1: The LINK light indicates good electric connectivity between two LAN ports. It also indicates proper polarity in the Ethernet connection.

WHEN CONNECTING DIRECTLY: Check to ensure that the Ultrasonic cable (P/N 1-360-01-596) cable is properly connected.

WHEN USING A HUB: When using a hub between the meter and the PC, a straight-through patch cable is required between the meter and the hub and a straight-through patch cable is required between the hub and the PC. Do not connect either the meter or PC to the hub UPLINK port. Most hubs do not allow use of the port immediately next to the hub UPLINK port when the UPLINK port is used to connect the hub to a LAN. Ensure the meter and PC are not plugged in to a hub non-usable UPLINK port.

Verify that the meter is powered up by checking that CPU Module LED 1 is on (either solid red or green). If the LED is not on, check power to the meter. If the LED is on, check the Ethernet cable connections.

Q2: My CPU Module LINK LED is on but I can't communicate with the meter using Ethernet. What's wrong?

A2: If you are connecting for the first time, refer to Set up the meter directory for instructions on initial communication (via Ethernet) setup.

If you are using the MeterLink™ program, ensure that the optional Ethernet connection is enabled.

Ensure that the meter's DHCP server is enabled (CPU Module switch ON). Verify that the PC has received an IP address from the meter as follows:

- Bring up DOS prompt window (Start|Run|(type)cmd)
- In the DOS prompt window, type ipconfig.

You will then see something like:

Windows® IP Configuration

Ethernet adapter Local Area Connection 1:

Connection-specific DNS Suffix:

IP Address:192.168.135.35 *(note: the last .35can beup to .44)*

Subnet Mask: 255.255.255.0DefaultGateway:

If you get the following:

Ethernet adapterLocal Area Connection 1:

IP Address: 0.0.0.0

Then the PC has *not* yet received an IP address from the DHCP server and you are advised to wait (up to 30 seconds) to receive an IP address before attempting to connect to the meter. If after 30 seconds the PC has not received an IP address from the meter

DHCP server or the IP addressshown above (from ipconfig) is different from the range of 192.168.135.35 through 192.168.135.44, verify that the PC is configured to receive its IP address automatically (via DHCP).

To ensure connection to the meter from the PC, at the DOS prompt type:

ping 192.168.135.100 <enter>

- If the meter is reachable, then you will see a message like:
  Pinging 192.168.135.100 with 32 bytes of data:
  Reply from 192.168.135.100: bytes=32 time < 10ms TTL=64
  etc.
- If the meter is not reachable, then you will see something like:
  Pinging 192.168.135.100 with 32 bytes of data:
  Request Timed Out etc.

Q3: How do I connect to multiple meters via Ethernet when they are on the same LAN?

A3: Before connecting multiple meters via Ethernet on a LAN, each meter must be configured with a unique user- specified IP address (following the initial communication quick start instructions in MeterLink utilities). Contact your IT department for valid IP addresses for your LAN and Gateway address if required. Once a meter's IP address is configured, the meter may be connected to the intranet LAN and accessed using that IP address.

Rosemount 3410 Series meters connected to an intranet LAN must not have their DHCP servers enabled.

Q4: How do I connect to multiple meters via Ethernet when they are on the same hub but not connected to an intranet LAN?

A4: The PC may receive its IP address from an external DHCP server; in this case, one and only one meter must have its DHCP server enabled. This DHCP server will serve up to 10 IP addresses to PCs attempting to talk to all meters on the hub.

Before connecting multiple meters via Ethernet on a hub, each meter must be configured with a unique user-specified IP address (following the initial communication quick start instructions in MeterLink utilities). Assign each meter on the hub a unique IP address within the range 192.168.135.150 through 192.168.135.254. The Gateway address for each meter maybe left unconfigured as 0.0.0.0. Once a meter's IP address is configured, the meter may be connected to the hub and accessed using that IP address.

C.2 Mechanical/electrical troubleshooting

This section is meant to assist site maintenance and operations personnel trained in the operation of the ultrasonic flow meter and knowledgeable in basic mechanical and electronic/electrical troubleshooting techniques, using lap top computers as well as digital volt/ohm meters. Exercise great care as to not "short out" a given electronic/electrical circuit when troubleshooting.

Table C-1: Mechanical/Electrical troubleshooting

Problem	Solution(s)
No power the unit	• Check for correct voltage (AC or DC) to the input of the Field Connection Board. (See Rosemount 3410 Series engineering drawings, System Wiring Diagram). • Check the main power source for blown fuse or tripped circuit breaker. Reference your "as built" installation drawings for your location. • Check the fuses on the Field Connection Board. Reference fuse F1 and F2 locations.
Cannot communicate with MeterLink™ program	• Ensure that the meter is properly powered. • Ensure that the computer cable is properly connected to the proper terminals (see Rosemount 3410 Series engineering drawings) for the connector. • Verify that the communication parameters of the MeterLink program are set correctly. See MeterLink utilities of this manual for instructions on configuring communications.
One or more of the chords is not indicating a reading (reporting zeros)	• Check for loose connections at the cable connectors. See Rosemount 3410 Series engineering drawings. • Check the resistance of the transducers (Will be approximately 1-2 Ω). • Problem also may be caused by a bad Acquisition board or interconnect cable. See Rosemount 3410 Series engineering drawings for more information. • Check system status in MeterLink, **Meter** → **Monitor** for any flagged errors. • Check the CPU board LEDs.
Waveform contains an excessive amount of noise	Increase the StackSize until noise level decreases (settings can be 1 (none), 2, 4, 8, or 16). If increasing the StackSize is not successful, try turning on the filter or consult with Flow Lifecycle Services for Rosemount products if you are unsure of how stacking a signal can effect the meter's operation. Refer to Technical Support under the **Help** menu of MeterLink for contact information.
Connected communication line to the flow computer but no signal is received	• Check for loose connections at the flow meter and the flow computer (see Rosemount 3410 Series engineering drawings). • Check the CPU Module, Field Connection board and the Power Supply wiring. Ensure the terminal block wiring and connectors are making good contact.
Communicating with meter but all chords display failures	• Verify that the resistance of transducers is within Specification (1-2 Ω). • Check the Acquisition board. • Check the interconnect cables between the base enclosure and the transmitter enclosure.

Table C-1: Mechanical/Electrical troubleshooting *(continued)*

Problem	Solution(s)
Chord is not indicating	• Check the resistance of the failed transducer. • If Chord A is not indicating, change the transducer cables from Chord D to chord A. • If Chord D then fails, the transducers are bad on Chord A. • The same test procedure can be accomplished by swapping Chords B and C if a chord fails in either chord. **Note** Note that the outside chord cables cannot be exchanged with inner chord cables.

D Flow Rate charts

D.1 Summary charts for Flow rate

Table D-1: Flow Rates (MSCFH) Based upon 100 ft/s

PSIG	4	6	8	10	12	16	20	24	30	36
100	247	561	971	1 532	2 174	3 432	5 398	7 807	12 607	18 154
200	468	1 065	1 845	2 908	4 127	6 515	10 248	14 822	23 935	34 467
300	696	1 584	2 743	4 325	6 137	9 690	15 240	22 043	35 596	51 258
400	931	2 118	3 668	5 782	8 206	12 955	20 377	29 472	47 593	69 534
500	1 172	2 667	4 619	7 282	10 334	16 315	25 661	37 114	59 934	86 305
600	1 421	3 232	5 597	8 823	12 522	19 770	31 095	44 973	72 626	104 582
700	1 676	3 813	6 602	10 409	14 772	23 322	36 682	53 055	85 677	123 374
800	1 938	4 409	7 635	12 036	17 082	26 968	42 417	61 349	99 070	142 661
900	2 207	5 021	8 694	13 706	19 452	30 710	48 302	69 861	112 816	162 455
1000	2 482	5 646	9 777	15 414	21 875	31 536	54 320	78 565	126 872	182 696
1100	2 763	6 286	10 885	17 161	24 355	38 451	60 475	87 471	141 254	203 405
1200	3 050	6 939	12 015	18 943	26 883	42 443	66 756	96 551	155 917	224 521
1300	3 341	7 602	13 164	20 753	29 453	46 500	73 137	105 781	170 822	245 983
1400	3 637	8 274	14 327	22 587	32 055	50 608	79 599	115 127	185 915	267 718
1500	3 935	8 953	15 504	24 442	34 688	54 765	89 137	124 583	201 184	289 706
1600	4 235	9 635	16 685	26 305	37 331	58 938	93 700	134 076	216 515	311 781
1700	4 536	10 231	17 871	28 175	39 986	63 128	99 291	143 608	231 908	333 948
1800	4 839	11 002	19 052	30 036	42 627	67 298	105 850	153 094	247 227	356 006
1900	5 134	11 681	20 226	31 888	45 255	71 448	112 376	162 534	262 471	377 958
2000	5 429	12 350	21 386	33 716	47 849	75 543	118 818	171 851	277 516	399 623

Table D-2: Flow Rates (MSCFH) Based upon 30 M/s

kPag	4	6	8	10	12	16	20	24	30	36
1000	9.67	22.01	38.11	60.07	85.27	134.6	211.7	306.2	494.5	712.1
1500	14.22	32.34	56.00	88.27	125.3	197.8	311.1	450.0	726.7	1046
2000	18.85	42.89	74.28	117.1	166.2	262.4	412.7	596.9	963.9	1388
2500	23.59	53.67	92.94	146.5	207.9	328.3	516.4	746.9	1206	1737
3000	28.43	64.68	112.0	176.5	250.6	392.6	622.3	900.0	1453	2093
3500	33.37	75.92	131.5	207.2	294.1	464.4	730.4	1056	1706	2457
4000	38.41	87.39	151.3	238.5	338.6	534.6	840.8	1216	1964	2828
4500	43.56	99.10	171.6	270.5	384.0	606.2	953.5	1379	2227	3207
5000	48.81	111.1	192.3	303.1	430.3	679.3	1068	1545	2495	3593

Table D-2: Flow Rates (MSCFH) Based upon 30 M/s *(continued)*

5500	54.17	123.2	213.4	336.4	477.4	753.8	1186	1715	2796	3987
6000	59.62	135.6	234.9	370.2	252.5	829.7	1305	1887	3048	4389
6500	65.17	148.3	256.8	404.7	574.5	907.0	1427	2063	3332	4798
7000	70.82	161.1	279.0	439.8	624.3	985.6	1550	2242	3621	5214
7500	76.56	174.2	301.6	475.4	674.8	1065	1676	2424	3914	5636
8000	82.38	187.4	324.6	511.6	726.2	1146	1803	2608	4212	6065
8500	88.28	200.9	347.8	548.2	778.2	1229	1932	2795	4513	6499
9000	94.25	214.4	271.3	585.3	830.9	1312	2063	2984	4818	6939
9500	100.28	228.1	395.1	622.7	883.9	1396	219	3175	5127	7382
10000	106.36	242.0	419.0	660.4	937.5	1480	2328	3367	5437	7830

Table D-3: Flow Rates (MMSCFD) Based upon 100 ft/s

PSIG	4	6	8	10	12	16	20	24	30	36
100	5.9	13.5	23.3	36.8	52.2	82.4	129.5	187.4	302.6	435.7
200	11.3	25.6	44.3	69.8	99.0	156.4	245.9	355.7	574.4	827.2
300	16.8	38.0	65.8	103.8	147.3	232.6	365.8	529.0	854.3	1 230
400	22.4	50.8	88.0	138.8	196.9	310.9	489.0	707.3	1 142	1 645
500	28.2	64.0	110.8	174.8	248.0	391.6	615.9	890.7	1 438	2 071
600	34.2	77.6	134.3	211.8	300.5	474.5	746.3	1 079	1 743	2 510
700	40.3	91.5	158.5	29.8	354.5	559.7	880.4	1 273	2 056	2 961
800	46.6	105.8	183.2	288.9	410.0	647.2	1 018	1 472	2 378	3 424
900	53.1	120.5	208.7	328.9	466.8	737.0	1 159	1 677	2 708	3 899
1000	59.7	135.5	234.6	369.9	252.0	828.9	1 304	1 886	3 045	4 385
1100	66.5	150.9	261.2	411.9	584.5	922.8	1 451	2 099	3 390	4 882
1200	73.4	166.5	288.4	454.6	645.2	1 019	1 602	2 317	3 742	5 389
1300	80.4	182.4	315.9	498.1	706.9	1 116	1 755	2 539	4 100	5 904
1400	87.5	198.6	343.8	542.1	769.3	1 215	1 910	2 763	4 462	6 425
1500	94.7	214.9	372.1	586.6	832.5	1 314	2 067	2 990	4 828	6 953
1600	101.9	231.3	400.4	631.3	896.0	1 415	2 225	3 218	5 196	7 483
1700	109.1	247.7	428.9	676.2	959.7	1 515	2 383	3 447	5 566	8 015
1800	116.4	264.0	457.2	720.9	1 023	1 615	2 540	3 674	5 933	8 544
1900	126.5	280.3	485.4	765.3	1 086	1 715	2 697	3 901	6 299	9 071
2000	130.6	296.4	513.3	809.2	1 148	1 813	2 852	4 142	6 660	9 591

Table D-4: Flow Rates (MMSCMD) Based upon 30 M/s

kPag	4	6	8	10	12	16	20	24	30	36
1000	0.232	0.528	0.915	1.442	2.046	3.231	5.082	7.350	11.869	17.091
1500	0.341	0.776	1.344	2.119	3.007	4.748	7.468	10.801	17.441	25.116

Table D-4: Flow Rates (MMSCMD) Based upon 30 M/s *(continued)*

2000	0.453	1.029	1.783	2.810	3.989	6.297	9.904	14.325	23.133	33.311
2500	0.566	1.288	2.231	3.516	4.991	7.879	12.393	17.924	28.946	41.682
3000	0.682	1.552	2.688	4.237	6.014	9.495	14.935	21.600	34.882	50.230
3500	0.801	1.821	3.155	4.973	7.059	11.145	17.530	25.354	40.943	58.958
4000	0.922	2.097	3.632	5.725	8.126	12.830	20.179	29.186	47.131	67.869
4500	1.045	2.378	4.119	6.492	9.215	14.549	22.883	33.097	53.447	76.963
5000	1.171	2.664	4.615	7.239	10.326	16.302	25.641	37.086	59.889	86.240
5500	1.300	2.957	5.121	7.789	11.459	18.091	28.454	41.154	66.458	95.699
6000	1.431	3.254	5.637	8.347	12.612	19.912	31.319	45.298	73.150	105.336
6500	1.564	3.557	6.162	9.713	13.787	21.767	34.236	49.517	79.964	115.148
7000	1.700	3.866	6.696	10.555	14.982	23.653	37.203	53.808	86.893	125.126
7500	1.837	4.179	7.239	11.410	16.196	25.570	40.218	58.168	93.934	135.265
8000	1.977	4.497	7.789	12.278	17.428	27.515	43.277	62.592	101.078	145.553
8500	2.119	4.819	8.347	13.157	18.676	29.485	46.376	67.075	108.318	155.978
9000	2.262	5.145	8.912	14.047	19.939	31.479	49.512	71.611	115.642	166.524
9500	2.407	5.474	9.482	14.945	21.214	33.492	52.679	76.191	123.038	177.175
10000	2.553	5.805	10.056	15.851	22.500	35.522	55.871	80.808	130.494	187.911

E Write-protected configuration

E.1 Parameters for Write-protected configuration

This appendix contains a table of configuration parameters that are write-protected against changes when the **CPU Board WRITE PROT.** switch is in the **ON** position. The data points in Table E-1 are applicable for Rosemount 3410 Series Firmware v1.06 and later.

Table E-1: Write-protected configuration parameters

Write-protected configuration parameters
AbnormalProfileDetectionLmt
Address
AlarmDef
AO1ActionUponInvalidContent
AO1Content
AO1Dir
AO1FullScaleEnergyRate
AO1FullScaleMassRate
AO1FullScaleVolFlowRate
AO1MaxVel
AO1MinVel
AO1TrimCurrent
AO1TrimGainExtMeasCurrent
AO1TrimZeroExtMeasCurrent
AO2ActionUponInvalidContent
AO2Content
AO2Dir
AO2FullScaleEnergyRate
AO2FullScaleMassRate
AO2FullScaleVolFlowRate
AO2MaxVel
AO2MinVel
AO2TrimCurrent
AO2TrimGainExtMeasCurrent
AO2TrimZeroExtMeasCurrent
ArgonComponentIndex
AtmosphericPress
AvgDlyA
AvgDlyB

Table E-1: Write-protected configuration parameters *(continued)*

Write-protected configuration parameters
AvgDlyC
AvgDlyD
AvgSoundVelHiLmt
AvgSoundVelLoLmt
BatchSize
BlockageTurbulenceLmtA
BlockageTurbulenceLmtB
BlockageTurbulenceLmtC
BlockageTurbulenceLmtD
CalMethod
ChordInactvA
ChordInactvB
ChordInactvC
ChordInactvD
City
ColocMeterMode
ContractHour
CRange
DailyLogInterval
DeviceNumber
DI1IsInvPolarity
DitherEnable
DltChk
DltDlyA
DltDlyB
DltDlyC
DltDlyD
DO1AContent
DO1AIsInvPolarity
DO1BContent
DO1BIsInvPolarity
DO2AContent
DO2AIsInvPolarity
DO2BContent
DO2BIsInvPolarity
EmRateDesired

Table E-1: Write-protected configuration parameters *(continued)*

Write-protected configuration parameters
EnableExpCorrPress
EnableExpCorrTemp
EnablePressureInput
EnableTemperatureInput
EthaneComponentIndex
Filter
FireSeq
FlowAnalysisHighFlowLmt
FlowAnalysisLowFlowLmt
FlowDir
FlowPOrTSrcUponAlarm
FODO1Mode
FODO1Source
FODO2Mode
FODO2Source
FODO3Mode
FODO3Source
FODO4Mode
FODO4Source
FODO5Mode
FODO5Source
FODO6Mode
FODO6Source
Freq1BPhase
Freq1Content
Freq1Dir
Freq1FeedbackCorrectionPcnt
Freq1FullScaleEnergyRate
Freq1FullScaleMassRate
Freq1FullScaleVolFlowRate
Freq1MaxFrequency
Freq1MaxVel
Freq1MinVel
Freq2BPhase
Freq2Content
Freq2Dir

Table E-1: Write-protected configuration parameters *(continued)*

Write-protected configuration parameters
Freq2FeedbackCorrectionPcnt
Freq2FullScaleEnergyRate
Freq2FullScaleMassRate
Freq2FullScaleVolFlowRate
Freq2MaxFrequency
Freq2MaxVel
Freq2MinVel
FTPServerControlPort
FwdA0
FwdA1
FwdA2
FwdA3
FwdBaselineAvgFlow
FwdBaselineComment
FwdBaselineCrossFlow
FwdBaselineFlowPressure
FwdBaselineFlowTemperature
FwdBaselineProfileFactor
FwdBaselineSwirlAngle
FwdBaselineSymmetry
FwdBaselineTime
FwdBaselineTurbulenceA
FwdBaselineTurbulenceB
FwdBaselineTurbulenceC
FwdBaselineTurbulenceD
FwdC0
FwdC1
FwdC2
FwdC3
FwdFlwRt<1..12>
FwdMtrFctr<1..12>
GasPropertiesSrcSel
GasPropertiesSrcSelGCAlarm
GCBaud
GCCommTimeout
GCDesiredStreamTimeout

Table E-1: Write-protected configuration parameters *(continued)*

Write-protected configuration parameters
GCDisabledComponentIndex
GCHeatingValueType
GCHeatingValueUnit
GCModbusID
GCProtocol
GCSerialPort
GCStreamNumber
H2ComponentIndex
H2SComponentIndex
HCH_Method
HighPressureAlarm
HighTemperatureAlarm
HourlyLogInterval
HTTPServerPort
InputPressureUnit
IsC6PlusAutoDetectionEnabled
IsDiagnosticChordEnabled
IsFreq1BZeroedOnErr
IsFreq2BZeroedOnErr
IsGasCompositionValidationEnabled
IsoButaneComponentIndex
IsoPentaneComponentIndex
IsTelnetServerEnabled
LA
LB
LC
LD
LinearExpansionCoef
LiquidDetectionSDevCrossFlowLmt
LiquidDetectionSDevProfileFactorLmt
LiquidDetectionSDevSymmetryLmt
LiveFlowPressureGain
LiveFlowPressureOffset
LiveFlowTemperatureGain
LiveFlowTemperatureOffset
LowFlowLmt

Table E-1: Write-protected configuration parameters *(continued)*

Write-protected configuration parameters
LowPressureAlarm
LowTemperatureAlarm
MaxHoldTm
MaxInputPressure
MaxInputTemperature
MaxNoDataBatches
MaxNoise
MeterHousingLength<A..D>
MeterMaxVel
MeterModel
MeterName
MeterNominalSize
MeterSerialNumber
MinChord
MinHoldTime
MinInputPressure
MinInputTemperature
MinPctGood
MinSigQlty
N2ComponentIndex
NegSpan
NonNormalModeTimeout
NPentaneComponentIndex
NumVals
PBase
PipeDiam
PipeOutsideDiameter
Pk1Pct
Pk1Thrsh
Pk1Wdth
PoissonsRatio
PosSpan
ReadWriteModePort<A..C>
RefPressExpCoef
RefPressureGr
RefPressureMolarDensity

Table E-1: Write-protected configuration parameters *(continued)*

Write-protected configuration parameters
RefTemperatureGr
RefTemperatureHV
RefTemperatureMolarDensity
RefTempLinearExpCoef
RevA0
RevA1
RevA2
RevA3
RevBaselineAvgFlow
RevBaselineComment
RevBaselineCrossFlow
RevBaselineFlowPressure
RevBaselineFlowTemperature
RevBaselineProfileFactor
RevBaselineSwirlAngle
RevBaselineSymmetry
RevBaselineTime
RevBaselineTurbulenceA
RevBaselineTurbulenceB
RevBaselineTurbulenceC
RevBaselineTurbulenceD
RevC0
RevC1
RevC2
RevC3
ReverseFlowDetectionZeroCut
ReverseFlowVolLmt
RevFlwRt<1..12>
RevMtrFctr<1..12>
SampInterval
SampPerCycle
SndSpdChkMaxVel
SndSpdChkMinVel
SndVelCompErrLimit
SNRatio
SpecBatchUpdtPeriod

Table E-1: Write-protected configuration parameters *(continued)*

Write-protected configuration parameters
SSMax
SSMin
StackEmRateDesired
StateAndCountry
StationName
SwirlAngleLmt
Tamp
TampHi
TampLo
TampSen
TampWt
TBase
TmDevFctr1
TmDevLow1
Tspe
TspeHi
TspeLmt
TspeLo
TspeSen
TspeWt
Tspf
TspfHi
TspfLo
TspfMatch
TspfSen
TspfWt
UnitsSystem
VelHold
VolFlowRateTimeUnit
VolUnitMetric
VolUnitUS
WallRoughness
XA
XB
XC
XD

Table E-1: Write-protected configuration parameters *(continued)*

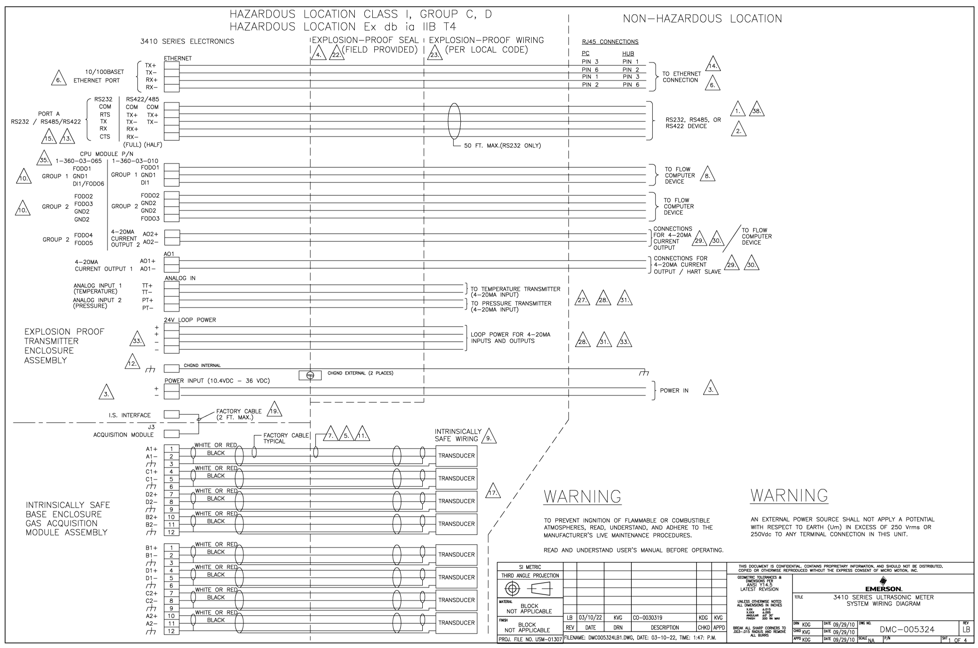
Write-protected configuration parameters
XdcrAssyComponent1Length<A1..D2>
XdcrAssyComponent1SerialNumber<A1..D2>
XdcrAssyComponent2Length<A1..D2>
XdcrAssyComponent2SerialNumber<A1..D2>
XdcrAssyComponent3Length<A1..D2>
XdcrAssyComponent3SerialNumber<A1..D2>
XdcrAssyComponent4Length<A1..D2>
XdcrAssyComponent4SerialNumber<A1..D2>
XdcrFiringSync
XdcrFreq
XdcrNumDriveCycles
XdcrType
YoungsModulus
ZeroCut

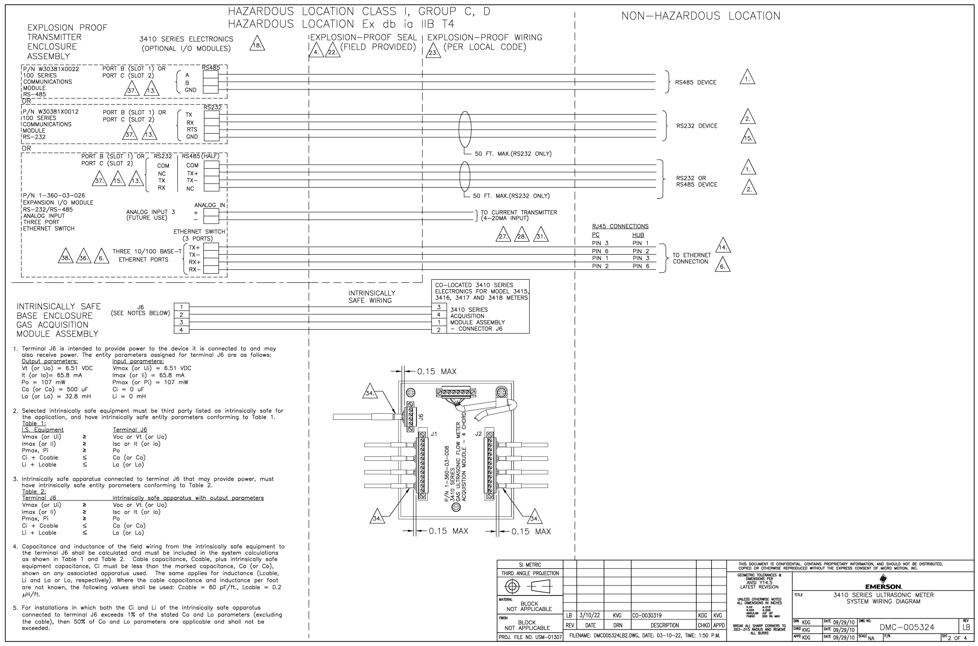
F Engineering drawings

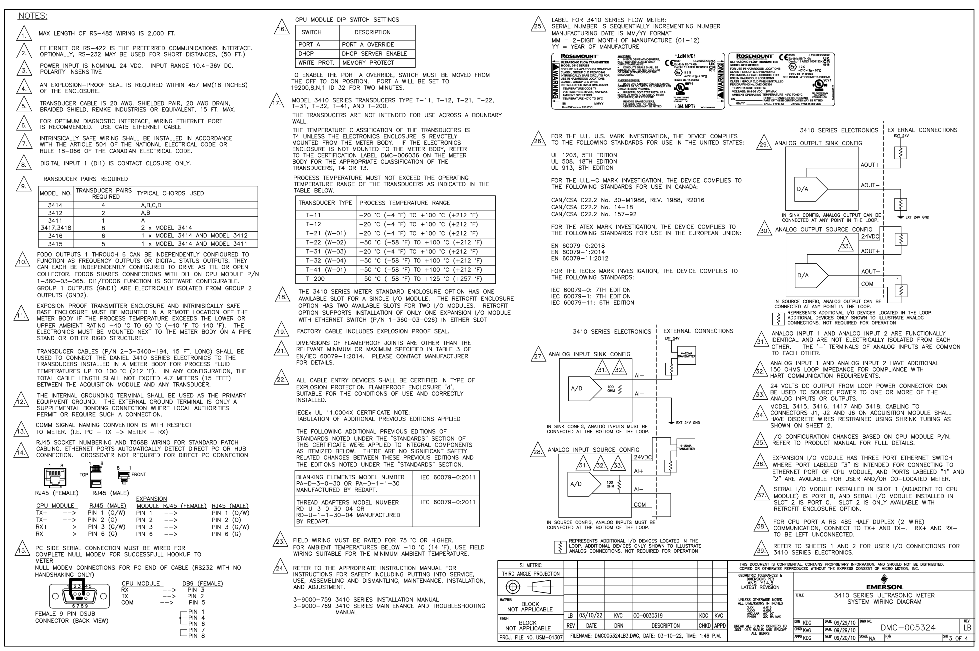
F.1 Rosemount 3410 Series engineering drawings

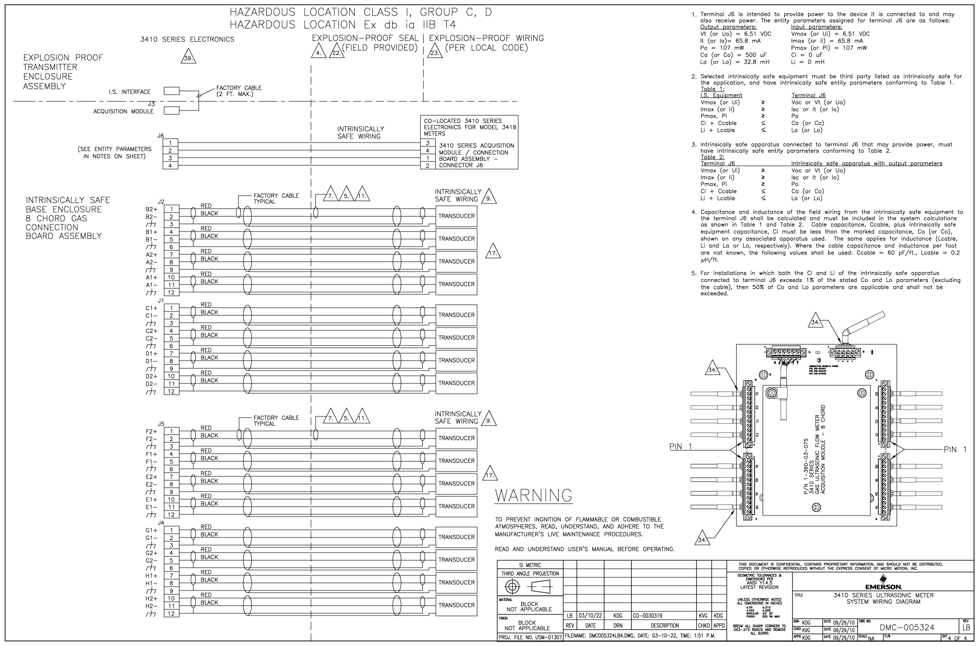
This appendix contains the following engineering drawing(s) for the ultrasonic meter.

DMC-005324	3410 Series Gas Ultrasonic Flow Meters System Wiring Diagram




HAZARDOUS LOCATION CLASS I, GROUP C, D
HAZARDOUS LOCATION Ex db ia IIB T4
NON-HAZARDOUS LOCATION
EXPLOSION PROOF TRANSMITTER ENCLOSURE ASSEMBLY
3410 SERIES ELECTRONICS (OPTIONAL I/O MODULES)
EXPLOSION-PROOF SEAL (FIELD PROVIDED)
EXPLOSION-PROOF WIRING (PER LOCAL CODE)
RS485 DEVICE
RS232 DEVICE
50 FT. MAX.(RS232 ONLY)
RS232 OR RS485 DEVICE
TO CURRENT TRANSMITTER (4-20MA INPUT)
RJ45 CONNECTIONS
TO ETHERNET CONNECTION
INTRINSICALLY SAFE WIRING
CO-LOCATED 3410 SERIES ELECTRONICS FOR MODEL 3415, 3416, 3417 AND 3418 METERS
INTRINSICALLY SAFE BASE ENCLOSURE GAS ACQUISITION MODULE ASSEMBLY
0.15 MAX
3410 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM
DMC-005324
EMERSON.


NOTES:
CPU MODULE DIP SWITCH SETTINGS
3410 SERIES ELECTRONICS
EXTERNAL CONNECTIONS
ANALOG OUTPUT SINK CONFIG
ANALOG OUTPUT SOURCE CONFIG
ANALOG INPUT SINK CONFIG
ANALOG INPUT SOURCE CONFIG
3410 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM
DMC-005324
EMERSON.


HAZARDOUS LOCATION CLASS I, GROUP C, D
HAZARDOUS LOCATION Ex db ia IIB T4
3410 SERIES ELECTRONICS
EXPLOSION–PROOF SEAL (FIELD PROVIDED)
EXPLOSION–PROOF WIRING (PER LOCAL CODE)
EXPLOSION PROOF TRANSMITTER ENCLOSURE ASSEMBLY
I.S. INTERFACE
ACQUISITION MODULE
FACTORY CABLE (2 FT. MAX.)
(SEE ENTITY PARAMETERS IN NOTES ON SHEET)
INTRINSICALLY SAFE WIRING
CO-LOCATED 3410 SERIES ELECTRONICS FOR MODEL 3418 METERS
3410 SERIES ACQUISITION MODULE / CONNECTION BOARD ASSEMBLY – CONNECTOR J6
INTRINSICALLY SAFE BASE ENCLOSURE 8 CHORD GAS CONNECTION BOARD ASSEMBLY
FACTORY CABLE TYPICAL
RED
BLACK
TRANSDUCER
PIN 1
1. Terminal J6 is intended to provide power to the device it is connected to and may also receive power. The entity parameters assigned for terminal J6 are as follows:
Output parameters:
Vt (or Uo) = 6.51 VDC
It (or Io)= 65.8 mA
Po = 107 mW
Ca (or Co) = 500 uF
La (or Lo) = 32.8 mH
Input parameters:
Vmax (or Ui) = 6.51 VDC
Imax (or Ii) = 65.8 mA
Pmax (or Pi) = 107 mW
Ci = 0 uF
Li = 0 mH
2. Selected intrinsically safe equipment must be third party listed as intrinsically safe for the application, and have intrinsically safe entity parameters conforming to Table 1.
Table 1:
I.S. Equipment | Terminal J6
Vmax (or Ui) ≥ Voc or Vt (or Uo)
Imax (or Ii) ≥ Isc or It (or Io)
Pmax, Pi ≥ Po
Ci + Ccable ≤ Ca (or Co)
Li + Lcable ≤ La (or Lo)
3. Intrinsically safe apparatus connected to terminal J6 that may provide power, must have intrinsically safe entity parameters conforming to Table 2.
Table 2:
Terminal J6 | Intrinsically safe apparatus with output parameters
Vmax (or Ui) ≥ Voc or Vt (or Uo)
Imax (or Ii) ≥ Isc or It (or Io)
Pmax, Pi ≥ Po
Ci + Ccable ≤ Ca (or Co)
Li + Lcable ≤ La (or Lo)
4. Capacitance and inductance of the field wiring from the intrinsically safe equipment to the terminal J6 shall be calculated and must be included in the system calculations as shown in Table 1 and Table 2. Cable capacitance, Ccable, plus intrinsically safe equipment capacitance, Ci must be less than the marked capacitance, Ca (or Co), shown on any associated apparatus used. The same applies for inductance (Lcable, Li and La or Lo, respectively). Where the cable capacitance and inductance per foot are not known, the following values shall be used: Ccable = 60 pF/ft., Lcable = 0.2 µH/ft.
5. For installations in which both the Ci and Li of the intrinsically safe apparatus connected to terminal J6 exceeds 1% of the stated Co and Lo parameters (excluding the cable), then 50% of Co and Lo parameters are applicable and shall not be exceeded.
WARNING
TO PREVENT INGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, READ, UNDERSTAND, AND ADHERE TO THE MANUFACTURER'S LIVE MAINTENANCE PROCEDURES.
READ AND UNDERSTAND USER'S MANUAL BEFORE OPERATING.
SI METRIC
THIRD ANGLE PROJECTION
MATERIAL BLOCK NOT APPLICABLE
FINISH BLOCK NOT APPLICABLE
PROJ. FILE NO. USM-01307
LB 03/10/22 KDG CO-0030319 KVG KDG
REV DATE DRN DESCRIPTION CHKD APPD
FILENAME: DMC005324LB4.DWG, DATE: 03-10-22, TIME: 1:51 P.M.
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GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION
UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS
EMERSON.
TITLE 3410 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM
DRN KDG DATE 09/29/10
CHKD KVG DATE 09/29/10
APPD KDG DATE 09/29/10
DWG NO. DMC–005324
REV LB
SCALE NA
SHT 4 OF 4

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Rev. AD
2025

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