Configuration and Use Manual
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Micro Motion™ 5700 Transmitters with FOUNDATION™ Fieldbus

Configuration and Use Manual

MICRO MOTION™

EMERSON™

Safety messages

Safety messages are provided throughout this manual to protect personnel and equipment. Read each safety message carefully before proceeding to the next step.

Safety and approval information

This Micro Motion 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, the complete ATEX Installation Drawings and Instructions, the IECEx Installation Instructions for installations outside of the European Union, and the CSA Installation Instructions for installations in North America are available on the internet at www.emerson.com or through your local Micro Motion support center.

Information affixed to equipment that complies with the Pressure Equipment Directive, can be found on the internet at www.emerson.com.

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 configuration manual. Product data sheets and manuals are available from the Micro Motion web site at www.emerson.com.

Return policy

Follow Micro Motion procedures when returning equipment. These procedures ensure legal compliance with government transportation agencies and help provide a safe working environment for Micro Motion employees. Micro Motion will not accept your returned equipment if you fail to follow Micro Motion procedures.

Return procedures and forms are available on our web support site at www.emerson.com, or by phoning the Micro Motion Customer Service department.

Emerson Flow customer service

Email:

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

Telephone:

North and South America		Europe and Middle East		Asia Pacific	
United States	800-522-6277	U.K. and Ireland	0870 240 1978	Australia	800 158 727
Canada	+1 303-527-5200	The Netherlands	+31 (0) 70 413 6666	New Zealand	099 128 804
Mexico	+52 55 5809 5010	France	+33 (0) 800 917 901	India	800 440 1468
Argentina	+54 11 4809 2700	Germany	0800 182 5347	Pakistan	888 550 2682
Brazil	+55 15 3413 8000	Italy	+39 8008 77334	China	+86 21 2892 9000
Chile	+56 2 2928 4800	Central & Eastern	+41 (0) 41 7686 111	Japan	+81 3 5769 6803
Peru	+51 15190130	Russia/CIS	+7 495 995 9559	South Korea	+82 2 3438 4600
		Egypt	0800 000 0015	Singapore	+65 6 777 8211
		Oman	800 70101	Thailand	001 800 441 6426
		Qatar	431 0044	Malaysia	800 814 008
		Kuwait	663 299 01		
		South Africa	800 991 390		
		Saudi Arabia	800 844 9564		
		UAE	800 0444 0684		

Contents

1 Before you begin

1.1 About this manual

This manual helps you configure, commission, use, maintain, and troubleshoot Micro Motion 5700 transmitters with FOUNDATION Fieldbus.

Important
This manual assumes that:

- The transmitter has been installed correctly and completely according to the instructions in the transmitter installation manual
- Users understand basic transmitter and sensor installation, configuration, and maintenance concepts and procedures

1.2 Hazard messages

This document uses the following criteria for hazard messages based on ANSI standards Z535.6-2011 (R2017).

DANGER
Serious injury or death will occur if a hazardous situation is not avoided.

WARNING
Serious injury or death could occur if a hazardous situation is not avoided.

CAUTION
Minor or moderate injury will or could occur if a hazardous situation is not avoided.

NOTICE
Data loss, property damage, hardware damage, or software damage can occur if a situation is not avoided. There is no credible risk of physical injury.

Physical access

NOTICE
Unauthorized personnel can potentially cause significant damage and/or misconfiguration of end users' equipment. Protect against all intentional or unintentional unauthorized use.

Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access to protect users' assets. This is true for all systems used within the facility.

1.3 Related documents

You can find all product documentation on the product documentation DVD shipped with the product or at www.emerson.com.

See any of the following documents for more information:

- *Micro Motion 5700 Product Data Sheet*
- *Micro Motion 5700 Transmitters for FOUNDATION™ Fieldbus: Installation Manual*
- *Replacing the Junction Box for the 4200 Transmitter and the 5700 Transmitter*
- *Replacing the Sensor Cable for the 4200 Transmitter and the 5700 Transmitter*
- Sensor installation manual

1.4 Communication methods

You can use several different communications methods to interface with the transmitter. You may use different methods in different locations or for different tasks.

Interface	Tool
Display	Infrared-sensitive buttons
Universal Service Port	ProLink™ III
FOUNDATION Fieldbus channel	• Field communicator • FOUNDATION Fieldbus (FF) host — On an *enhanced FF host*, the transmitter parameters are displayed either in the form of a menu tree (for example, the 475 Field Communicator) or in the form of UIRD (for example, the AMS Intelligent Device Manager with DeltaV™ System). Both the menu tree and UIRD are provided as part of the Device Description. — A *basic FF host* displays the transmitter parameters in the form of a list under the Resource block and transducer blocks. — The configuration sections contain information for both types of host.

For information about how to use the communication tools, see the appendices in this manual.

Tip
You may be able to use other communications tools, such as AMS™ Suite: Intelligent Device Manager.

2 Quick start

2.1 Power up the transmitter

The transmitter must be powered up for all configuration and commissioning tasks, or for process measurement.

Procedure

1. Verify that all transmitter and sensor covers and seals are closed.

   WARNING
   To prevent ignition of flammable or combustible atmospheres, ensure that all covers and seals are tightly closed. For hazardous area installations, applying power while housing covers are removed or loose can cause an explosion resulting in injury or death.

2. Turn on the electrical power at the power supply.

Postrequisites

Although the sensor is ready to receive process fluid shortly after power-up, the electronics can take up to 10 minutes to reach thermal equilibrium. Therefore, if this is the initial startup, or if power has been off long enough to allow components to reach ambient temperature, allow the electronics to warm up for approximately 10 minutes before relying on process measurements. During this warm-up period, you may observe minor measurement instability or inaccuracy.

2.2 Check meter status

Check the meter for any error conditions that require user action or that affect measurement accuracy.

Procedure

1. Wait approximately 10 seconds for the power-up sequence to complete.

   Immediately after power-up, the transmitter runs through diagnostic routines and checks for error conditions. During the power-up sequence, the `Transmitter Initializing` alert is active. This alert should clear automatically when the power-up sequence is complete.

2. Check the status LED on the transmitter.

   Table 2-1: Status LED and device status

Status LED condition	Device status
Solid green	No alerts are active.
Solid yellow	One or more alerts are active with **Alert Severity** = Out of Specification, Maintenance Required, or Function Check.
Solid red	One or more alerts are active with **Alert Severity** = Failure.
Flashing yellow (1 Hz)	The `Function Check in Progress` alert is active.

2.3 Determine the FOUNDATION Fieldbus unique device ID using the display

Every FOUNDATION Fieldbus device has a unique 24-digit number that the fieldbus segment uses to identify it. You can determine the number using the display.

Procedure

Choose **Menu** → **About** → **Device Information**.

The number is located under **Device Unique ID**.

2.4 Commissioning wizards

The transmitter menu includes a *Guided Setup* to help you move quickly through the most common configuration parameters. ProLink III also provides a commissioning wizard.

By default, when the transmitter starts up, the Guided Setup menu is offered. You can choose to use it or not. You can also choose whether or not Guided Setup is displayed automatically.

- To enter Guided Setup upon transmitter startup, choose **Yes** at the prompt.
- To enter Guided Setup after transmitter startup, choose **Menu** → **Startup Tasks**.
- To control the automatic display of Guided Setup, choose **Menu** → **Configuration** → **Guided Setup**.

For information on the ProLink III commissioning wizard, see the *Micro Motion ProLink III with ProcessViz Software User Manual*.

As the commissioning wizards are self guided, they are not documented in detail.

2.5 Make a startup connection to the transmitter

For all configuration tools except the display, you must have an active connection to the transmitter to configure the transmitter.

Procedure

Identify the connection type to use, and follow the instructions for that connection type in the appropriate appendix.

2.6 Set the transmitter clock

Display	**Menu** → **Configuration** → **Time/Date/Tag**
ProLink III	**Device Tools** → **Configuration** → **Transmitter Clock**
Field communicator	**Configure** → **Manual Setup** → **Clock**
Enhanced FF host	**Configure** → **Manual Setup** → **Clock**
Basic FF host	**Device TB** → **Set Clock Date-Time** (OD Index 136)

The transmitter clock provides timestamp data for alerts, service logs, history logs, and all other timers and dates in the system. You can set the clock for your local time or for any standard time you want to use.

Tip
You may find it convenient to set all of your transmitter clocks to the same time, even if the transmitters are in different time zones.

Procedure

1. Select the time zone that you want to use.
2. If you need a custom time zone, select **Special Time Zone** and enter your time zone as a difference from UTC (Coordinated Universal Time).
3. Set the time appropriately for the selected time zone.

   Tip
   The transmitter does not adjust for Daylight Savings Time. If you observe Daylight Savings Time, you must reset the transmitter clock manually.

4. Set the month, day, and year.

   The transmitter tracks the year and automatically adds a day for leap years.

2.7 View the licensed features

Display	**Menu** → **About** → **Licenses** → **Licensed Features**
ProLink III	**Device Tools** → **Device Information** → **Licensed Features**
Field communicator	**Overview** → **Device Information** → **Licenses**
Enhanced FF host	**Overview** → **Device Information** → **Licenses**
Basic FF host	**Device TB** → **Permanent Feature** (OD Index 142) **Device TB** → **Temporary Feature** (OD Index 140)

You can view the licensed features to ensure that the transmitter was ordered with the required features.

Licensed features are purchased and available for permanent use. The options model code represents the licensed features.

A trial license allows you to explore features before purchasing. The trial license enables the specified features for a limited number of days. This number is displayed for reference. At the end of this period, the feature will no longer be available.

To purchase additional features or request a trial license, document the Unique ID Number and current license key from your transmitter and contact customer service. To enable the additional features or trial license, you will need to install the new license on the transmitter.

2.8 Set informational parameters

Display	**Menu** → **Configuration** → **Device Information**
ProLink III	**Device Tools** → **Configuration** → **Informational Parameters**
Field communicator	**Configure** → **Manual Setup** → **Device**

Enhanced FF host	**Configure → Manual Setup → Device**
Basic FF host	**Device TB → Transmitter Information** (OD Index 14–21) **Device TB → Core Processor Information** (OD Index 22–25) **Device TB → Sensor Information** (OD Index 28–33)

You can set several parameters that identify or describe the transmitter and sensor. These parameters are not used in processing and are not required.

Procedure

1. Set informational parameters for the transmitter.
   a) Set **Transmitter Serial Number** to the serial number of your transmitter.

      The transmitter serial number is provided on the metal tag that is attached to the transmitter housing.

   b) Set **Descriptor** to any desired description of this transmitter or measurement point.

   c) Set **Message** to any desired message.

   d) Verify that **Model Code (Base)** is set to the base model code of the transmitter.

      The base model code completely describes your transmitter, except for the features that can be licensed independently. The base model code is set at the factory.

   e) Set **Model Code (Options)** to the options model code of the transmitter.

      The options model code describes the independent features that have been licensed for this transmitter. The original options model code is set at the factory. If you license additional options for this transmitter, Micro Motion will supply an updated options model code.

      For a field communicator, configuring model code options is not available for this release.

2. Set informational parameters for the sensor.
   a) Set **Sensor Serial Number** to the serial number of the sensor connected to this transmitter.

      The sensor serial number is provided on the metal tag that is attached to the sensor case.

   b) Set **Sensor Material** to the material used for the sensor.

   c) Set **Sensor Liner** to the material used for the sensor liner, if any.

   d) Set **Flange Type** to the type of flange that was used to install the sensor.

   Do not set **Sensor Type**. **Sensor Type** is set or derived during characterization.

2.9 Characterize the meter (if required)

Display	**Menu → Configuration → Sensor Parameters**
ProLink III	**Device Tools → Calibration Data**
Field communicator	**Configure → Manual Setup → Characterization**

Enhanced FF host	**Configure** → **Manual Setup** → **Characterization**
Basic FF host	**Measurement TB** → **Device Calibration** (OD Index 95–113)

Characterizing the meter adjusts your transmitter to match the unique traits of the sensor it is paired with. The characterization parameters (also called calibration parameters) describe the sensor's sensitivity to flow, density, and temperature. Depending on your sensor type, different parameters are required.

Values for your sensor are provided on the sensor tag or the calibration certificate.

- If your transmitter was ordered with a sensor, it was characterized at the factory. However, you should still verify the characterization parameters.
- Perform a characterization whenever you replace a core processor.

Procedure

1. Optional: Specify **Sensor Type**.
   - Straight Tube (T-Series sensors)
   - Curved Tube (all sensors except T-Series)

   Note
   Unlike earlier transmitters, the 5700 derives **Sensor Type** from the user-specified values for FCF and K1 in combination with an internal ID.

2. Set the flow calibration factor: **FCF** (also called **Flow Cal** or **Flow Calibration Factor**). Be sure to include all decimal points.
3. Set the density characterization parameters: **D1**, **D2**, **TC**, **K1**, **K2**, and **FD**. (**TC** is sometimes shown as **DT**.)
4. Apply the changes as required by the tool you are using.

   The transmitter identifies your sensor type, and characterization parameters are adjusted as required:

   - If **Sensor Type** changed from Curved Tube to Straight Tube, five characterization parameters are added to the list.
   - If **Sensor Type** changed from Straight Tube to Curved Tube, five characterization parameters are removed from the list.
   - If **Sensor Type** did not change, the list of characterization parameters does not change.

5. T-Series sensors only: Set the additional characterization parameters listed below.

Characterization parameter type	Parameters
Flow	**FTG**, **FFQ**
Density	**DTG**, **DFQ1**, **DFQ2**

2.9.1 Sample sensor tags

Figure 2-1: Tag on newer curved-tube sensors (all sensors except T-Series)

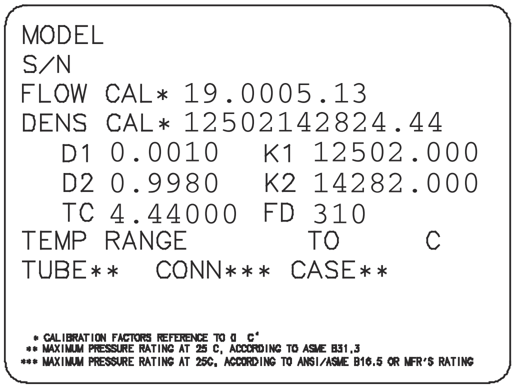


Figure 2-2: Tag on older straight-tube sensor (T-Series)

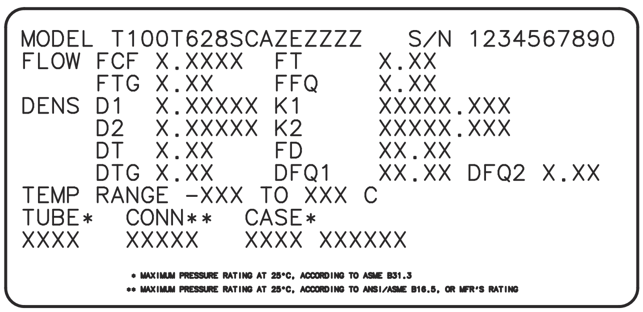
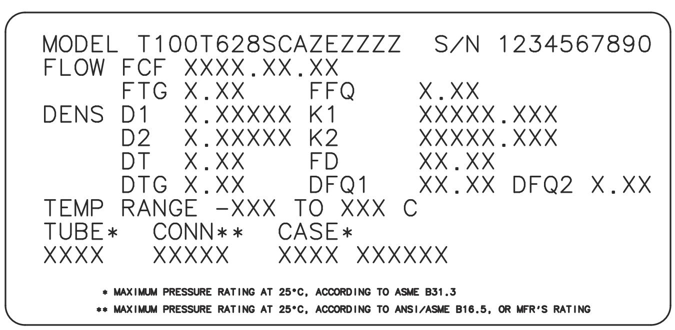


Figure 2-3: Tag on newer straight-tube sensor (T-Series)



2.9.2 Flow calibration parameters (FCF, FT)

Two separate values are used to describe flow calibration: a 6-character FCF value and a 4-character FT value. They are provided on the sensor tag.

Both values contain decimal points. During characterization, these are entered as a single 10-character string. The 10-character string is called either **Flowcal** or **FCF**.

If your sensor tag shows the **FCF** and the **FT** values separately and you need to enter a single value, concatenate the two values to form the single parameter value, retaining both decimal points.

Concatenating FCF and FT

```
FCF = x.xxxx FT = y.yy Flow calibration parameter: x.xxxxy.yy
```

2.9.3 Density calibration parameters (D1, D2, K1, K2, FD, DT, TC)

Density calibration parameters are typically on the sensor tag and the calibration certificate.

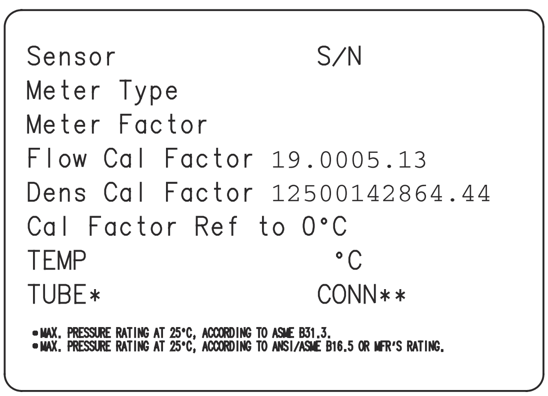
If your sensor tag does not show a D1 or D2 value:

- For **D1**, enter the Dens A or **D1** value from the calibration certificate. This value is the line-condition density of the low-density calibration fluid. Micro Motion uses air. If you cannot find a Dens A or **D1** value, enter `0.001` g/cm^3.
- For **D2**, enter the Dens B or **D2** value from the calibration certificate. This value is the line-condition density of the high-density calibration fluid. Micro Motion uses water. If you cannot find a Dens B or **D2** value, enter `0.998` g/cm^3 .

If your sensor tag does not show a K1 or K2 value:

- For **K1**, enter the first five digits of the density calibration factor. In this sample tag, this value is shown as 12500.
- For **K2**, enter the second five digits of the density calibration factor. In this sample tag, this value is shown as 14286.

Figure 2-4: K1, K2, and TC values in the density calibration factor



If your sensor does not show an **FD** value, contact customer service.

If your sensor tag does not show a **DT** or **TC** value, enter the last four characters of the density calibration factor. In the sample tag shown above, the value is shown as 4.44.

Do not confuse the **Meter Factor** line on the pictured sensor tag with any meter factor settings discussed in this manual.

2.10 Verify mass flow measurement

Check to see that the mass flow rate reported by the transmitter is accurate. You can use any available method.

Procedure

- Read the value for **Mass Flow Rate** on the transmitter display.
- Connect to the transmitter with ProLink III and read the value for **Mass Flow Rate** in the *Process Variables* panel.
- Connect to the transmitter with a field communicator and read the value for **Mass Flow Rate**.

  Online → **Overview** → **Mass Flow Rate**

Postrequisites

If the reported mass flow rate is not accurate:

- Check the characterization parameters.
- Review the troubleshooting suggestions for flow measurement issues.

2.11 Verify the zero

Display	**Menu** → **Service Tools** → **Verification & Calibration** → **Meter Zero** → **Zero Verification**
ProLink III	**Device Tools** → **Calibration** → **Smart Zero Verification and Calibration** → **Verify Zero**
Field communicator	**Service Tools** → **Maintenance** → **Calibration** → **Zero Calibration** → **Perform Zero Verify**
Enhanced FF host	**Service Tools** → **Maintenance** → **Calibration** → **Zero Calibration** → **Perform Zero Verify**
Basic FF host	**Measurement TB** → **Perform Zero Verify** (OD Index 124)

Verifying the zero helps you determine if the stored zero value is appropriate to your installation, or if a field zero can improve measurement accuracy.

Important
In most cases, the factory zero is more accurate than the field zero. Do not zero the meter unless one of the following is true:

- The zero is required by site procedures.
- The stored zero value fails the zero verification procedure.

Do not verify the zero or zero the meter if a high-severity alert is active. Correct the problem, then verify the zero or zero the meter. You may verify the zero or zero the meter if a low-severity alert is active.

Procedure

1. Prepare the meter:
   a) Allow the meter to warm up for at least 20 minutes after applying power.
   b) Run the process fluid through the sensor until the sensor temperature reaches the normal process operating temperature.
   c) Stop flow through the sensor by shutting the downstream valve, and then the upstream valve if available.

   d) Verify that the sensor is blocked in, that flow has stopped, and that the sensor is completely full of process fluid.

2. Start the zero verification procedure, and wait until it completes.
3. If the zero verification procedure fails:
   a) Confirm that the sensor is completely blocked in, that flow has stopped, and that the sensor is completely full of process fluid.
   b) Verify that the process fluid is not flashing or condensing, and that it does not contain particles that can settle out.
   c) Repeat the zero verification procedure.
   d) If it fails again, zero the meter.

Postrequisites

Restore normal flow through the sensor by opening the valves.

Related information

Zero the meter

3 Introduction to configuration and commissioning

3.1 Security and write protection

The transmitter has several features that can help to protect it against intentional or unintentional access and configuration changes.

- When locked, the mechanical lock switch on the front of the display prevents any configuration changes to the transmitter from any local or remote configuration tool. A transmitter without a display does not have a lock switch.
- When enabled, the software setting **Write Protection** prevents any configuration changes. The setting can only be enabled if the transmitter does not have a display.
- If the Universal Service Port (USP) is disabled, the port cannot be used by any service tool to communicate with or make changes to the transmitter.
- When enabled, **Security** prevents any configuration changes being made from the display unless the appropriate password is entered.
- When enabled, the fieldbus write lock prevents any configuration changes being written from the fieldbus segment.

3.1.1 Universal Service Port security

This transmitter is equipped with a Universal Service Port that works with USB type A connections, including compatible flash drives. There are multiple levels of security built into the transmitter's service port that you can configure according to your needs and security standards.

The service port offers the following features that enhance interface security:

- The service port is inaccessible without physical access to the transmitter and requires removal of the terminal cover
- The service port can be disabled from the transmitter through software
- The transmitter has a non-traditional operating system that is not designed to execute programs or run scripts
- The display can be password protected to limit access to the USB file menu
- Overall transmitter security switches such as the lock switch or write-protection disallows configuration changes from all interfaces including the Universal Service Port

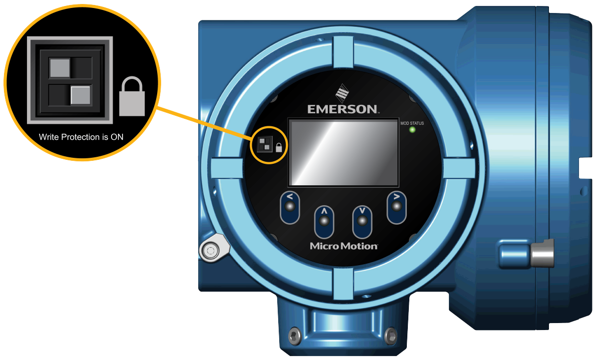
This transmitter:

- Was designed to be implemented in an industrial automation control system (Level 1 and Level 2 of the Purdue Reference Architecture Model), with defense in depth security controls
- Is not intended to be directly connected to an enterprise or to an internet-facing network without a compensating control in place

3.1.2 Lock or unlock the transmitter

If the transmitter has a display, a mechanical switch on the display can be used to lock or unlock the transmitter. When locked, no configuration changes can be made using any configuration tool.

Figure 3-1: Lock switch on transmitter display



You can determine whether you need to lock or unlock the transmitter by looking at the switch.

- If the switch is in the right position, the transmitter is locked.
- If the switch is in the left position, the transmitter is unlocked.

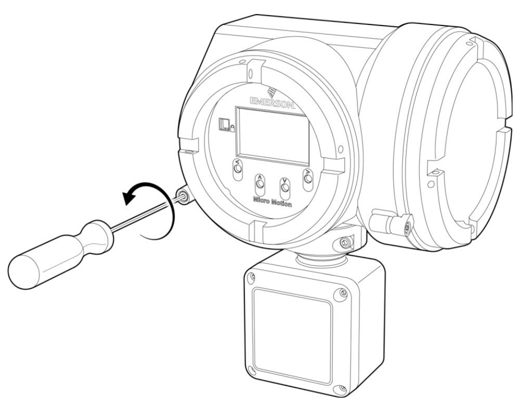
Note
The top switch is reserved for future use.

Procedure

1. **WARNING**
   If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

   If you are in a hazardous area, power down the transmitter.
2. Remove the transmitter housing cover.

Figure 3-2: Removing the transmitter housing cover



3. Using a fine-pointed tool, move the switch to the desired position.
4. Replace the transmitter housing cover.
5. If necessary, power up the transmitter.

3.1.3 Enable or disable the service port

Display	**Menu → Configuration → Security → Service Port**
ProLink III	Not available
Field communicator	**Configure → Manual Setup → Security → Enable/Disable Service Port**
Enhanced FF host	**Configure → Manual Setup → Security → Enable/Disable Service Port**
Basic FF host	**Device TB → Enable Service Port** (OD Index 146)

The service port is enabled by default, so you can use it for transferring files or connect to it with ProLink III. If you want to completely prevent it from being used, you can disable it.

Note
Enabling or disabling the service port will not take effect until power has been cycled to the transmitter.

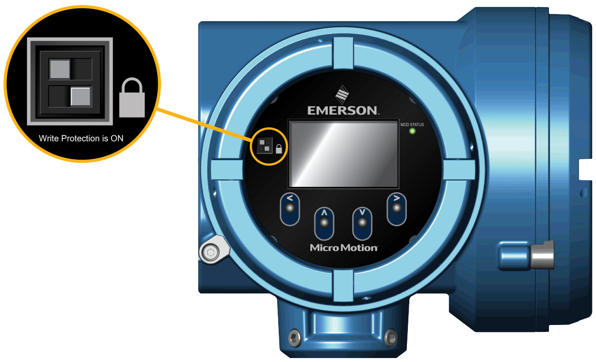
WARNING
Do not use the service port if the transmitter is in a hazardous area because using the service port means that you must open the transmitter wiring compartment. Opening the wiring compartment in a hazardous area while the transmitter is powered up can cause an explosion resulting in injury or death.

3.1.4 Enable or disable software write-protection

Display	Use the mechanical switch on the display.
ProLink III	**Device Tools → Configuration → Write-Protection**
Field communicator	**Configure → Manual Setup → Security → Lock/Unlock Device**
Enhanced FF host	**Configure → Manual Setup → Security → FOUNDATION Fieldbus → Write Lock**
Basic FF host	**Resource Block → Write Lock** (OD Index 34)

When enabled, **Write-Protection** prevents changes to the transmitter configuration. You can perform all other functions, and you can view the transmitter configuration parameters.

Note
The write protection setting via software methods (such as ProLink III) is available only on transmitters without a display.
For transmitters with a display, write protection is available only using the lock switch on the display. See Lock or unlock the transmitter.



Write-protecting the transmitter primarily prevents accidental changes to configuration, not intentional changes. Any user who can make changes to the configuration can disable write protection.

3.1.5 Configure security for the display

Display	**Menu → Configuration → Security → Display Security**
ProLink III	**Device Tools → Configuration → Transmitter Display → Display Security**
Field communicator	**Configure → Manual Setup → Display → Display Menus**
Enhanced FF host	**Configure → Manual Setup → Display → Display Menus**
Basic FF host	**Device TB → Offline Menu Passcode Required (OD Index 67)** **Device TB → Passcode (4 Digits alphanumeric) (OD Index 68)** **Device TB → Alert Passcode (OD Index 89)**

When using the display, you can require users to enter a password to do any of the following tasks:

- Enter the main menu
- Change a parameter
- Access alert data through the display
- Start, stop, or reset totalizers or inventories via the context menu

The display password can be the same or different from the totalizer/inventory context menu control password. If different, the display password is used to reset, start, and stop totalizers or inventories using **Menu → Operations → Totalizers**.

Procedure

1. Configure **Password Required** as desired.

Option	Description
At Write	When an user chooses an action that leads to a configuration change, they are prompted to enter the display password.
Enter Menu	When the menu is selected from the process variable screen, the display password will be immediately required if **Password Required** is set.
Never (default)	When a user chooses an action that leads to a configuration change, they are prompted to activate ⇦⇧⇩⇨. This is designed to protect against accidental changes to configuration. It is not a security measure.

2. If the At Write or Enter Menu option was selected, enable or disable alert security as desired.

Option	Description
Enabled	If an alert is active, the alert symbol ⓘ is shown in the upper right corner of the display but the alert banner is not displayed. If the operator attempts to enter the alert menu, they are prompted to enter the display password.
Disabled	If an alert is active, the alert symbol ⓘ is shown in the upper right corner of the display and the alert banner is displayed automatically. No password or confirmation is required to enter the alert menu.

Restriction

You cannot set Password Required to Never and enable alert security.

- If you did not enable **Password Required**, alert security is disabled and cannot be enabled.
- Alert security is disabled automatically if you set **Password Required** to Never after:
  - **Password Required** is initially set to either At Write or Enter Menu
  - Alert security is enabled

3. If **Password Required** has been set to At Write or Enter Menu, you will be prompted to enter the desired password.
   - Default: AAAA
   - Range: Any four alphanumeric characters
   - **Password Required** must be set to At Write or Enter Menu to enable the totalizer/inventory control context menu password option.

Important

If you enable **Password Required** but you do not change the display password, the transmitter will post a configuration alert.

4. Configure **Main Menu Available** as desired.

Option	Description
Enabled	The local display **Menu** option from the process variable screen will be accessible.
Disabled	The local display **Menu** option from the process variable screen will not be accessible.

Important
Once **Main Menu Available** has been disabled, you cannot enable it from the local display. Use another configuration tool, such as ProLink III, to re-enable main menu access from the local display.

3.1.6 Enable or disable fieldbus write lock

When locked, the fieldbus write lock prevents any configuration changes being written from the fieldbus segment.

Procedure

Set the **Write Lock** parameter (OD index 34) of the Resource block to **Locked** (1) or **Unlocked** (0).

3.2 Work with configuration files

You can save the current transmitter configuration in two forms: a backup file and a replication file. You can save the configuration to the SD card on your transmitter or to a USB drive.

Tip
You can use a saved configuration file to change the nature of the transmitter quickly. This might be convenient if the transmitter is used for different applications or different process fluids.

You can load a configuration file to the transmitter's working memory or to the transmitter's SD card. You can load either a backup file or a replication file.

Backup files
Contain all parameters. They are used to restore the current device if required. The `.spare` extension is used to identify backup files.

Replication files
Contain all parameters except the device-specific parameters, e.g., calibration factors or meter factors. They are used to replicate the transmitter configuration to other devices. The `.xfer` extension is used to identify replication files.

3.2.1 Save a configuration file using the display

Prerequisites

If you are planning to use the USB drive, the service port must be enabled. It is enabled by default. However, if you need to enable it, choose **Menu** → **Configuration** → **Security** and set **Service Port** to On.

Procedure

- To save the current configuration to the transmitter's SD card as a backup file:
  a) Choose **Menu** → **Configuration** → **Save/Restore Config** → **Save Config to Memory**.
  b) Enter the name for this configuration file.

  The configuration file is saved to the transmitter's SD card as `yourname.spare`.

- To save the current configuration to a USB drive, as either a backup file or a replication file:
  a) **WARNING**
     If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

     Open the wiring compartment on the transmitter and insert a USB drive into the service port.
  b) Choose **Menu** → **USB Options** → **Transmitter –> USB Drive** → **Save Active Config to USB Drive**.
  c) Choose Backup or Replicate.
  d) Enter the name for this configuration file.

  The configuration file is saved to the USB drive as `yourname.spare` or `yourname.xfer`.

- To copy a configuration file from the transmitter's SD card to the USB drive:
  a) **WARNING**
     If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

     Open the wiring compartment on the transmitter and insert a USB drive into the service port.
  b) Choose **Menu** → **USB Options** → **Transmitter –> USB Drive** → **Transfer Config File to USB Drive**.
  c) Choose Backup or Replicate.
  d) Select the file that you want to transfer.

  The configuration file is copied to the USB drive, using its existing name.

3.2.2 Save a configuration file using ProLink III

Note
When you use ProLink III format for configuration files, you can specify configuration parameters individually or by groups. Therefore, you can use this format for both backup and replication.

Procedure

- To save the current configuration to the transmitter's SD card:
  a) Choose **Device Tools** → **Configuration Transfer** → **Save Configuration**.
  b) Select On my 5700 Device Internal Memory and select **Next**.
  c) Select **Save**.

d) Enter the name for this configuration file.
e) Set the file type.
   — To save a backup file, set the file type to Backup.
   — To save a replication file, set the file type to Transfer.
f) Select **Save**.

The configuration file is saved to the transmitter's SD card as `yourname.spare` or `yourname.xfer`.

- To save the current configuration to your PC, in 5700 format:
  a) Choose **Device Tools** → **Configuration Transfer** → **Save Configuration**.
  b) Select On my computer in 5700 device file format and select **Next**.
  c) Select **Save**.
  d) Browse to the desired location, then enter the name for this configuration file.
  e) Set the file type.
     — To save a backup file, set the file type to Backup.
     — To save a replication file, set the file type to Transfer.
  f) Select **Save**.

  The configuration file is saved to the specified location as `yourname.spare` or `yourname.xfer`.

- To save the current configuration to your PC, in ProLink III format:
  a) Choose **Device Tools** → **Configuration Transfer** → **Save Configuration**.
  b) Select On my computer in ProLink III file format and click **Next**.
  c) Select **Save**.
  d) Select the configuration parameters to be included in this file.
     — To save a backup file, select all parameters.
     — To save a replication file, select all parameters except device-specific parameters.
  e) Select Save.
  f) Browse to the desired location, then enter the name for this configuration file.
  g) Set the file type to ProLink configuration file.
  h) Select Start Save.

  The configuration file is saved to the specified location as `yourname.pcfg`.

3.2.3 Save a configuration file using a basic FF host

Procedure

- To save the current configuration to the transmitter's SD card as a backup or replication file:

a) Verify or write the appropriate value to the **Config file type** parameter of the Device TB for the type of file you want to save.
   - 1 for a backup (spare) file.
   - 3 for a replication file.

b) Enter the name for the configuration file in the **File Name** parameter of the Device TB.

c) Write a 1 to the **Save Config File** parameter of the Device TB.

The configuration file is saved to the transmitter's SD card as `yourname.spare` or `yourname.xfer`, depending on the type.

3.2.4 Load a configuration file using the display

Prerequisites

You must have a backup file or a replication file available for use.

If you are planning to use the USB drive, the service port must be enabled. It is enabled by default. However, if you need to enable it, choose **Menu** → **Configuration** → **Security** and set **Service Port** to On.

Procedure

- To load either a backup file or a replication file from the transmitter's SD card:
  a) Choose **Menu** → **Configuration** → **Save/Restore Config** → **Restore Config from Memory**.
  b) Select **Backup** or **Replicate**.
  c) Select the file that you want to load.

  The file is loaded to working memory and becomes active immediately.

- To load a either a backup file or a replication file from a USB drive:
  a) ⚠ **WARNING**
     If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

     Open the wiring compartment on the transmitter and insert the USB drive containing the backup file or replication file into the service port.
  b) Choose **Menu** → **USB Options** → **USB Drive –> Transmitter** → **Upload Configuration File**.
  c) Select **Backup** or **Replicate**.
  d) Select the file that you want to load.
  e) Choose Yes or No when prompted to apply the settings.
     - Yes: The file is loaded to working memory and becomes active immediately.
     - No: The file is loaded to the transmitter's SD card but not to working memory. You can load it from the SD card to working memory at a later time.

3.2.5 Load a configuration file using ProLink III

You can load a configuration file to the transmitter's working memory. You can load a backup file or a replication file. Two PC file formats are supported: the 5700 format and the ProLink III format.

Note
When you use ProLink III format for configuration files, you can specify configuration parameters individually or by groups. Therefore, you can use this format for both backup and replication.

Procedure

- To load a backup file or replication file from the transmitter's SD card:
  a) Choose **Device Tools** → **Configuration Transfer** → **Load Configuration**.
  b) Select On my 5700 Device Internal Memory and select **Next**.
  c) Select Restore.
  d) Set the file type.
     — To load a backup file, set the file type to Backup.
     — To load a replication file, set the file type to Transfer.
  e) Select the file that you want to load and select **Load**.

  The parameters are written to working memory, and the new settings become effectively immediately.
- To load a backup file or replication file in 5700 format from the PC:
  a) Choose **Device Tools** → **Configuration Transfer** → **Load Configuration**.
  b) Select On my computer in 5700 device file format and select **Next**.
  c) Select Restore.
  d) Set the file type.
     — To load a backup file, set the file type to Backup.
     — To load a replication file, set the file type to Transfer.
  e) Navigate to the file you want to load, and select it.

  The parameters are written to working memory, and the new settings become effectively immediately.
- To load a file in ProLink III format from the PC:
  a) Choose **Device Tools** → **Configuration Transfer** → **Load Configuration**.
  b) Select On my computer in ProLink III file format and select **Next**.
  c) Select the parameters that you want to load.
  d) Select Load.
  e) Set the file type to Configuration file.
  f) Navigate to the file you want to load, and select it.
  g) Select Start Load.

The parameters are written to working memory, and the new settings become effectively immediately.

3.2.6 Load a configuration file using a basic FF host

You can load a backup or replication configuration file to the transmitter's working memory from the SD card using a basic FF host. If you need to load a file from a USB drive, you must use ProLink III or the display.

Prerequisites

You must have a backup file or a replication file available for use.

Procedure

- To load either a backup file or a replication file from the transmitter's SD card:
    a) Verify or write the appropriate value to the **Config file type** parameter of the Device TB for the type of file you want to load.
        — 1 for a backup (spare) file.
        — 3 for a replication file.
    b) Enter the name of the file you want to restore in the **File Name** parameter of the Device TB.
    c) Write a 1 to the **Restore Config File** parameter of the Device TB.

  The file is loaded to working memory and becomes active immediately.

3.2.7 Restore the factory configuration

Display	**Menu** → **Configuration** → **Save/Restore Configuration** → **Restore Config from Memory**
ProLink III	**Device Tools** → **Configuration Transfer** → **Restore Factory Configuration**
Field communicator	**Service Tools** → **Maintenance** → **Reset/Restore** → **Restore Factory Configuration**
Enhanced FF host	**Service Tools** → **Maintenance** → **Reset/Restore** → **Restore Factory Configuration**
Basic FF host	**Measurement TB** → **Restore Factory Configuration** (OD Index 122)

A file containing the factory configuration is always saved in the transmitter's internal memory, and is available for use.

This action is typically used for error recovery or for repurposing a transmitter.

If you restore the factory configuration, the real-time clock, the audit trail, the historian, and other logs are not reset.

3.2.8 Replicate a transmitter configuration

Replicating a transmitter configuration is a fast method to set up similar or identical measurement points.

Procedure

1. Configure a transmitter and verify its operation and performance.
2. Use any available method to save a replication file from that transmitter.
3. Use any available method to load the replication file to another transmitter.

4. At the replicated transmitter, set device-specific parameters and perform device-specific procedures:
    a) Set the clock.
    b) Set the tag and related parameters.
    c) Characterize the transmitter.
    d) Perform zero validation and take any recommended actions.
    e) Perform loop tests and take any recommended actions, including mA Output trim.
    f) Use sensor simulation to verify transmitter response.
5. At the replicated transmitter, make any other configuration changes.
6. Follow your standard procedures to ensure that the replicated transmitter is performing as desired.

4 Configure process measurement

4.1 Configure Sensor Flow Direction Arrow

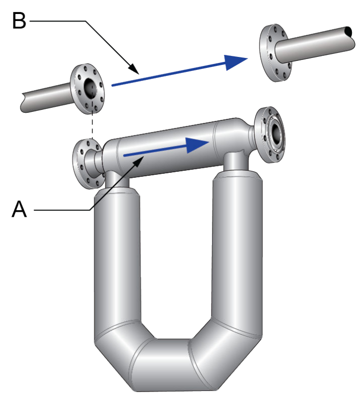
Display	**Menu → Configuration → Process Measurement → Flow Variables → Flow Direction**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Sensor Direction**
Field communicator	**Configure → Manual Setup → Measurements → Flow → Sensor Direction**
Enhanced FF host	**Configure → Manual Setup → Measurements → Flow → Sensor Direction**
Basic FF host	**Measurement TB → Flow Direction** (OD Index 30)

Sensor Flow Direction Arrow is used to accommodate installations in which the Flow arrow on the sensor does not match the majority of the process flow. This typically happens when the sensor is accidentally installed backwards.

Sensor Flow Direction Arrow interacts with **mA Output Direction**, **Frequency Output Direction**, and **Totalizer Direction** to control how flow is reported by the outputs and accumulated by the totalizers and inventories.

The **Sensor Flow Direction Arrow** also affects how flow is reported on the transmitter display and via digital communications. This includes ProLink III, a field communicator, the FF host, and all other user interfaces.

Figure 4-1: Flow arrow on sensor



A. Flow arrow
B. Actual flow direction

Procedure

Set **Sensor Flow Direction Arrow** as appropriate.

Option	Description
With Arrow	The majority of flow through the sensor matches the Flow arrow on the sensor. Actual forward flow is processed as forward flow.
Against Arrow	The majority of flow through the sensor is opposite to the Flow arrow on the sensor. Actual forward flow is processed as reverse flow.

Tip
Micro Motion sensors are bidirectional. Measurement accuracy is not affected by actual flow direction or the setting of **Sensor Flow Direction Arrow**. **Sensor Flow Direction Arrow** controls only whether actual flow is processed as forward flow or reverse flow.

Related information

Configure mA Output Direction
Configure Frequency Output Direction
Configure Discrete Output Source
Configure totalizers and inventories
Effect of Sensor Flow Direction Arrow on digital communications

4.2 Configure mass flow measurement

The mass flow measurement parameters control how mass flow is measured and reported. The mass total and mass inventory are derived from the mass flow data.

4.2.1 Configure Mass Flow Measurement Unit

Display	**Menu → Configuration → Process Measurement → Flow Variables → Mass Flow Settings → Units**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Mass Flow Rate Unit**
Field communicator	**Configure → Manual Setup → Measurements → Flow → Mass Flow Unit**
Enhanced FF host	**Configure → Manual Setup → Measurements → Flow → Mass Flow Unit**
Basic FF host	**Measurement TB → Mass Flow Unit** (OD Index 19)

Mass Flow Measurement Unit specifies the unit of measure that will be used for the mass flow rate. The default unit used for mass total and mass inventory is derived from this unit.

Procedure

Set **Mass Flow Measurement Unit** to the unit you want to use.

Default: g/sec (grams per second)

Tip
If the measurement unit you want to use is not available, you can define a special measurement unit.

Options for Mass Flow Measurement Unit

The transmitter provides a standard set of measurement units for **Mass Flow Measurement Unit**, plus one user-defined special measurement unit. Different communications tools may use different labels for the units.

Unit description	Label				
	Display	ProLink III	Field communicator	Enhanced FF host	Basic FF host
Grams per second	gram/s	g/sec	g/s	g/s	1318
Grams per minute	gram/min	g/min	g/min	g/min	1319

Unit description	Label				
	Display	**ProLink III**	**Field communicator**	**Enhanced FF host**	**Basic FF host**
Grams per hour	gram/h	g/hr	g/h	g/h	1320
Kilograms per second	kg/s	kg/sec	kg/s	kg/s	1322
Kilograms per minute	kg/min	kg/min	kg/min	kg/min	1323
Kilograms per hour	kg/h	kg/hr	kg/h	kg/h	1324
Kilograms per day	kg/d	kg/day	kg/d	kg/d	1325
Metric tons per minute	MetTon/min	mTon/min	MetTon/min	t/min	1327
Metric tons per hour	MetTon/h	mTon/hr	MetTon/h	t/h	1328
Metric tons per day	MetTon/d	mTon/day	MetTon/d	t/d	1329
Pounds per second	lb/s	lbs/sec	lb/s	lb/s	1330
Pounds per minute	lb/min	lbs/min	lb/min	lb/min	1331
Pounds per hour	lb/h	lbs/hr	lb/h	lb/h	1332
Pounds per day	lb/d	lbs/day	lb/d	lb/d	1333
Short tons (2000 pounds) per minute	STon/min	sTon/min	STon/min	STon/min	1335
Short tons (2000 pounds) per hour	STon/h	sTon/hr	STon/h	STon/h	1336
Short tons (2000 pounds) per day	STon/d	sTon/day	STon/d	STon/d	1337
Long tons (2240 pounds) per hour	LTon/h	lTon/hr	LTon/h	LTon/h	1340
Long tons (2240 pounds) per day	LTon/d	lTon/day	LTon/d	LTon/d	1341
Special unit	SPECIAL	Special	Special	Special	253

Define a special measurement unit for mass flow

Display	**Menu → Configuration → Process Measurement → Flow Variables → Mass Flow Settings → Units → SPECIAL**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Mass Flow Rate Unit → Special**
Field communicator	**Configure → Manual Setup → Measurements → Optional Setup → Special Units → Mass Special Units**
Enhanced FF host	**Configure → Manual Setup → Measurements → Optional Setup → Special Units → Mass Special Units**
Basic FF host	**Measurement TB → Mass Flow Configuration** (OD index 20–24)

Procedure

1. Specify **Base Mass Unit**.

   Base Mass Unit is the existing mass unit that the special unit will be based on.

2. Specify **Base Time Unit**.

   Base Time Unit is the existing time unit that the special unit will be based on.

3. Calculate **Mass Flow Conversion Factor** as follows:
   a) x base units = y special units
   b) **Mass Flow Conversion Factor** = x ÷ y

4. Enter **Mass Flow Conversion Factor**.

   The original mass flow rate value is divided by this value.

5. Set **Mass Flow Label** to the name you want to use for the mass flow unit.
6. Set **Mass Total Label** to the name you want to use for the mass total and mass inventory unit.

The special measurement unit is stored in the transmitter. You can configure the transmitter to use the special measurement unit at any time.

Example: Defining a special measurement unit for mass flow

If you want to measure mass flow in ounces per second (oz/sec):

1. Set **Base Mass Unit** to Pounds (lb).
2. Set **Base Time Unit** to Seconds (sec).
3. Calculate **Mass Flow Conversion Factor**:
   a. 1 lb/sec = 16 oz/sec
   b. **Mass Flow Conversion Factor** = 1 ÷ 16 = 0.0625
4. Set **Mass Flow Conversion Factor** to `0.0625`.
5. Set **Mass Flow Label** to `oz/sec`.
6. Set **Mass Total Label** to `oz`.

4.2.2 Configure Flow Damping

Display	**Menu → Configuration → Process Measurement → Flow Variables → Flow Damping**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Flow Rate Damping**
Field communicator	**Configure → Manual Setup → Measurements → Flow → Flow Damping**
Enhanced FF host	**Configure → Manual Setup → Measurements → Flow → Flow Damping**
Basic FF host	**Measurement TB → Flow Damping** (OD Index 29)

Flow Damping controls the amount of damping that will be applied to the measured mass flow rate. It affects flow rate process variables that are based on the measured mass flow rate. This includes volume flow rate and gas standard volume flow rate.

Flow Damping also affects specialized flow rate variables such as temperature-corrected volume flow rate (API Referral) and net mass flow rate (concentration measurement).

Damping is used to smooth out small, rapid fluctuations in process measurement. The damping value specifies the time period, in seconds, over which the transmitter will spread changes in the process variable.

At the end of the interval, the internal value of the process variable (the damped value) will reflect 63% of the change in the actual measured value.

Procedure

Set **Flow Damping** to the value you want to use.

- Default: 0.64 seconds
- Range: 0 seconds to 60 seconds

Note
If a number greater than 60 is entered, it is automatically changed to 60.

Tip
- A high damping value makes the process variable appear smoother because the reported value changes slowly.
- A low damping value makes the process variable appear more erratic because the reported value changes more quickly.
- The combination of a high damping value and rapid, large changes in flow rate can result in increased measurement error.
- Whenever the damping value is non-zero, the reported measurement will lag the actual measurement because the reported value is being averaged over time.
- In general, lower damping values are preferable because there is less chance of data loss, and less lag time between the actual measurement and the reported value.
- The transmitter automatically rounds off any entered damping value to the nearest valid value. Therefore, the recommended damping value for gas applications should be 3.2 seconds. If you enter 2.56, the transmitter will round it off to 3.2.
- For filling applications, Micro Motion recommends using the default value of 0.04 seconds.

Effect of flow damping on volume measurement

Flow damping affects volume measurement for liquid volume data. Flow damping also affects volume measurement for gas standard volume data. The transmitter calculates volume data from the damped mass flow data.

Interaction between Flow Damping and mA Output Damping

In some circumstances, both **Flow Damping** and **mA Output Damping** are applied to the reported mass flow value.

Flow Damping controls the rate of change in flow process variables. **mA Output Damping** controls the rate of change reported via the mA Output. If **mA Output Process Variable** is set to Mass Flow Rate, and both **Flow Damping** and **mA Output Damping** are set to non-zero values, flow damping is applied first, and the added damping calculation is applied to the result of the first calculation.

4.2.3 Configure Mass Flow Cutoff

Display	**Menu** → **Configuration** → **Process Measurement** → **Flow Variables** → **Mass Flow Settings** → **Low Flow Cutoff**
ProLink III	**Device Tools** → **Configuration** → **Process Measurement** → **Flow** → **Mass Flow Cutoff**
Field communicator	**Configure** → **Manual Setup** → **Measurements** → **Flow** → **Mass Flow Cutoff**
Enhanced FF host	**Configure** → **Manual Setup** → **Measurements** → **Flow** → **Mass Flow Cutoff**
Basic FF host	**Measurement TB** → **Mass Flow Cutoff** (OD Index 26)

Mass Flow Cutoff specifies the lowest mass flow rate that will be reported as measured. All mass flow rates below this cutoff will be reported as 0.

Procedure

Set **Mass Flow Cutoff** to the value you want to use.

- Default: A sensor-specific value set at the factory. If your transmitter was ordered without a sensor, the default may be 0.0.
- Recommendation: 0.5% of maximum flow rate of the attached sensor. See the sensor specifications.

Important
Do not use your meter for measurement with **Mass Flow Cutoff** set to 0.0 g/sec. Ensure that **Mass Flow Cutoff** is set to the value that is appropriate for your sensor.

Effect of Mass Flow Cutoff on volume measurement

Mass Flow Cutoff does not affect volume measurement. Volume data is calculated from the actual mass data rather than the reported value.

Volume flow has a separate Volume Flow Cutoff that is not affected by the Mass Flow Cutoff value.

Interaction between Mass Flow Cutoff and mA Output Cutoff

Mass Flow Cutoff defines the lowest mass flow value that the transmitter will report as measured. **mA Output Cutoff** defines the lowest flow rate that will be reported via the mA Output. If **mA Output Process Variable** is set to Mass Flow Rate, the mass flow rate reported via the mA Output is controlled by the higher of the two cutoff values.

Mass Flow Cutoff affects all reported values and values used in other transmitter behavior (e.g., events defined on mass flow).

mA Output Cutoff affects only mass flow values reported via the mA Output.

Example: Cutoff interaction with mA Output Cutoff lower than Mass Flow Cutoff

Configuration:

- **mA Output Process Variable**: Mass Flow Rate
- **Frequency Output Process Variable**: Mass Flow Rate
- **mA Output Cutoff**: `10` g/sec
- **Mass Flow Cutoff**: `15` g/sec

Result: If the mass flow rate drops below 15 g/sec, mass flow will be reported as 0, and 0 will be used in all internal processing.

Example: Cutoff interaction with mA Output Cutoff higher than Mass Flow Cutoff

Configuration:

- **mA Output Process Variable**: Mass Flow Rate
- **Frequency Output Process Variable**: Mass Flow Rate
- **mA Output Cutoff**: `15` g/sec
- **Mass Flow Cutoff**: `10` g/sec

Result:

- If the mass flow rate drops below 15 g/sec but not below 10 g/sec:
  - The mA Output will report zero flow.
  - The Frequency Output will report the actual flow rate, and the actual flow rate will be used in all internal processing.
- If the mass flow rate drops below 10 g/sec, both outputs will report zero flow, and 0 will be used in all internal processing.

4.3 Configure volume flow measurement for liquid applications

The volume flow measurement parameters control how liquid volume flow is measured and reported. The volume total and volume inventory are derived from volume flow data.

Restriction
You cannot implement both liquid volume flow and gas standard volume flow at the same time. Choose one or the other.

4.3.1 Configure Volume Flow Type for liquid applications

Display	**Menu → Configuration → Process Measurement → Flow Variables → Volume Flow Settings → Flow Type → Liquid**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Volume Flow Type → Liquid Volume**
Field communicator	**Configure → Manual Setup → Measurements → Optional Setup → GSV → Volume Flow Type → Liquid Volume**
Enhanced FF host	**Configure → Manual Setup → Measurements → Volume Flow → Type**
Basic FF host	**Measurement TB → Volume Flow Type** (OD Index 52)

Volume Flow Type controls whether liquid or gas standard volume flow measurement will be used.

Restriction
Gas standard volume measurement is incompatible with the following applications:

- API Referral
- Concentration measurement

- Advanced Phase Measurement — liquid with gas

For these applications, set **Volume Flow Type** to Liquid.

Procedure

Set **Volume Flow Type** to Liquid.

4.3.2 Configure Volume Flow Measurement Unit for liquid applications

Display	**Menu → Configuration → Process Measurement → Flow Variables → Volume Flow Settings → Units**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Volume Flow Rate Unit**
Field communicator	**Configure → Manual Setup → Measurements → Flow → Volume Flow Unit**
Enhanced FF host	**Configure → Manual Setup → Measurements → Flow → Volume Flow Unit**
Basic FF host	**Measurement TB → Volume Flow Unit** (OD Index 31)

Volume Flow Measurement Unit specifies the unit of measurement that will be displayed for the volume flow rate. The unit used for the volume total and volume inventory is based on this unit.

Prerequisites

Before you configure **Volume Flow Measurement Unit**, be sure that **Volume Flow Type** is set to Liquid.

Procedure

Set **Volume Flow Measurement Unit** to the unit you want to use.

Default: l/sec (liters per second)

Tip
If the measurement unit you want to use is not available, you can define a special measurement unit.

Options for Volume Flow Measurement Unit for liquid applications

Unit description	Label				
	Display	**ProLink III**	**Field communicator**	**Enhanced FF host**	**Basic FF host code**
Cubic feet per second	ft3/s	ft3/sec	Cuft/s	CFS	1356
Cubic feet per minute	ft3/min	ft3/min	Cuft/min	CFM	1357
Cubic feet per hour	ft3/h	ft3/hr	Cuft/h	CFH	1358
Cubic feet per day	ft3/d	ft3/day	Cuft/d	ft^3/d	1359
Cubic meters per second	m3/s	m3/sec	Cum/s	m^3/s	1347
Cubic meters per minute	m3/min	m3/min	Cum/min	m^3/min	1348
Cubic meters per hour	m3/h	m3/hr	Cum/h	m^3/h	1349
Cubic meters per day	m3/d	m3/day	Cum/d	m^3/d	1350
U.S. gallons per second	gal/s	US gal/sec	gal/s	gal/s	1362

Unit description	Label				
	Display	ProLink III	Field communicator	Enhanced FF host	Basic FF host code
U.S. gallons per minute	gal/m	US gal/min	gal/min	GPM	1363
U.S. gallons per hour	gal/h	US gal/hr	gal/h	gal/h	1364
U.S. gallons per day	gal/d	US gal/day	gal/d	gal/d	1365
Million U.S. gallons per day	MMgal/d	mil US gal/day	MMgal/d	Mgal/d	1366
Liters per second	L/s	l/sec	L/s	L/s	1351
Liters per minute	L/min	l/min	L/in	L/min	1352
Liters per hour	L/h	l/hr	L/h	L/h	1353
Million liters per day	MML/d	mil l/day	ML/d	ML/d	1355
Imperial gallons per second	Impgal/s	Imp gal/sec	Impgal/s	ImpGal/s	1367
Imperial gallons per minute	Impgal/m	Imp gal/min	Impgal/min	ImpGal/min	1368
Imperial gallons per hour	Impgal/h	Imp gal/hr	Impgal/h	ImpGal/h	1369
Imperial gallons per day	Impgal/d	Imp gal/day	Impgal/d	ImpGal/d	1370
Barrels per second (1)	bbl/s	barrels/sec	bbl/s	bbl/s	1371
Barrels per minute (1)	bbl/min	barrels/min	bbl/min	bbl/min	1372
Barrels per hour (1)	bbl/h	barrels/hr	bbl/h	bbl/h	1373
Barrels per day (1)	bbl/d	barrels/day	bbl/d	bbl/d	1374
Beer barrels per second (2)	Beer bbl/s	Beer barrels/sec	Beer bbl/s	bbl(US Beer)/s	1634
Beer barrels per minute (2)	Beer bbl/min	Beer barrels/min	Beer bbl/min	bbl(US Beer)/min	1633
Beer barrels per hour (2)	Beer bbl/h	Beer barrels/hr	Beer bbl/h	bbl(US Beer)/h	1632
Beer barrels per day (2)	Beer bbl/d	Beer barrels/day	Beer bbl/d	bbl(US Beer)/d	1631
Special unit	SPECIAL	Special	Special	Special	253

(1) Unit based on oil barrels (42 U.S. gallons).
(2) Unit based on U.S. beer barrels (31 U.S. gallons).

Define a special measurement unit for volume flow

Display	**Menu → Configuration → Process Measurement → Flow Variables → Volume Flow Settings → Units → SPECIAL**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Volume Flow Rate Unit → Special**
Field communicator	**Configure → Manual Setup → Measurements → Optional Setup → Special Units → Volume Special Units**
Enhanced FF host	**Configure → Manual Setup → Measurements → Optional Setup → Special Units → Volume Special Units**
Basic FF host	**Measurement TB → Volume Flow Configuration** (OD Index 32–35)

Procedure

1. Specify **Base Volume Unit**.

   Base Volume Unit is the existing volume unit that the special unit will be based on.
2. Specify **Base Time Unit**.

   Base Time Unit is the existing time unit that the special unit will be based on.
3. Calculate **Volume Flow Conversion Factor** as follows:
   a) x base units = y special units
   b) **Volume Flow Conversion Factor** = x ÷ y
4. Enter **Volume Flow Conversion Factor**.

   The original volume flow rate value is divided by this conversion factor.
5. Set **Volume Flow Label** to the name you want to use for the volume flow unit.
6. Set **Volume Total Label** to the name you want to use for the volume total and volume inventory unit.

The special measurement unit is stored in the transmitter. You can configure the transmitter to use the special measurement unit at any time.

Example: Defining a special measurement unit for volume flow

You want to measure volume flow in pints per second (pints/sec).

1. Set **Base Volume Unit** to Gallons (gal).
2. Set **Base Time Unit** to Seconds (sec).
3. Calculate the conversion factor:
   a. 1 gal/sec = 8 pints/sec
   b. **Volume Flow Conversion Factor** = 1 ÷ 8 = 0.1250
4. Set **Volume Flow Conversion Factor** to `0.1250`.
5. Set **Volume Flow Label** to `pints/sec`.
6. Set **Volume Total Label** to `pints`.

4.3.3 Configure Volume Flow Cutoff

Display	**Menu → Configuration → Process Measurement → Flow Variables → Volume Flow Settings → Low Flow Cutoff**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Volume Flow Cutoff**
Field communicator	**Configure → Manual Setup → Measurements → Flow → Volume Flow Cutoff**
Enhanced FF host	**Configure → Manual Setup → Measurements → Flow → Volume Flow Cutoff**
Basic FF host	**Measurement TB → Volume Flow Cutoff** (OD Index 38)

Volume Flow Cutoff specifies the lowest volume flow rate that will be reported as measured. All volume flow rates below this cutoff are reported as 0.

Procedure

Set **Volume Flow Cutoff** to the value you want to use.

- Default: 0.0 l/sec (liters per second)
- Range: 0 l/sec to *x* l/sec, where *x* is the sensor's flow calibration factor, multiplied by 0.0002.

Interaction between Volume Flow Cutoff and mAO Cutoff

Volume Flow Cutoff defines the lowest liquid volume flow value that the transmitter will report as measured. **mAO Cutoff** defines the lowest flow rate that will be reported via the mA Output. If **mA Output Process Variable** is set to Volume Flow Rate, the volume flow rate reported via the mA Output is controlled by the higher of the two cutoff values.

Volume Flow Cutoff affects both the volume flow values reported via the outputs and the volume flow values used in other transmitter behavior (e.g., events defined on the volume flow).

mAO Cutoff affects only flow values reported via the mA Output.

Example: Cutoff interaction with mAO Cutoff lower than Volume Flow Cutoff

Configuration:

- **mA Output Process Variable**: Volume Flow Rate
- **Frequency Output Process Variable**: Volume Flow Rate
- **AO Cutoff**: `10` l/sec
- **Volume Flow Cutoff**: `15` l/sec

Result: If the volume flow rate drops below 15 l/sec, volume flow will be reported as 0, and 0 will be used in all internal processing.

Example: Cutoff interaction with mAO Cutoff higher than Volume Flow Cutoff

Configuration:

- **mA Output Process Variable**: Volume Flow Rate
- **Frequency Output Process Variable**: Volume Flow Rate
- **AO Cutoff**: `15` l/sec
- **Volume Flow Cutoff**: `10` l/sec

Result:

- If the volume flow rate drops below 15 l/sec but not below 10 l/sec:
  - The mA Output will report zero flow.
  - The Frequency Output will report the actual flow rate, and the actual flow rate will be used in all internal processing.
- If the volume flow rate drops below 10 l/sec, both outputs will report zero flow, and 0 will be used in all internal processing.

4.4 Configure Gas Standard Volume (GSV) flow measurement

The gas standard volume (GSV) flow measurement parameters control how gas standard volume flow is measured and reported.

Restriction
You cannot implement both liquid volume flow and gas standard volume flow at the same time. Choose one or the other.

4.4.1 Configure Volume Flow Type for gas applications

Display	**Menu → Configuration → Process Measurement → Flow Variables → Volume Flow Settings → Flow Type → Gas**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Volume Flow Type → Gas Standard Volume**
Field communicator	**Configure → Manual Setup → Measurements → Optional Setup → GSV → Volume Flow Type → Standard Gas Volume**
Enhanced FF host	**Configure → Manual Setup → Measurement → Volume Flow → Type**
Basic FF host	**Measurement TB → Volume Flow Type** (OD Index 52)

Volume Flow Type controls whether liquid or gas standard volume flow measurement will be used.

Restriction
Gas standard volume measurement is incompatible with the following applications:

- API Referral
- Concentration measurement
- Advanced Phase Measurement — liquid with gas

For these applications, set **Volume Flow Type** to Liquid.

Procedure

Set **Volume Flow Type** to Gas.

4.4.2 Configure Standard Gas Density

Display	**Menu → Configuration → Process Measurement → Flow Variables → Volume Flow Settings → Standard Gas Density**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Standard Density of Gas**
Field communicator	**Configure → Manual Setup → Measurements → Optional Setup → GSV → Gas Ref Density**
Enhanced FF host	**Configure → Manual Setup → Measurements → Optional Setup → GSV → Gas Ref Density**
Basic FF host	**Measurement TB → Gas Reference Density** (OD Index 53)

Standard Gas Density is the density of your gas at reference temperature and reference pressure. This is often called *standard density* or *base density*. It is used to calculate the GSV flow rate from the mass flow rate.

Procedure

Set **Standard Gas Density** to the density of your gas at reference temperature and reference pressure.

You can use any reference temperature and reference pressure that you choose. It is not necessary to configure these values in the transmitter.

Tip
ProLink III provides a guided method that you can use to calculate the standard density of your gas if you do not know it.

4.4.3 Configure Gas Standard Volume Flow Measurement Unit

Display	**Menu → Configuration → Process Measurement → Flow Variables → Volume Flow Settings → Units**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Gas Standard Volume Flow Unit**
Field communicator	**Configure → Manual Setup → Measurements → Flow → GSV Flow Unit**
Enhanced FF host	**Configure → Manual Setup → Measurement → Gas Standard Volume Flow → Unit**
Basic FF host	**Measurement TB → Gas Standard Volume Flow Unit** (OD Index 55)

Gas Standard Volume Flow Measurement Unit specifies the unit of measure that will be used for the gas standard volume (GSV) flow rate. The unit used for gas standard volume total and gas standard volume inventory is derived from this unit.

Prerequisites

Before you configure **Gas Standard Volume Flow Measurement Unit**, be sure that **Volume Flow Type** is set to Gas Standard Volume.

Procedure

Set **Gas Standard Volume Flow Measurement Unit** to the unit you want to use.

Default: SCFM (Standard Cubic Feet per Minute)

Tip
If the measurement unit you want to use is not available, you can define a special measurement unit.

Options for Gas Standard Volume Flow Measurement Unit

The transmitter provides a standard set of measurement units for **Gas Standard Volume Flow Measurement Unit**, plus one user-defined special measurement unit. Different communications tools may use different labels for the units.

Unit description	Label				
	Display	**ProLink III**	**Field communicator**	**Enhanced FF host**	**Basic FF host**
Normal cubic meters per second	NCMS	Nm3/sec	Nm3/sec	Nm^3/s	1522
Normal cubic meters per minute	NCMM	Nm3/min	Nm^3/min	Nm^3/min	1523
Normal cubic meters per hour	NCMH	Nm3/hr	Nm3/hr	Nm^3/h	1524
Normal cubic meters per day	NCMD	Nm3/day	Nm3/day	Nm^3/d	1525
Normal liter per second	NLPS	NLPS	NLPS	NL/s	1532
Normal liter per minute	NLPM	NLPM	NLPM	NL/min	1533
Normal liter per hour	NLPH	NLPH	NLPH	NL/h	1534
Normal liter per day	NLPD	NLPD	NLPD	NL/d	1535
Standard cubic feet per second	SCFS	SCFS	SCFS	SCFS	33000
Standard cubic feet per minute	SCFM	SCFM	SCFM	SCFM	1360
Standard cubic feet per hour	SCFH	SCFH	SCFH	SCFH	1361
Standard cubic feet per day	SCFD	SCFD	SCFD	SCFD	33001
Standard cubic meters per second	SCMS	Sm3/sec	Sm3/sec	Sm^3/s	1527
Standard cubic meters per minute	SCMM	Sm3/min	Sm3/min	Sm^3/min	1528
Standard cubic meters per hour	SCMH	Sm3/hr	Sm3/hr	Sm^3/h	1529
Standard cubic meters per day	SCMD	Sm3/day	Sm3/day	Sm^3/d	1530
Standard liter per second	SLPS	SLPS	SLPS	SL/s	1537
Standard liter per minute	SLPM	SLPM	SLPM	SL/min	1538
Standard liter per hour	SLPH	SLPH	SLPH	SL/h	1539
Standard liter per day	SLPD	SLPD	SLPD	SL/d	1540
Special measurement unit	SPECIAL	Special	Special	Special	253

Define a special measurement unit for gas standard volume flow

Display	**Menu → Configuration → Process Measurement → Flow Variables → Volume Flow Settings → Units → SPECIAL**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Gas Standard Volume Flow Unit → Special**
Field communicator	**Configure → Manual Setup → Measurements → Optional Setup → Special Units → Special Gas Standard Volume Units**
Enhanced FF host	**Configure → Manual Setup → Measurements → Optional Setup → Special Units → Special Gas Standard Volume Units**
Basic FF host	**Measurement TB → Gas Process Variables** (OD Index 56–59, 61)

A special measurement unit is a user-defined unit of measure that allows you to report process data, totalizer data, and inventory data in a unit that is not available in the transmitter. A special measurement unit is calculated from an existing measurement unit using a conversion factor.

Procedure

1. Specify **Base Gas Standard Volume Unit**.

   Base Gas Standard Volume Unit is the existing gas standard volume unit that the special unit will be based on.
2. Specify **Base Time Unit**.

   Base Time Unit is the existing time unit that the special unit will be based on.
3. Calculate **Gas Standard Volume Flow Conversion Factor** as follows:
   a) x base units = y special units
   b) **Gas Standard Volume Flow Conversion Factor** = x ÷ y
4. Enter the **Gas Standard Volume Flow Conversion Factor**.

   The original gas standard volume flow value is divided by this conversion factor.
5. Set **Gas Standard Volume Flow Label** to the name you want to use for the gas standard volume flow unit.
6. Set **Gas Standard Volume Total Label** to the name you want to use for the gas standard volume total and gas standard volume inventory unit.

The special measurement unit is stored in the transmitter. You can configure the transmitter to use the special measurement unit at any time.

Example: Defining a special measurement unit for gas standard volume flow

You want to measure gas standard volume flow in thousands of standard cubic feet per minute.

1. Set **Base Gas Standard Volume Unit** to SCFM.
2. Set **Base Time Unit** to minutes (min).
3. Calculate the conversion factor:
   a. One thousands of standard cubic feet per minute = 1000 cubic feet per minute
   b. **Gas Standard Volume Flow Conversion Factor** = 1 ÷ 1000 = 0.001

4. Set **Gas Standard Volume Flow Conversion Factor** to `0.001`.
5. Set **Gas Standard Volume Flow Label** to `KSCFM`.
6. Set **Gas Standard Volume Total Label** to `KSCF`.

4.4.4 Configure Gas Standard Volume Flow Cutoff

Display	**Menu → Configuration → Process Measurement → Flow Variables → Volume Flow Settings → Low Flow Cutoff**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Gas Standard Volume Flow Cutoff**
Field communicator	**Configure → Manual Setup → Measurements → Optional Setup → GSV → GSV Cutoff**
Enhanced FF host	**Configure → Manual Setup → Measurements → Optional Setup → Gas Standard Volume Flow → Cutoff**
Basic FF host	**Measurement TB → Gas Standard Volume Cutoff** (OD Index 60)

Gas Standard Volume Flow Cutoff specifies the lowest gas standard volume flow rate that will reported as measured. All gas standard volume flow rates below this cutoff will be reported as 0.

Procedure

Set **Gas Standard Volume Flow Cutoff** to the value you want to use.

- Default: 0.0
- Range: 0.0 to any positive value

Interaction between Gas Standard Volume Flow Cutoff and mA Output Cutoff

Gas Standard Volume Flow Cutoff defines the lowest Gas Standard Volume flow value that the transmitter will report as measured. **mA Output Cutoff** defines the lowest flow rate that will be reported via the mA Output. If **mA Output Process Variable** is set to Gas Standard Volume Flow Rate, the volume flow rate reported via the mA Output is controlled by the higher of the two cutoff values.

Gas Standard Volume Flow Cutoff affects both the gas standard volume flow values reported through outputs and the gas standard volume flow values used in other transmitter behavior (for example, events defined on gas standard volume flow).

mA Output Cutoff affects only flow values reported via the mA Output.

Example: Cutoff interaction with mA Output Cutoff lower than Gas Standard Volume Flow Cutoff

Configuration:

- **mA Output Process Variable** for the primary mA Output: Gas Standard Volume Flow Rate
- **Frequency Output Process Variable**: Gas Standard Volume Flow Rate
- **mA Output Cutoff** for the primary mA Output: `10` SLPM (standard liters per minute)
- **Gas Standard Volume Flow Cutoff**: `15` SLPM

Result: If the gas standard volume flow rate drops below 15 SLPM, the volume flow will be reported as 0, and 0 will be used in all internal processing.

Example: Cutoff interaction with mA Output Cutoff higher than Gas Standard Volume Flow Cutoff

Configuration:

- **mA Output Process Variable** for the primary mA Output: Gas Standard Volume Flow Rate
- **Frequency Output Process Variable**: Gas Standard Volume Flow Rate
- **mA Output Cutoff** for the primary mA Output: `15` SLPM (standard liters per minute)
- **Gas Standard Volume Flow Cutoff**: `10` SLPM

Result:

- If the gas standard volume flow rate drops below 15 SLPM but not below 10 SLPM:
  - The primary mA Output will report zero flow.
  - The Frequency Output will report the actual flow rate, and the actual flow rate will be used in all internal processing.
- If the gas standard volume flow rate drops below 10 SLPM, both outputs will report zero flow, and 0 will be used in all internal processing.

4.5 Configure density measurement

The density measurement parameters control how density is measured and reported. Density measurement is used with mass flow rate measurement to determine liquid volume flow rate.

4.5.1 Configure Density Measurement Unit

Display	**Menu → Configuration → Process Measurement → Density → Units**
ProLink III	**Device Tools → Configuration → Process Measurement → Density → Density Unit**
Field communicator	**Configure → Manual Setup → Measurements → Density → Density Unit**
Enhanced FF host	**Configure → Manual Setup → Measurements → Density → Density Unit**
Basic FF host	**Measurement TB → Density Unit** (OD Index 45)

Density Measurement Unit controls the measurement units that will be used in density calculations and reporting.

Restriction
If the API Referral application is enabled, you cannot change the density measurement unit here. The density measurement unit is controlled by the API table selection.

Procedure

Set **Density Measurement Unit** to the option you want to use.

Default: g/cm^3 (grams per cubic centimeter)

Options for Density Measurement Unit

The transmitter provides a standard set of measurement units for **Density Measurement Unit**. Different communications tools may use different labels.

Unit description	Label				
	Display	ProLink III	Field communicator	Enhanced FF host	Basic FF host
Specific gravity[(1)]	SGU	SGU	SGU	SGU	1114
Grams per cubic centimeter	g/cm3	g/cm3	g/Cucm	g/cm³	1100
Grams per liter	g/L	g/l	g/L	g/L	1105
Grams per milliliter	g/mL	g/ml	g/mL	g/ml	1104
Kilograms per liter	kg/L	kg/l	kg/L	kg/L	1103
Kilograms per cubic meter	kg/m3	kg/m3	kg/Cum	kg/m³	1097
Pounds per U.S. gallon	lb/gal	lbs/USgal	lb/gal	lb/gal	1108
Pounds per cubic foot	lb/ft3	lbs/ft3	lb/Cuft	lb/ft³	1107
Pounds per cubic inch	lb/in3	lbs/in3	lb/CuIn	lb/in³	1106
Degrees API	API	API	degAPI	degAPI	1113
Short ton per cubic yard	STon/yd3	sT/yd3	STon/yd³	STon/yd³	1109

(1) Non-standard calculation. This value represents line density divided by the density of water at 60 °F (15.6 °C).

4.5.2 Configure Density Damping

Display	**Menu → Configuration → Process Measurement → Density → Damping**
ProLink III	**Device Tools → Configuration → Process Measurement → Density → Density Damping**
Field communicator	**Configure → Manual Setup → Measurements → Density → Density Damping**
Enhanced FF host	**Configure → Manual Setup → Measurements → Density → Density Damping**
Basic FF host	**Measurement TB → Density Damping** (OD Index 49)

Density Damping controls the amount of damping that will be applied to density data.

Damping is used to smooth out small, rapid fluctuations in process measurement. The damping value specifies the time period, in seconds, over which the transmitter will spread changes in the process variable. At the end of the interval, the internal value of the process variable (the damped value) will reflect 63% of the change in the actual measured value.

Procedure

Set **Density Damping** to the desired value.

- Default: 1.28 seconds
- Range: 0.0 to 60 seconds

Tip

- A high damping value makes the process variable appear smoother because the reported value changes slowly.
- A low damping value makes the process variable appear more erratic because the reported value changes more quickly.
- The combination of a high damping value and rapid, large changes in density can result in increased measurement error.
- Whenever the damping value is non-zero, the damped value will lag the actual measurement because the damped value is being averaged over time.
- In general, lower damping values are preferable because there is less chance of data loss, and less lag time between the actual measurement and the damped value.
- If a number greater than 60 is entered, it is automatically changed to 60.

Effect of Density Damping on volume measurement

Density Damping affects liquid volume measurement. Liquid volume values are calculated from the damped density value rather than the measured density value. **Density Damping** does not affect gas standard volume measurement.

Interaction between Density Damping and mA Output Damping

When the mA Output is configured to report density, both **Density Damping** and **mA Output Damping** are applied to the reported density value.

Density Damping controls the rate of change in the value of the process variable in transmitter memory. **mA Output Damping** controls the rate of change reported via the mA Output.

If **mA Output Source** is set to Density, and both **Density Damping** and **mA Output Damping** are set to non-zero values, density damping is applied first, and the mA Output damping calculation is applied to the result of the first calculation. This value is reported over the mA Output.

4.5.3 Configure Density Cutoff

Display	**Menu → Configuration → Process Measurement → Density → Cutoff**
ProLink III	**Device Tools → Configuration → Process Measurement → Density → Density Cutoff**
Field communicator	**Configure → Manual Setup → Measurements → Density → Density Cutoff**
Enhanced FF host	**Configure → Manual Setup → Measurements → Density → Density Cutoff**
Basic FF host	**Measurement TB → Density Cutoff** (OD Index 50)

Density Cutoff specifies the lowest density value that will be reported as measured. All density values below this cutoff will be reported as 0.

Procedure

Set **Density Cutoff** to the value you want to use.

- Default: 0.2 g/cm^3
- Range: 0.0 g/cm^3 to 0.5 g/cm^3

Effect of Density Cutoff on volume measurement

Density Cutoff affects liquid volume measurement. If the density value goes below **Density Cutoff**, the volume flow rate is reported as 0.

4.6 Configure temperature measurement

The temperature measurement parameters control how temperature data is processed. Temperature data is used in several different ways, including temperature compensation, API Referral, and concentration measurement.

4.6.1 Configure Temperature Measurement Unit

Display	**Menu → Configuration → Process Measurement → Temperature → Units**
ProLink III	**Device Tools → Configuration → Process Measurement → Temperature → Temperature Unit**
Field communicator	**Configure → Manual Setup → Measurements → Temperature → Unit**
Enhanced FF host	**Configure → Manual Setup → Measurements → Temperature → Unit**
Basic FF host	**Measurement TB → Temperature Unit** (OD Index 41)

Temperature Measurement Unit specifies the unit that will be used for temperature measurement.

Procedure

Set **Temperature Measurement Unit** to the option you want to use.

Default: °C (Celsius)

Options for Temperature Measurement Unit

The transmitter provides a standard set of units for **Temperature Measurement Unit**. Different communications tools may use different labels for the units.

Unit description	Label				
	Display	ProLink III	Field communicator	Enhanced FF host	Basic FF host fieldbus code
Degrees Celsius	°C	°C	degC	degC	1001
Degrees Fahrenheit	°F	°F	degF	degF	1002
Degrees Rankine	°R	°R	degR	degR	1003
Kelvin	°K	°K	Kelvin	K	1000

4.6.2 Configure Temperature Damping

Display	**Menu → Configuration → Process Measurement → Temperature → Damping**
ProLink III	**Device Tools → Configuration → Process Measurement → Temperature → Temperature Damping**

Field communicator	**Configure → Manual Setup → Measurements → Temperature → Damping**
Enhanced FF host	**Configure → Manual Setup → Measurements → Temperature → Damping**
Basic FF host	**Measurement TB → Temperature Damping** (OD Index 44)

Temperature Damping controls the amount of damping that will be applied to temperature data from the sensor. **Temperature Damping** is not applied to external temperature data.

Damping is used to smooth out small, rapid fluctuations in process measurement. The damping value specifies the time period, in seconds, over which the transmitter will spread changes in the process variable. At the end of the interval, the internal value of the process variable (the damped value) will reflect 63% of the change in the actual measured value.

Procedure

Set **Temperature Damping** to the desired value.

- Default: 4.8 seconds
- Range: 0.0 to 80 seconds

Note
If a number greater than 80 is entered, it is automatically changed to 80.

Tip
- A high damping value makes the process variable appear smoother because the reported value changes slowly.
- A low damping value makes the process variable appear more erratic because the reported value changes more quickly.
- The combination of a high damping value and rapid, large changes in temperature can result in increased measurement error.
- Whenever the damping value is non-zero, the damped value will lag the actual measurement because the damped value is being averaged over time.
- In general, lower damping values are preferable because there is less chance of data loss, and less lag time between the actual measurement and the damped value.

Effect of Temperature Damping on process measurement

Temperature Damping affects all processes and algorithms that use temperature data from the internal sensor RTD.

Temperature compensation

Temperature compensation adjusts process measurement to compensate for the effect of temperature on the sensor tubes.

API Referral

Temperature Damping affects API Referral process variables only if the transmitter is configured to use temperature data from the sensor. If an external temperature value is used for API Referral, **Temperature Damping** does not affect API Referral process variables.

Concentration measurement

Temperature Damping affects concentration measurement process variables only if the transmitter is configured to use temperature data from the sensor. If an external temperature value is used for concentration measurement, **Temperature Damping** does not affect concentration measurement process variables.

4.7 Configure Pressure Measurement Unit

Display	**Menu → Configuration → Process Measurement → Pressure → Units**
ProLink III	**Device Tools → Configuration → Process Measurement → Pressure Compensation → Pressure Unit**
Field communicator	**Configure → Manual Setup → Measurements → Optional Setup → External Pressure/Temperature → Pressure → Unit**
Enhanced FF host	**Configure → Manual Setup → Measurements → Optional Setup → External Pressure/Temperature → Pressure → Unit**
Basic FF host	**Measurement TB → Pressure Unit** (OD Index 63)

Pressure Measurement Unit controls the measurement unit used for pressure. This unit must match the unit used by the external pressure device.

Pressure data is used for pressure compensation and for API Referral. The device does not measure pressure directly. You must set up a pressure input.

Procedure

Set **Pressure Measurement Unit** to the desired unit.

Default: psi

4.7.1 Options for Pressure Measurement Unit

The transmitter provides a standard set of measurement units for **Pressure Measurement Unit**. Different communications tools may use different labels for the units. In most applications, set **Pressure Measurement Unit** to match the pressure measurement unit used by the remote device.

Unit description	Label				
	Display	**ProLink III**	**Field communicator**	**Enhanced FF host**	**Basic FF host code**
Feet water @ 68 °F	ftH2O @68°F	Ft Water @ 68°F	ftH_2O	ftH_2O (68°F)	1154
Inches water @ 4 °C	inH2O @4°C	In Water @ 4°C	inH2O @4DegC	inH_2O (4°C)	1147
Inches water @ 60 °F	inH2O @60°F	In Water @ 60°F	inH2O @60DegF	inH_2O (60°F)	33003
Inches water @ 68 °F	inH2O @68°F	In Water @ 68°F	inH2O	inH_2O (68°F)	1148
Millimeters water @ 4 °C	mmH2O @4°C	mm Water @ 4°C	mmH2O @4DegC	mmH_2O (4°C)	1150
Millimeters water @ 68 °F	mmH2O @68°F	mm Water @ 68°F	mmH2O	mmH_2O (68°F)	1151
Millimeters mercury @ 0 °C	mmHg @0°C	mm Mercury @ 0°C	mmHg	mmHg (0°F)	1158

Unit description	Label				
	Display	**ProLink III**	**Field communicator**	**Enhanced FF host**	**Basic FF host code**
Inches mercury @ 0 °C	inHg @0°C	In Mercury @ 0°C	inHg	inHg (0°C)	1156
Pounds per square inch	psi	PSI	psi	psi	1141
Bar	bar	bar	bar	bar	1137
Millibar	mbar	millibar	mbar	mbar	1138
Grams per square centimeter	g/cm2	g/cm2	g/Sqcm	g/cm^2	1144
Kilograms per square centimeter	kg/cm2	kg/cm2	kg/Sqcm	Kg/cm^2	1145
Pascals	Pa	pascals	Pa	Pa	1130
Kilopascals	kPA	Kilopascals	kPa	kPa	1133
Megapascals	mPA	Megapascals	MPa	MPa	1132
Torr @ 0 °C	torr	Torr @ 0°C	torr	torr	1139
Atmospheres	atm	atms	atm	atm	1140

4.8 Configure Velocity Measurement Unit

Display	**Menu → Configuration → Process Measurement → Velocity → Units**
ProLink III	**Device Tools → Configuration → Process Measurement → Velocity → Unit**
Field communicator	**Configure → Manual Setup → Measurements → Approximate Velocity → Velocity Unit**
Enhanced FF host	**Configure → Manual Setup → Measurements → Approximate Velocity → Velocity Unit**
Basic FF host	**Measurement TB → Velocity Unit** (OD Index 51)

Velocity Measurement Unit controls the measurement unit used to report velocity.

Procedure

Set **Velocity Measurement Unit** to the desired unit.

Default: m/sec

4.8.1 Options for Velocity Measurement Unit

The transmitter provides a standard set of measurement units for **Velocity Measurement Unit**. Different communications tools may use different labels.

Unit description	Label			
	Display	**ProLink III**	**Field communicator or enhanced FF host**	**Basic FF host code**
Feet per minute	ft/min	ft/min	ft/min	1070
Feet per second	ft/s	ft/sec	ft/s	1067
Inches per minute	in/min	in/min	in/min	1069
Inches per second	in/s	in/sec	in/s	1066
Meters per hour	m/h	m/hr	m/h	1063
Meters per second	m/s	m/sec	m/s	1061

5 Configure process measurement applications

5.1 Set up the API Referral application

The API Referral application corrects line density to reference temperature and reference pressure according to American Petroleum Institute (API) standards. The resulting process variable is *referred density*.

Restriction
The API Referral application is not compatible with the following applications:

- Gas Standard Volume Measurement (GSV)
- Advanced Phase Measurement
- Concentration measurement

5.1.1 Set up the API Referral application using the display

Enable the API Referral application using the display

The API Referral application must be enabled before you can perform any setup. If the API Referral application was enabled at the factory, you do not need to enable it now.

Prerequisites

The API Referral application must be licensed on your transmitter.

Procedure

1. Choose **Menu** → **Configuration** → **Process Measurement**.
2. Choose **Flow Variables** → **Volume Flow Settings** and ensure that **Flow Type** is set to Liquid.
3. Return to the *Process Measurement* menu.
4. If the concentration measurement application is displayed in the list, choose **Concentration Measurement** and ensure that **Enabled/Disabled** is set to Disabled.

   The concentration measurement application and the API Referral application cannot be enabled simultaneously.

5. Enable API Referral.
   a) Choose **Menu** → **Configuration** → **Process Measurement** → **API Referral**.
   b) Set **Enabled/Disabled** to Enabled.

Configure API Referral using the display

The API Referral parameters specify the API table, measurement units, and reference values to be used in referred density calculations.

Prerequisites

You will need API documentation for the API table that you select.

Depending on your API table, you may need to know the thermal expansion coefficient (TEC) for your process fluid.

You must know the reference temperature and reference pressure that you want to use.

Procedure

1. Choose **Menu** → **Configure** → **Process Measurement** → **API Referral**.
2. Set **API Table** to the API table that you want to use to calculate referred density.

   Each API table is associated with a specific set of equations. Choose your API table based on your process fluid and the measurement unit that you want to use for referred density.

   Your choice also determines the API table that will be used to calculate the correction factor for volume (CTPL or CTL).

3. Refer to the API documentation and confirm your table selection.
   a) Verify that your process fluid falls within range for line density, line temperature, and line pressure.
   b) Verify that the referred density range of the selected table is adequate for your application.

4. If you chose a C table, enter **Thermal Expansion Coefficient (TEC)** for your process fluid.

   Acceptable limits:

   - 230.0×10^{-6} to 930.0×10^{-6} per °F
   - 414.0×10^{-6} to 1674.0×10^{-6} per °C

5. If required, set **Reference Temperature** to the temperature to which density will be corrected in referred density calculations.

   The default reference temperature is determined by the selected API table.

6. If required, set **Reference Pressure** to the pressure to which density will be corrected in referred density calculations.

   The default reference pressure is determined by the selected API table.

Set up temperature and pressure data for API Referral using the display

The API Referral application uses temperature and, optionally, pressure data in its calculations. You must decide how to provide this data, then perform the required configuration and setup.

Note
Fixed values for temperature or pressure are not recommended. Using a fixed temperature or pressure value may produce inaccurate process data.

Prerequisites

The pressure measurement must be gauge pressure, not atmospheric pressure.

The pressure device must use the pressure unit that is configured in the transmitter.

If you are using an external temperature device, it must use the temperature unit that is configured in the transmitter.

Procedure

1. Choose the method to be used to supply temperature data, and perform the required setup.

Method	Description	Setup
Internal temperature	Temperature data from the on-board temperature sensor (RTD) will be used for all measurements and calculations. No external temperature data will be available.	a. Choose **Menu** → **Configuration** → **Process Measurement** → **Temperature**. b. Set **External Temperature** to Off.
Digital communications	A host writes temperature data to the meter at appropriate intervals. This data will be available in addition to the internal temperature data.	a. Choose **Menu** → **Configuration** → **Process Measurement** → **Temperature**. b. Set **External Temperature** to On. c. Perform the necessary host programming and communications setup to write temperature data to the transmitter at appropriate intervals.

2. Choose the method to be used to supply pressure data, and perform the required setup.

Method	Description	Setup
Digital communications	A host writes pressure data to the meter at appropriate intervals.	a. Choose **Menu** → **Configuration** → **Process Measurement** → **Pressure** → **External Pressure**. b. Set **External Pressure** to On. c. Perform the necessary host programming and communications setup to write pressure data to the transmitter at appropriate intervals.

Postrequisites

Choose **Menu** → **Service Tools** → **Service Data** → **View Process Variables** and verify the values for External Temperature and External Pressure.

Need help?

If the value is not correct:

- Ensure that the external device and the meter are using the same measurement unit.
- For digital communications:
  - Verify that the host has access to the required data.

— Verify that the output variable is being correctly received and processed by the transmitter.

5.1.2 Set up the API Referral application using ProLink III

Enable the API Referral application using ProLink III

Prerequisites

The API Referral application must be licensed and enabled on your transmitter before you can perform any setup. If the API Referral application was enabled at the factory, you do not need to enable it now.

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Flow** and ensure that **Volume Flow Type** is set to Liquid Volume.
2. Choose **Device Tools** → **Configuration** → **Transmitter Options**.
3. If the concentration measurement application is enabled, disable it and select **Apply**.

   The concentration measurement application and the API Referral application cannot be enabled simultaneously.
4. Enable **API Referral** and select **Apply**.

Configure API Referral using ProLink III

The API Referral parameters specify the API table, measurement units, and reference values to be used in referred density calculations.

Prerequisites

You will need API documentation for the API table that you select.

Depending on your API table, you may need to know the thermal expansion coefficient (TEC) for your process fluid.

You must know the reference temperature and reference pressure that you want to use.

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **API Referral**.
2. Specify the API table to use to calculate referred density.

   Each API table is associated with a specific set of equations.

   a) Set **Process Fluid** to the API table group that your process fluid belongs to.

API table group	Process fluids
A tables	Generalized crude and JP4
B tables	Generalized products: Gasoline, jet fuel, aviation fuel, kerosene, heating oils, fuel oils, diesel, gas oil
C tables	Liquids with a constant base density or known thermal expansion coefficient (TEC). You will be required to enter the TEC for your process fluid.

API table group	Process fluids
D tables	Lubricating oils
E tables	NGL (Natural Gas Liquids) and LPG (Liquid Petroleum Gas)

b) Set **Referred Density Measurement Unit** to the measurement units that you want to use for referred density.

c) Select **Apply**.

These parameters uniquely identify the API table to be used to calculate referred density. The selected API table is displayed, and the meter automatically changes the density unit, temperature unit, pressure unit, and reference pressure to match the API table.

Your choice also determines the API table that will be used to calculate the correction factor for volume (CTPL or CTL).

Restriction
Not all combinations are supported by the API Referral application. See the list of API tables in this manual.

3. Refer to the API documentation and confirm your table selection.
   a) Verify that your process fluid falls within range for line density, line temperature, and line pressure.
   b) Verify that the referred density range of the selected table is adequate for your application.
4. If you chose a C table, enter **Thermal Expansion Coefficient (TEC)** for your process fluid.

   Acceptable limits:

   - 230.0×10^{-6} to 930.0×10^{-6} per °F
   - 414.0×10^{-6} to 1674.0×10^{-6} per °C
5. Set **Reference Temperature** to the temperature to which density will be corrected in referred density calculations. If you choose Other, select the temperature measurement unit and enter the reference temperature.
6. Set **Reference Pressure** to the pressure to which density will be corrected in referred density calculations.

Set up temperature and pressure data for API Referral using ProLink III

The API Referral application uses temperature and, optionally, pressure data in its calculations. You must decide how to provide this data, then perform the required configuration and setup.

Note
Fixed values for temperature or pressure are not recommended. Using a fixed temperature or pressure value may produce inaccurate process data.

Prerequisites

The pressure measurement must be gauge pressure, not atmospheric pressure.

The pressure device must use the pressure unit that is configured in the transmitter.

If you are using an external temperature device, it must use the temperature unit that is configured in the transmitter.

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **API Referral**.
2. Choose the method to be used to supply temperature data, and perform the required setup.

Option	Description	Setup
Internal RTD temperature data	Temperature data from the on-board temperature sensor (RTD) is used.	a. Set **Line Temperature Source** to Internal RTD. b. Select **Apply**.
Digital communications	A host writes temperature data to the meter at appropriate intervals. This data will be available in addition to the internal RTD temperature data.	a. Set **Line Temperature Source** to Fixed Value or Digital Communications. b. Select **Apply**. c. Perform the necessary host programming and communications setup to write temperature data to the meter at appropriate intervals.

3. Choose the method you will use to supply pressure data, and perform the required setup.

Option	Description	Setup
Digital communications	A host writes pressure data to the meter at appropriate intervals.	a. Set **Pressure Source** to Fixed Value or Digital Communications. b. Perform the necessary host programming and communications setup to write pressure data to the meter at appropriate intervals.

Postrequisites

If you are using external temperature data, verify the external temperature value displayed in the ***Inputs*** group on the ProLink III main window.

The current pressure value is displayed in the **External Pressure** field. Verify that the value is correct.

Need help?

If the value is not correct:

- Ensure that the external device and the meter are using the same measurement unit.
- For digital communications:
  — Verify that the host has access to the required data.
  — Verify that the output variable is being correctly received and processed by the transmitter.

5.1.3 Set up the API Referral application using a basic FF host

Enable the API Referral application using a basic FF host

The API Referral application must be enabled before you can perform any setup. If the API Referral application was enabled at the factory, you do not need to enable it now.

Procedure

1. If necessary, disable the concentration measurement application: Write `0` to **Device TB** → **Concentration Measurement**.

   The concentration measurement application and the API Referral application cannot be enabled simultaneously.

2. Enable the API Referral application: Write `1` to **Device TB** → **API Referral**.

Configure API Referral using a basic FF host

The API Referral parameters specify the API table, measurement units, and reference values to be used in referred density calculations.

Prerequisites

You will need API documentation for the API table that you select.

Depending on your API table, you may need to know the thermal expansion coefficient (TEC) for your process fluid.

You must know the reference temperature and reference pressure that you want to use.

Procedure

1. Specify the API table to use: **API Referral TB** → **2540 CTL Table Type**.

   Each API table is associated with a specific set of equations. Your choice also determines the measurement unit to be used for temperature and pressure, and the default values for reference temperature and reference pressure.

   The meter automatically changes the density unit, temperature unit, pressure unit, and reference pressure to match the API table.

2. Refer to the API documentation and confirm your table selection.
   a) Verify that your process fluid falls within range for line density, line temperature, and line pressure.
   b) Verify that the referred density range of the selected table is adequate for your application.

3. If you chose a C table, enter the Thermal Expansion Coefficient (TEC) for your process fluid: **API Referral TB** → **Thermal Expansion Coefficient**.

   Acceptable limits:

   - 230.0×10^{-6} to 930.0×10^{-6} per °F
   - 414.0×10^{-6} to 1674.0×10^{-6} per °C

4. If required, set the temperature to which density will be corrected in referred density calculations: **API Referral TB → Reference Temp**.

   The default reference temperature is determined by the selected API table.

5. If required, set the reference pressure to the pressure to which density will be corrected in referred density calculations: **API Referral TB → Reference Pressure**.

   The default reference pressure is determined by the selected API table. API Referral requires gauge pressure.

Set up temperature and pressure data for API Referral using a basic FF host

The API Referral application uses line temperature and line pressure data in its calculations. You must decide how to provide this data, then perform the required configuration and setup.

Tip

Fixed values for temperature or pressure are not recommended. Using a fixed temperature or pressure value may produce inaccurate process data.

Important

- Line temperature data is used in several different measurements and calculations. It is possible to use the internal RTD temperature in some areas and an external temperature in others. The transmitter stores the internal RTD temperature and the external temperature separately. However, the transmitter stores only one alternate temperature value, which may be either the external temperature or the configured fixed value. Accordingly, if you choose a fixed temperature for some uses, and an external temperature for others, the external temperature will overwrite the fixed value.
- Line pressure data is used in several different measurements and calculations. The transmitter stores only one pressure value, which may be either the external pressure or the configured fixed value. Accordingly, if you choose a fixed pressure for some uses, and an external pressure for others, the external pressure will overwrite the fixed value.

Prerequisites

- The pressure measurement must be gauge pressure, not atmospheric pressure.
- The pressure device must use the pressure unit that is configured in the transmitter.
- If you are using an external temperature device, it must use the temperature unit that is configured in the transmitter.

Procedure

1. Choose the method to be used to supply temperature data, and perform the required setup.

Option	Description	Setup
Internal RTD temperature data	Temperature data from the on-board temperature sensor (RTD) is used.	a. Write `0` to **Measurement TB** → **Temperature Compensation**.
Fieldbus AO function block	Temperature from an external device is used, supplied via the AO function block.	a. Write `1` to **Measurement TB** → **Temperature Compensation** . b. Ensure that the AO function block is set up as a temperature source. c. Connect the AO function block of the transmitter to the AI function block of the external temperature device.
Digital communications	A host writes temperature data to the meter at appropriate intervals. This data will be available in addition to the internal RTD temperature data.	a. Perform the necessary host programming and communications setup to write temperature data to the meter at appropriate intervals.

2. Set up the pressure input.
    a) Ensure that the AO function block is set up as a pressure source.
    b) Connect the AO function block of the transmitter to the AI function block of the external pressure device.

5.1.4 Set up the API Referral application using a field communicator or an enhanced FF host

This section guides you through the tasks required to set up and implement the API Referral application using a field communicator or an enhanced FF host.

Enable the API Referral application using a field communicator or an enhanced FF host

Prerequisites

The API Referral application must be licensed and enabled on your transmitter. If the API Referral application was enabled at the factory, you do not need to enable it now.

Volume Flow Type must be set to Liquid.

Procedure

1. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **GSV** and ensure that **Volume Flow Type** is set to Liquid.

    This parameter is available only if API Referral or concentration measurement is not enabled. If you do not see this parameter, it is already set correctly.

2. If the concentration measurement application is enabled, disable it.

    The concentration measurement application and the API Referral application cannot be enabled simultaneously.

3. Enable the API Referral application.
4. If **Advance Phase Measurement** → **Output Type** is other than Disabled, disable it.

   The Advance Phase Measurement application and the API Referral application cannot be enabled simultaneously.

Configure API Referral using a field communicator or an enhanced FF host

The API Referral parameters specify the API table, measurement units, and reference values to be used in referred density calculations.

Prerequisites

You will need API documentation for the API table that you select.

Depending on your API table, you may need to know the thermal expansion coefficient (TEC) for your process fluid.

You must know the reference temperature and reference pressure that you want to use.

Procedure

1. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **API Referral**.
2. Choose **API Referral Setup**.
3. Specify the API table that you want to use to calculate referred density.

   Each API table is associated with a specific set of equations.

   a) Set **API Table Number** to the number that matches the API table units that you want to use for referred density.

      Your choice also determines the measurement unit to be used for temperature and pressure, and the default values for reference temperature and reference pressure.

API table number	Measurement unit for referred density	Temperature measurement unit	Pressure measurement unit	Default reference temperature	Default reference pressure
5	°API	°F	psi (g)	60 °F	0 psi (g)
6(1)	°API	°F	psi (g)	60 °F	0 psi (g)
23	SGU	°F	psi (g)	60 °F	0 psi (g)
24(1)	SGU	°F	psi (g)	60 °F	0 psi (g)
53	kg/m^3	°C	kPa (g)	15 °C	0 kPa (g)
54(1)	kg/m^3	°C	kPa (g)	15 °C	0 kPa (g)
59(2)	kg/m^3	°C	kPa (g)	20 °C	0 kPa (g)
60(2)	kg/m^3	°C	kPa (g)	20 °C	0 kPa (g)

*(1) Used only with **API Table Letter** = C.*
*(2) Used only with **API Table Letter** = E.*

   b) Set **API Table Letter** to the letter of the API table group that is appropriate for your process fluid.

API table letter	Process fluids
A	Generalized crude and JP4
B	Generalized products: Gasoline, jet fuel, aviation fuel, kerosene, heating oils, fuel oils, diesel, gas oil
C(1)	Liquids with a constant base density or known thermal expansion coefficient (TEC). You will be required to enter the TEC for your process fluid.
D	Lubricating oils
E(2)	NGL (Natural Gas Liquids) and LPG (Liquid Petroleum Gas)

(1) *Used only with **API Table Number**= 6, 24, or **54**.*
(2) *Used only with **API Table Number** = 23, 24, 53, 54, 59, or 60.*

API Table Number and **API Table Letter** uniquely identify the API table. The selected API table is displayed, and the meter automatically changes the density unit, temperature unit, pressure unit, reference temperature, and reference pressure to match the API table.

Your choice also determines the API table that will be used to calculate the correction factor for volume (CTPL or CTL).

Restriction
Not all combinations are supported by the API Referral application. See the list of API tables in this manual.

4. If you chose a C table, enter **Thermal Expansion Coefficient (TEC)** for your process fluid.

   Acceptable limits:

   - 230.0 x 10^{-6} to 930.0 x 10^{-6} per °F
   - 414.0 x 10^{-6} to 1674.0 x 10^{-6} per °C

5. Refer to the API documentation and confirm your table selection.
   a) Verify that your process fluid falls within range for line density, line temperature, and line pressure.
   b) Verify that the referred density range of the selected table is adequate for your application.

6. If required, set **Reference Temperature** to the temperature to which density will be corrected in referred density calculations.

   The default reference temperature is determined by the selected API table.

7. If required, set **Reference Pressure** to the pressure to which density will be corrected in referred density calculations.

   The default reference pressure is determined by the selected API table. API Referral requires gauge pressure.

Set up temperature and pressure data for API Referral using a field communicator

The API Referral application uses temperature and, optionally, pressure data in its calculations. You must decide how to provide this data, then perform the required configuration and setup.

Note
Fixed values for temperature or pressure are not recommended. Using a fixed temperature or pressure value may produce inaccurate process data.

Procedure

1. Choose the method to be used to supply temperature data, and perform the required setup.

Method	Description	Setup
Internal RTD temperature data	Temperature data from the on-board temperature sensor (RTD) is used.	a. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Pressure/Temperature** → **Temperature**. b. Set **External Temperature** to Disable.
Digital communications	A host writes temperature data to the meter at appropriate intervals. This data will be available in addition to the internal RTD temperature data.	a. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Variables** → **External Temperature**. b. Set **Temperature Compensation** to Enable. c. Perform the necessary host programming and communications setup to write temperature data to the meter at appropriate intervals.

2. Choose the method to be used to supply pressure data, and perform the required setup.

Method	Description	Setup
Digital communications	A host writes pressure data to the meter at appropriate intervals.	a. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Variables** → **External Pressure**. b. Set **Pressure Compensation** to Enable. c. Perform the necessary host programming and communications setup to write pressure data to the transmitter at appropriate intervals.

Postrequisites

Need help?
If the value is not correct:

- Ensure that the external device and the meter are using the same measurement unit.
- For digital communications:
  — Verify that the host has access to the required data.
  — Verify that the host is writing to the correct register in memory, using the correct data type.

Set up temperature and pressure data for API Referral using an enhanced FF host

The API Referral application uses temperature and, optionally, pressure data in its calculations. You must decide how to provide this data, then perform the required configuration and setup.

Note

Fixed values for temperature or pressure are not recommended. Using a fixed temperature or pressure value may produce inaccurate process data.

Procedure

1. Choose the method to be used to supply temperature data, and perform the required setup.

Method	Description	Setup
Internal RTD temperature data	Temperature data from the on-board temperature sensor (RTD) is used.	a. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Variables** → **External Temperature**. b. Set **Temperature Compensation** to Disable.
Digital communications	A host writes temperature data to the meter at appropriate intervals. This data will be available in addition to the internal RTD temperature data.	a. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Variables** → **External Temperature**. b. Set **Temperature Compensation** to Enable.

2. Perform the required setup for digital communications so that the host writes pressure data to the meter at appropriate intervals.
   a) Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Variables** → **External Pressure**.
   b) Set **Pressure Compensation** to Enable.

Postrequisites

Need help?

If the value is not correct:

- Ensure that the external device and the meter are using the same measurement unit.
- For digital communications:
  — Verify that the host has access to the required data.
  — Verify that the output variable is being correctly received and processed by the transmitter.

5.1.5 API tables supported by the API Referral application

The API tables listed here are supported by the API Referral application.

Table 5-1: API tables, process fluids, measurement units, and default reference values

Process fluid	API tables (calculations)(1)		Referred density (API): unit and range	Default reference temp	Default reference pressure	API standard
	Referred density(2)	CTL or CTPL(3) (4)				
Generalized crude and JP4	5A	6A	Unit: °API Range: 0 to 100 °API	60 °F	0 psi (g)	API MPMS 11.1
	23A	24A	Unit: SGU Range: 0.6110 to 1.0760 SGU	60 °F	0 psi (g)	
	53A	54A	Unit: kg/m³ Range: 610 to 1075 kg/m³	15 °C	0 kPa (g)	
Generalized products (gasoline, jet fuel, aviation fuel, kerosene, heating oils, fuel oils, diesel, gas oil)	5B	6B	Unit: °API Range: 0 to 85 °API	60 °F	0 psi (g)	API MPMS 11.1
	23B	24B	Unit: SGU Range: 0.6535 to 1.0760 SGU	60 °F	0 psi (g)	
	53B	54B	Unit: kg/m³ Range: 653 to 1075 kg/m³	15 °C	0 kPa (g)	
Liquids with a constant density base or known thermal expansion coefficient(5)	N/A	6C	Unit: °API	60 °F	0 psi (g)	API MPMS 11.1
	N/A	24C	Unit: SGU	60 °F	0 psi (g)	
	N/A	54C	Unit: kg/m³	15 °C	0 kPa (g)	
Lubricating oils	5D	6D	Unit: °API Range: −10 to +40 °API	60 °F	0 psi (g)	API MPMS 11.1
	23D	24D	Unit: SGU Range: 0.8520 to 1.1640 SGU	60 °F	0 psi (g)	
	53D	54D	Unit: kg/m³ Range: 825 to 1164 kg/m³	15 °C	0 kPa (g)	
NGL (natural gas liquids) and LPG (liquid petroleum gas)	23E	24E	Unit: SGU	60 °F	0 psi (g)	API MPMS 11.2.4
	53E	54E	Unit: kg/m³	15 °C	0 psi (g)	
	59E	60E	Unit: kg/m³	20 °C	0 psi (g)	

(1) *Each API table represents a specialized equation defined by the American Petroleum Institute for a specific combination of process fluid, line conditions, and output.*

(2) Referred density is calculated from line density. You must specify this table, either directly or by selecting the process fluid and base density measurement unit.
(3) You do not need to specify this table. It is invoked automatically as a result of the previous table selection.
(4) CTL is a correction factor based on online temperature. CTPL is a correction factor based on both line pressure and line temperature. Calculation of CTL and CTPL for A, B, C, and D table products is in accordance with API MPMS Chapter 11.1. Calculation of CTL and CTPL for E table products is in accordance with API MPMS Chapters 11.2.2, 11.2.4, and 11.2.5.
(5) The Thermal Expansion Coefficient (TEC) replaces the referred density calculation. Use the CTL/CTPL table instead.

5.1.6 Process variables from the API Referral application

The API Referral application calculates several different process variables according to API standards.

CTPL	Correction factor based on line temperature and line pressure.
CTL	Correction factor based on line temperature at saturation conditions.
Referred density	The measured density after CTL or CTPL has been applied.
API volume flow	The measured volume flow rate after CTL or CTPL has been applied. Also called *corrected volume flow*.
Batch-weighted average density	One density value is recorded for each unit of flow (e.g., barrel, liter). The average is calculated from these values. The average is reset when the API totalizer is reset. Not available unless a totalizer has been configured with **Source** set to Corrected Volume Flow.
Batch-weighted average temperature	One temperature value is recorded for each unit of flow (e.g., barrel, liter). The average is calculated from these values. The average is reset when the API totalizer is reset. Not available unless a totalizer has been configured with **Source** set to Temperature-Corrected Volume Flow.
API volume total	The total API volume measured by the transmitter since the last API totalizer reset. Also called *corrected volume total*. Not available unless a totalizer has been configured with **Source** set to Corrected Volume Flow.
API volume inventory	The total API volume measured by the transmitter since the last API inventory reset. Also called *corrected volume inventory*. Not available unless an inventory has been configured with **Source** set to Corrected Volume Flow.

5.2 Set up concentration measurement

The concentration measurement application calculates concentration from line density and line temperature.

5.2.1 Preparing to set up concentration measurement

The procedure for setting up concentration measurement application depends on how your device was ordered and how you want to use the application. Review this information before you begin.

Requirements for concentration measurement

To use the concentration measurement application, the following conditions must be met:

- The concentration measurement application must be enabled.
- The API Referral application must be disabled.

- The Advanced Phase Measurement application must be disabled or set for the Liquid with Gas application.
- A concentration matrix must be loaded into one of the six slots on the transmitter.

Tip
In most cases, the concentration matrix that you ordered was loaded at the factory. If it was not, you have several options for loading a matrix. You can also build a matrix.

- **Temperature Source** must be configured and set up.
- One matrix must be selected as the active matrix (the matrix used for measurement).

Requirements for matrices

A matrix is the set of coefficients used to convert process data to concentration, plus related parameters. The matrix can be saved as a file.

The transmitter requires all matrices to be in .matrix format. You can use ProLink III to load matrices in other formats:

- .edf (used by ProLink II)
- .xml (used by ProLink III)

The transmitter can store matrices in two locations:

- One of the six slots in memory
- The transmitter's SD card

Any matrix in a slot is available for use. In other words, it can be selected as the active matrix and used for measurement. Matrices on the SD card are not available for use. Matrices must be loaded into a slot before they can be used for measurement.

All matrices in slots must use the same derived variable. Matrices on the SD card have no requirement for their derived variables to match.

Requirements for derived variables

A *derived variable* is the process variable that a concentration matrix measures. All other process variables are calculated from the derived variable. There are eight possible derived variables. Each matrix is designed for one specific derived variable.

The transmitter can store up to six matrices in six slots. There are additional matrices on the transmitter's SD card. All matrices in the six slots must use the same derived variable. If you change the setting of **Derived Variable**, all matrices are deleted from the six slots. Any matrices on the transmitter's SD card are not affected.

Tip
Always ensure that **Derived Variable** is set correctly before loading matrices into slots.

Derived variables and net flow rate

If you want the transmitter to calculate Net Mass Flow Rate, the derived variable must be set to Mass Concentration (Density). If your matrix is not designed for Mass Concentration (Density), contact customer support for assistance.

If you want the transmitter to calculate Net Volume Flow Rate, the derived variable must be set to Volume Concentration (Density). If your matrix is not designed for Volume Concentration (Density), contact customer support for assistance.

Derived variables based on specific gravity

The following derived variables are based on specific gravity:

- Specific Gravity
- Concentration (Specific Gravity)
- Mass Concentration (Specific Gravity)
- Volume Concentration (Specific Gravity)

If you are using one of these derived variables, two additional parameters can be configured:

- **Reference Temperature of Water** (default setting: 4 °C)
- **Water Density at Reference Temperature** (default setting: 999.99988 kg/m^3)

These two parameters are used to calculate specific gravity.

You cannot set these parameters from the display. If the default values are not appropriate, you must use another method to set them.

Optional tasks in setting up concentration measurement

The following tasks are optional:

- Modifying names and labels
- Configuring extrapolation alerts

5.2.2 Set up concentration measurement using the display

This section guides you through most of the tasks related to setting up and implementing the concentration measurement application.

Restriction
This section does not cover building a concentration matrix. For detailed information on building a matrix, see the *Micro Motion Enhanced Density Application Manual*.

Enable concentration measurement using the display

The concentration measurement application must be enabled before you can perform any setup. If the concentration measurement application was enabled at the factory, you do not need to enable it now.

Prerequisites

The concentration measurement application must be licensed on your transmitter.

Disable the following applications before enabling concentration measurement as concentration measurement cannot be enabled at the same time:

- Advanced Phase Measurement — gas with liquid
- API Referral
- Gas Standard Volume

Procedure

1. Choose **Menu** → **Configuration** → **Process Measurement**.

2. Choose **Flow Variables** → **Volume Flow Settings** and ensure that **Flow Type** is set to Liquid.
3. Return to the *Process Measurement* menu.
4. If the API Referral application is displayed in the menu, choose **API Referral** and ensure that **Enabled/Disabled** is set to Disabled.

   The concentration measurement application and the API Referral application cannot be enabled simultaneously.
5. If the Advanced Phase Measurement application is displayed in the menu, choose **Advanced Phase Measurement** → **Application Setup** and ensure that **Enabled/Disabled** is set to Disabled.
6. Enable concentration measurement.
   a) Choose **Menu** → **Configuration** → **Process Measurement** → **Concentration Measurement**.
   b) Set **Enabled/Disabled** to Enabled.

Load a concentration matrix from a USB drive using the display

At least one concentration matrix must be loaded into one of the six slots on your transmitter. You can load up to six matrices into slots. You can also copy matrices to the transmitter's SD card, and load them into slots at a later time.

Tip
In many cases, concentration matrices were ordered with the device and loaded at the factory. You may not need to load any matrices.

WARNING
If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

Prerequisites

The concentration measurement application must be enabled on your device.

For each concentration matrix that you want to load, you need a file containing the matrix data. The transmitter's SD card and the ProLink III installation include a set of standard concentration matrices. Other matrices are available from Micro Motion.

Each concentration matrix file must be in .matrix format.

Tip
- If you have a custom matrix on another device, you can save it to a file, then load it to the current device.
- If you have a matrix file in a different format, you can load it using ProLink III.

The .matrix files must be copied to the root directory of a USB drive.

You must know the derived variable that the matrix is designed to calculate.

Important
- All concentration matrices on your transmitter must use the same derived variable.

- If you change the setting of **Derived Variable**, all existing concentration matrices will be deleted from the six slots on the transmitter, but not from the SD card. Set **Derived Variable** before loading concentration matrices.

Procedure

1. Choose **Menu** → **Configuration** → **Process Measurement** → **Concentration Measurement** → **Configure Application** and ensure that the setting of **Derived Variable** matches the derived variable used by your matrix. If it does not, change it as required and click **Apply**.

   Important
   If you change the setting of **Derived Variable**, all existing concentration matrices will be deleted from the six slots, but not from the transmitter's SD card. Verify the setting of **Derived Variable** before continuing.

2. Load the matrix.
   a) Remove the cover from the transmitter's wiring compartment, open the snap flap to access the service port, and insert the USB drive into the service port.
   b) Choose **Menu** → **USB Options** → **USB Drive –> Transmitter** → **Upload Configuration File**.
   c) Set **Config File Type** to Concentration Measurement Matrix.
   d) Select the .matrix file that you want to load, and wait for the transfer to complete.

3. Choose Yes or No when you are asked if you want to apply the settings.

   The transmitter has six slots that are used to store concentration matrices. Any one of these can be used for measurement. The transmitter also has the capability to store multiple concentration matrices on its SD card. These cannot be used for measurement until they are moved to a slot.

Option	Description
Yes	The matrix is saved to the SD card, and the loading process continues with loading the matrix into one of the slots.
No	The matrix is saved to the SD card, and the loading process ends. You must load a matrix into a slot before you can use it for measurement.

4. If you chose Yes, select the slot to load this matrix into, and wait until the load is complete.

   You can load the matrix into any empty slot, or you can overwrite an existing matrix.

Postrequisites

If you loaded the matrix into a slot, choose **Menu** → **Configuration** → **Process Measurement** → **Concentration Measurement** → **Configure Application** → **Active Matrix** and ensure that the matrix is listed.

If you loaded the matrix onto the SD card only, choose **Menu** → **Configuration** → **Process Measurement** → **Concentration Measurement** → **Load Matrix** and ensure that the matrix is listed.

Load a concentration matrix from the SD card using the display

If you have a concentration matrix on the transmitter's SD card, you can load it into one of the six slots on your transmitter. You cannot use the matrix for measurement until it has been loaded into a slot. You can load up to six matrices into slots.

Prerequisites

You must have one or more concentration matrices stored on the transmitter's SD card. The standard matrices are loaded to the SD card at the factory.

You must know the derived variable that the matrix is designed to calculate.

Procedure

1. Choose **Menu** → **Configuration** → **Process Measurement** → **Concentration Measurement** and ensure that the setting of **Derived Variable** matches the derived variable used by your matrix. If it does not, change it as required and click **Apply**.

   Important
   If you change the setting of **Derived Variable**, all existing concentration matrices will be deleted from the six slots, but not from the transmitter's SD card. Verify the setting of **Derived Variable** before continuing.

2. Choose **Menu** → **Configuration** → **Process Measurement** → **Concentration Measurement** → **Load Matrix**.
   The transmitter displays a list of all matrices that are on the SD card.
3. Select the matrix that you want to load.
4. Select the slot that you want to load it into.

   You can load the matrix into any empty slot, or you can overwrite an existing matrix.

Postrequisites

Choose **Menu** → **Configuration** → **Process Measurement** → **Concentration Measurement** → **Configure Application** → **Active Matrix** and ensure that the matrix is listed.

Set up temperature data using the display

The concentration measurement application uses line temperature data in its calculations. You must decide how to provide this data, then perform the required configuration and setup. Temperature data from the on-board temperature sensor (RTD) is always available. Optionally, you can set up an external temperature device and use external temperature data.

The temperature setup that you establish here will be used for all concentration measurement matrices on this meter.

Important
Line temperature data is used in several different measurements and calculations. It is possible to use the internal RTD temperature in some areas and an external temperature in others. The transmitter stores the internal RTD temperature and the external temperature separately. However, the transmitter stores only one alternate temperature value, which may be either the external temperature or the configured fixed value. Accordingly, if you choose a fixed temperature for some uses, and an external temperature for others, the external temperature will overwrite the fixed value.

Procedure

Choose the method to be used to supply temperature data, and perform the required setup.

Method	Description	Setup
Internal temperature	Temperature data from the on-board temperature sensor (RTD) will be used for all measurements and calculations. No external temperature data will be available.	a. Choose **Menu** → **Configuration** → **Process Measurement** → **Temperature**. b. Set **External Temperature** to Off.
Digital communications	A host writes temperature data to the meter at appropriate intervals. This data will be available in addition to the internal temperature data.	a. Choose **Menu** → **Configuration** → **Process Measurement** → **Temperature**. b. Set **External Temperature** to On. c. Perform the necessary host programming and communications setup to write temperature data to the transmitter at appropriate intervals.

Postrequisites

Choose **Menu** → **Service Tools** → **Service Data** → **View Process Variables** and verify the value for External Temperature.

Need help?
If the value is not correct:

- Ensure that the external device and the meter are using the same measurement unit.
- For digital communications:
  - Verify that the host has access to the required data.
  - Verify that the output variable is being correctly received and processed by the transmitter.

Modify matrix names and labels using the display

For convenience, you can change the name of a concentration matrix and the label used for its measurement unit. This does not affect measurement.

Procedure

1. Choose **Menu** → **Configuration** → **Process Measurement** → **Concentration Measurement** → **Configure Matrix**.
2. Select the matrix that you want to modify.
3. Set **Matrix Name** to the name that will be used for this matrix.
4. Set **Concentration Unit** to the label that will be used for the concentration unit.

   If you want to use a custom label, you can use the display to select Special. However, you cannot use the display to configure the custom label. You must use another tool to change the label from Special to a user-defined string.

Modify extrapolation alerts using the display

You can enable and disable extrapolation alerts, and set extrapolation alert limits. These parameters control the behavior of the concentration measurement application but do not affect measurement directly.

Each concentration matrix is built for a specific density range and a specific temperature range. If line density or line temperature goes outside the range, the transmitter will extrapolate concentration values. However, extrapolation may affect accuracy. Extrapolation alerts are used to notify the operator that extrapolation is occurring.

Each concentration matrix has its own extrapolation alert limits.

Procedure

1. Choose **Menu** → **Configuration** → **Process Measurement** → **Concentration Measurement** → **Configure Matrix**.
2. Select the matrix that you want to modify.
3. Set **Extrapolation Limit** to the point, in percent, at which an extrapolation alert will be posted.
4. Choose **Menu** → **Configuration** → **Process Measurement** → **Concentration Measurement** → **Configure Application** → **Extrapolation Alerts**.
5. Enable or disable the high and low limit alerts for temperature and density as desired.

Example: Extrapolation alerts in action

If **Extrapolation Limit** is set to 5%, **High Limit (Temp)** is enabled, and the active matrix is built for a temperature range of 40 °F (4.4 °C) to 80 °F (26.7 °C), a high-temperature extrapolation alert will be posted if line temperature goes above 82 °F (27.8 °C).

Select the active concentration matrix using the display

You must select the concentration matrix to be used for measurement. Although the transmitter can store up to six concentration matrices, only one matrix can be used for measurement at any one time.

Procedure

1. Choose **Menu** → **Configuration** → **Process Measurement** → **Concentration Measurement** → **Configure Application**.
2. Set **Active Matrix** to the matrix you want to use.

5.2.3 Set up concentration measurement using ProLink III

This section guides you through the tasks required to set up, configure, and implement concentration measurement.

Enable concentration measurement using ProLink III

The concentration measurement application must be enabled before you can perform any setup. If the concentration measurement application was enabled at the factory, you do not need to enable it now.

Prerequisites

The concentration measurement application must be licensed on your transmitter.

Disable the following applications before enabling concentration measurement as concentration measurement cannot be enabled at the same time:

- Advanced Phase Measurement — gas with liquid
- API Referral
- Gas Standard Volume

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Flow** and ensure that **Volume Flow Type** is set to Liquid Volume.
2. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Advance Phase Measurement** → **APM Status** and ensure that **Application Status** is set to Disable or Liquid with Gas.
3. Choose **Device Tools** → **Configuration** → **Transmitter Options**.
4. Disable API Referral and set the Advance Phase Measurement application to Disabled or Single Liquid.
5. Set **Concentration Measurement** to Enabled and select **Apply**.

Load a concentration matrix using ProLink III

At least one concentration matrix must be loaded onto your transmitter. You can load up to six.

Prerequisites

The concentration measurement application must be enabled on your device.

For each concentration matrix that you want to load, you need a file containing the matrix data. The ProLink III installation includes a set of standard concentration matrices. Other matrices are available from Micro Motion. The file can be on your computer or in the transmitter's internal memory.

The file must be in one of the formats that ProLink III supports. This includes:

- .xml (ProLink III)
- .matrix (5700)

If you are loading an .xml file, you must know the following information for your matrix:

- The derived variable that the matrix is designed to calculate
- The density unit that the matrix was built with
- The temperature unit that the matrix was built with

If you are loading a .matrix file, you must know the derived variable that the matrix is designed to calculate.

Important

- All concentration matrices on your transmitter must use the same derived variable.
- If you change the setting of **Derived Variable**, all existing concentration matrices will be deleted from the six slots on the transmitter, but not from the transmitter's SD card. Set **Derived Variable** before loading concentration matrices.
- ProLink III loads matrices directly to one of the transmitter's six slots.

Tip

In many cases, concentration matrices were ordered with the device and loaded at the factory. You may not need to load any matrices.

Restriction

You cannot use ProLink III to load a matrix to the transmitter's SD card.

Procedure

1. If you are loading an .xml file, choose **Device Tools** → **Configuration** → **Process Measurement** → **Line Density** and set **Density Unit** to the density unit used by your matrix.

   Important

   When you load a matrix in one of these formats, if the density unit is not correct, concentration data will be incorrect. The density units must match at the time of loading. You can change the density unit after the matrix is loaded.

2. If you are loading an .xml file, choose **Device Tools** → **Configuration** → **Process Measurement** → **Line Temperature**and set **Temperature Unit** to the temperature unit used by your matrix.

   Important

   When you load a matrix in one of these formats, if the temperature unit is not correct, concentration data will be incorrect. The temperature units must match at the time of loading. You can change the temperature unit after the matrix is loaded.

3. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Concentration Measurement**.
   The *Concentration Measurement* window is displayed. It is organized into steps that allow you to perform several different setup and configuration tasks. For this task, you will not use all the steps.
4. In Step 1, ensure that the setting of **Derived Variable** matches the derived variable used by your matrix. If it does not, change it as required and select **Apply**.

   Important

   If you change the setting of **Derived Variable**, all existing concentration matrices will be deleted from the six slots. Verify the setting of **Derived Variable** before continuing.

5. Load one or more matrices.
   a) In Step 2, set **Matrix Being Configured** to the location (slot) to which the matrix will be loaded.
   b) To load a .xml file from your computer, select **Load Matrix from File**, navigate to the file, and load it.
   c) To load a .matrix file from your computer, select **Load Matrix from My Computer**, navigate to the file, and load it.
   d) To load a .matrix file from the transmitter's internal memory, select Load Matrix from 5700 Device Memory, navigate to the file on the transmitter, and load it.
   e) Repeat until all required matrices are loaded.

Set reference temperature values for specific gravity using ProLink III

When **Derived Variable** is set to any option based on specific gravity, you must set the reference temperature for water, then verify the density of water at the configured reference temperature. These values affect specific gravity measurement.

This requirement applies to the following derived variables:

- Specific Gravity
- Concentration (Specific Gravity)
- Mass Concentration (Specific Gravity)
- Volume Concentration (Specific Gravity)

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Concentration Measurement**.
   The *Concentration Measurement* window is displayed. It is organized into steps that allow you to perform several different setup and configuration tasks. For this task, you will not use all the steps.
2. Scroll to Step 2, set **Matrix Being Configured** to the matrix you want to modify, and select **Change Matrix**.
3. Scroll to Step 3, then perform the following actions:
   a) Set **Reference Temperature for Referred Density** to the temperature to which line density will be corrected for use in the specific gravity calculation.
   b) Set **Reference Temperature for Water** to the water temperature that will be used in the specific gravity calculation.
   c) Set **Water Density at Reference Temperature** to the density of water at the specified reference temperature.
      The transmitter automatically calculates the density of water at the specified temperature. The new value will be displayed the next time that transmitter memory is read. You can enter a different value if you prefer.
4. Select **Apply** at the bottom of Step 3.

Set up temperature data using ProLink III

The concentration measurement application uses line temperature data in its calculations. You must decide how to provide this data, then perform the required configuration and setup. Temperature data from the on-board temperature sensor (RTD) is always available. Optionally, you can set up an external temperature device and use external temperature data.

The temperature setup that you establish here will be used for all concentration measurement matrices on this meter.

Important
Line temperature data is used in several different measurements and calculations. It is possible to use the internal RTD temperature in some areas and an external temperature in others. The transmitter stores the internal RTD temperature and the external temperature separately. However, the transmitter stores only one alternate temperature value, which may be either the external temperature or the configured fixed value.

Accordingly, if you choose a fixed temperature for some uses, and an external temperature for others, the external temperature will overwrite the fixed value.

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Concentration Measurement**.

   The *Concentration Measurement* window is displayed. It is organized into steps that allow you to perform several different setup and configuration tasks. For this task, you will not use all the steps.

2. Scroll to Step 4.
3. Choose the method to be used to supply temperature data, and perform the required setup.

Option	Description	Setup
Internal temperature	Temperature data from the on-board temperature sensor (RTD) will be used for all measurements and calculations. No external temperature data will be available.	a. Set **Line Temperature Source** to Internal. b. Click **Apply**.
Digital communications	A host writes temperature data to the meter at appropriate intervals. This data will be available in addition to the internal RTD temperature data.	a. Set **Line Temperature Source** to Fixed Value or Digital Communications. b. Click **Apply**. c. Perform the necessary host programming and communications setup to write temperature data to the meter at appropriate intervals.

Postrequisites

If you are using external temperature data, verify the external temperature value displayed in the ***Inputs*** group on the ProLink III main window.

Need help?
If the value is not correct:

- Ensure that the external device and the meter are using the same measurement unit.
- For digital communications:
  - Verify that the host has access to the required data.
  - Verify that the output variable is being correctly received and processed by the transmitter.

Modify matrix names and labels using ProLink III

For convenience, you can change the name of a concentration matrix and the label used for its measurement unit. This does not affect measurement.

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Concentration Measurement**.
   The *Concentration Measurement* window is displayed. It is organized into steps that allow you to perform several different setup and configuration tasks. For this task, you will not use all the steps.

2. Scroll to Step 2, set **Matrix Being Configured** to the matrix you want to modify, and click **Change Matrix**.
3. Scroll to Step 3, then perform the following actions:
    a) Set **Concentration Units Label** to the label that will be used for the concentration unit.
    b) If you set **Concentration Units Label** to Special, enter the custom label in **User-Defined Label**.
    c) In **Matrix Name**, enter the name to be used for the matrix.
4. Select **Apply** at the bottom of Step 3.

Modify extrapolation alerts using ProLink III

You can enable and disable extrapolation alerts, and set extrapolation alert limits. These parameters control the behavior of the concentration measurement application but do not affect measurement directly.

Each concentration matrix is built for a specific density range and a specific temperature range. If line density or line temperature goes outside the range, the transmitter will extrapolate concentration values. However, extrapolation may affect accuracy. Extrapolation alerts are used to notify the operator that extrapolation is occurring.

Each concentration matrix has its own extrapolation alert limits.

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Concentration Measurement**.
   The *Concentration Measurement* window is displayed. It is organized into steps that allow you to perform several different setup and configuration tasks. For this task, you will not use all the steps.
2. Scroll to Step 2, set **Matrix Being Configured** to the matrix you want to modify, and click **Change Matrix**.
3. Scroll to Step 4.
4. Set **Extrapolation Alert Limit** to the point, in percent, at which an extrapolation alert will be posted.
5. Enable or disable the high and low limit alerts for temperature and density, as desired, and click **Apply**.

Example: Extrapolation alerts in action

If **Extrapolation Limit** is set to 5%, **High Limit (Temp)** is enabled, and the active matrix is built for a temperature range of 40 °F (4.4 °C) to 80 °F (26.7 °C), a high-temperature extrapolation alert will be posted if line temperature goes above 82 °F (27.8 °C).

Select the active concentration matrix using ProLink III

You must select the concentration matrix to be used for measurement. Although the transmitter can store up to six concentration matrices, only one matrix can be used for measurement at any one time.

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Concentration Measurement**.
2. Scroll to Step 2, set **Active Matrix** to the matrix you want to use and select **Change Matrix**.

5.2.4 Set up concentration measurement using a field communicator or an enhanced FF host

This section guides you through most of the tasks related to setting up and implementing the concentration measurement application.

Enable concentration measurement using a field communicator or an enhanced FF host

The concentration measurement application must be enabled before you can perform any setup. If the concentration measurement application was enabled at the factory, you do not need to enable it now.

Prerequisites

The concentration measurement application must be licensed on your transmitter.

Disable the following applications before enabling concentration measurement as concentration measurement cannot be enabled at the same time:

- Advanced Phase Measurement — gas with liquid
- API Referral
- Gas Standard Volume

Procedure

1. Choose **Overview** → **Device Information** → **Licenses** → **Enable/Disable Applications** and ensure that **Volume Flow Type** is set to Liquid.
2. Choose **Overview** → **Device Information** → **Licenses** → **Enable/Disable Applications**.
3. Enable the concentration measurement application.

Load a concentration matrix from the transmitter's SD card using a field communicator

If you have a concentration matrix on the transmitter's SD card, you can move it into one of the six slots on your transmitter. You cannot use the matrix for measurement until it has been loaded into a slot. You can load up to six matrices into slots.

Prerequisites

You must have one or more concentration matrices loaded onto the transmitter's SD card.

You must know the derived variable that the matrix is designed to calculate.

Procedure

1. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Conc Measurement** → **CM Configuration** and ensure that the setting of **Derived Variable** matches the derived variable used by your matrix. If it does not, change it as required and click **Apply**.

Important
If you change the setting of **Derived Variable**, all existing concentration matrices will be deleted from the six slots, but not from the transmitter's SD card. Verify the setting of **Derived Variable** before continuing.

2. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Conc Measurement** → **Load Matrix File from IM**.
3. Select the slot that you want to load to.

   You can load the matrix into any empty slot, or you can overwrite an existing matrix.
4. Enter the name of the matrix file on the SD card, without the .matrix extension.

   Example

   If the matrix file name is `test.matrix`, enter `test`.

Postrequisites

Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Conc Measurement** → **CM Configuration** → **Active Matrix** and ensure that the selected slot contains the matrix that you loaded.

Set reference temperature values for specific gravity using a field communicator or an enhanced FF host

Field communicator	**Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Concentration Measurement** → **Configuration Matrix**
Enhanced FF host	**Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Concentration Measurement** → **Matrix Configuration**

When **Derived Variable** is set to any option based on specific gravity, you must set the reference temperature for water, then verify the density of water at the configured reference temperature. These values affect specific gravity measurement.

To check the setting of **Derived Variable**, choose:

- Field communicator: **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Conc Measurement** → **CM Configuration**
- Enhanced FF host: **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Concentration Measurement** → **Concentration Measurement Configuration**

Important
Do not change the setting of **Derived Variable**. If you change the setting of **Derived Variable**, all existing concentration matrices will be deleted from transmitter memory.

Procedure

1. Set **Matrix Being Configured** to the matrix you want to modify.
2. Choose **Reference Conditions**, then perform the following actions:
   a) Set **Reference Temperature** to the temperature to which line density will be corrected for use in the specific gravity calculation.

b) Set **Water Reference Temperature** to the water temperature that will be used in the specific gravity calculation.

c) Set **Water Reference Density** to the density of water at the specified reference temperature.

The transmitter automatically calculates the density of water at the specified temperature. The new value will be displayed the next time that transmitter memory is read. Optionally, you can enter a different value.

Provide temperature data using a field communicator or an enhanced FF host

The concentration measurement application uses line temperature data in its calculations. You must decide how to provide this data, then perform the required configuration and setup. Temperature data from the on-board temperature sensor (RTD) is always available. Optionally, you can set up an external temperature device and use external temperature data.

The temperature setup that you establish here will be used for all concentration measurement matrices on this meter.

Procedure

Choose the method to be used to supply temperature data, and perform the required setup.

Method	Description	Setup
Internal RTD temperature data	Temperature data from the on-board temperature sensor (RTD) is used.	a. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Variables** b. Set **Temperature Compensation** to Disable.
Digital communications	A host writes temperature data to the meter at appropriate intervals. This data will be available in addition to the internal RTD temperature data.	a. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Variables**. b. Set **Temperature Compensation** to Enable. c. Perform the necessary host programming and communications setup to write temperature data to the meter at appropriate intervals.

Postrequisites

To verify the **External Temperature**, choose:

Field communicator	**Service Tools** → **Variables** → **Process** → **External Temperature**
Enhanced FF host	**Service Tools** → **Variables** → **Variable Summary** → **External Temperature**

Need help?

If the value is not correct:

- Ensure that the external device and the meter are using the same measurement unit.
- For digital communications:
  — Verify that the host has access to the required data.

— Verify that the output variable is being correctly received and processed by the transmitter.

Modify matrix names and labels using a field communicator or an enhanced FF host

Field communicator	**Configure → Manual Setup → Measurements → Optional Setup → Conc Measurement → Configure Matrix**
Enhanced FF host	**Configure → Manual Setup → Measurements → Optional Setup → Concentration Measurement → Matrix Configuration → Matrix Selection**

For convenience, you can change the name of a concentration matrix and the label used for its measurement unit. This does not affect measurement.

Procedure

1. Set **Matrix Being Configured** to the matrix you want to modify.
2. Set **Matrix Name** to the name to be used for the matrix.
3. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Concentration Measurement** → **Matrix Configuration** → **Concentration**.
4. Set **Concentration Unit** to the label that will be used for the concentration unit.
5. If you set **Concentration Unit** to Special, choose **Label** and enter the custom label.

Modify extrapolation alerts using a field communicator

You can enable and disable extrapolation alerts, and set extrapolation alert limits. These parameters control the behavior of the concentration measurement application but do not affect measurement directly.

Each concentration matrix is built for a specific density range and a specific temperature range. If line density or line temperature goes outside the range, the transmitter will extrapolate concentration values. However, extrapolation may affect accuracy. Extrapolation alerts are used to notify the operator that extrapolation is occurring.

Each concentration matrix has its own extrapolation alert limits.

Procedure

1. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Conc Measurement** → **Configure Matrix**.
2. Set **Matrix Being Configured** to the matrix you want to modify.
3. Set **Extrapolation Alert Limit** to the point, in percent, at which an extrapolation alert will be posted.
4. Choose **Configure** → **Alert Setup** → **CM Alerts**.
5. Enable or disable the high and low alerts for temperature and density, as desired.

Extrapolation alerts in action

If **Extrapolation Limit** is set to 5%, **High Limit (Temp)** is enabled, and the active matrix is built for a temperature range of 40 °F (4.4 °C) to 80 °F (26.7 °C), a high-temperature extrapolation alert will be posted if line temperature goes above 82 °F (27.8 °C).

Modify extrapolation alerts for concentration measurement using an enhanced FF host

You can enable and disable extrapolation alerts, and set extrapolation alert limits. These parameters control the behavior of the concentration measurement application but do not affect measurement directly.

Each concentration matrix is built for a specific density range and a specific temperature range. If line density or line temperature goes outside the range, the transmitter will extrapolate concentration values. However, extrapolation may affect accuracy. Extrapolation alerts are used to notify the operator that extrapolation is occurring.

Each concentration matrix has its own extrapolation alert limits.

Procedure

1. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Concentration Measurement** → **Matrix Configuration** → **Matrix Selection**.
2. Set **Matrix Being Configured** to the matrix you want to modify.
3. Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Concentration Measurement** → **Matrix Configuration** → **Extrapolation**.
4. Set **Extrapolation Alert Limit** to the point, in percent, at which an extrapolation alert will be posted.
5. Choose **Configure** → **Alert Setup** → **Concentration Measurement Alerts**.
6. Enable or disable the high and low alerts for temperature and density, as desired.

Extrapolation alerts in action

If **Extrapolation Limit** is set to 5%, **High Limit (Temp)** is enabled, and the active matrix is built for a temperature range of 40 °F (4.4 °C) to 80 °F (26.7 °C), a high-temperature extrapolation alert will be posted if line temperature goes above 82 °F (27.8 °C).

Select the active concentration matrix using a field communicator or an enhanced FF host

Field communicator	**Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Conc Measurement** → **CM Configuration**
Enhanced FF host	**Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Concentration Measurement** → **Concentration Measurement**

You must select the concentration matrix to be used for measurement. Although the transmitter can store up to six concentration matrices, only one matrix can be used for measurement at any one time.

Procedure

Set **Active Matrix** to the matrix you want to use.

5.2.5 Set up concentration measurement using a basic FF host

This section guides you through most of the tasks related to setting up and implementing the concentration measurement application.

Restriction
This section does not cover building a concentration matrix. See *Micro Motion Enhanced Density Application Manual* for detailed information on building a matrix.

Enable concentration measurement using a basic FF host

The concentration measurement application must be enabled before you can perform any setup. If the concentration measurement application was enabled at the factory, you do not need to enable it now.

Procedure

1. Set the GSV Volume Flow Type to liquid: write a `0` to the **Volume Flow Type** parameter on the **Measurement TB**.
2. Enable the concentration measurement application: write `1` to the **Concentration Measurement** parameter on the **Device TB** (OD Index 144).

Set reference temperature values for specific gravity using a basic FF host

When **Derived Variable** is set to any option based on specific gravity, you must set the reference temperature for water, then verify the density of water at the configured reference temperature. These values affect specific gravity measurement.

To check the setting of **Derived Variable**, read the value of the **Derived Variable** parameter in the Concentration Measurement TB.

Table 5-2: Fieldbus codes for derived variable options (Derived Variable parameter)

Fieldbus code	Derived variable
1	Density at reference temperature
2	Specific gravity
3	Mass concentration (density)
4	Mass concentration (specific gravity)
5	Volume concentration (density)
6	Volume concentration (specific gravity)
7	Concentration (density)
8	Concentration (specific gravity)

Important
Do not change the setting of **Derived Variable**. If you change the setting of **Derived Variable**, all existing concentration matrices will be deleted from transmitter memory.

Procedure

Write the desired values into the appropriate parameters in the Concentration Measurement TB for **Reference Temperature**, **Water Reference Temperature**, and **Water Reference Density**.

The transmitter automatically calculates the density of water at the specified temperature. The new value will be displayed the next time that transmitter memory is read. You can enter a different value if you want to.

Modify matrix names and labels using a basic FF host

For convenience, you can change the name of a concentration matrix and the label used for its measurement unit. This does not affect measurement.

Procedure

1. Choose the matrix you want to modify by writing to the **Matrix Being Configured** parameter in the Concentration Measurement TB. Each saved matrix has a unique value of 0 through 5.
2. Write the desired values into the **Matrix Name** and **Concentration Unit** parameters in the Concentration Measurement TB.

   Table 5-3: Concentration unit codes

Fieldbus code	Unit
1110	degTwad
1426	degBrix
1111	degBaum hv
1112	degBaum lt
1343	% sol/wt
1344	% sol/vol
1427	degBall
1428	proof/vol
1429	proof/mass
33004	deg plato
253	special

3. Write a value into the **Special Concentration Unit Label** parameter if **Concentration Unit** is set to code 253 (special).

Modify extrapolation alerts for concentration measurement using a basic FF host

You can enable and disable extrapolation alerts, and set extrapolation alert limits. These parameters control the behavior of the concentration measurement application but do not affect measurement directly.

Each concentration matrix is built for a specific density range and a specific temperature range. If line density or line temperature goes outside the range, the transmitter will extrapolate concentration values. However, extrapolation may affect accuracy. Extrapolation alerts are used to notify the operator that extrapolation is occurring.

Each concentration matrix has its own extrapolation alert limits.

Procedure

1. Choose the matrix you want to configure using the **Matrix Being Configured** parameter in the Concentration Measurement TB. Each saved matrix has a unique value of 0 through 5.
2. Write the desired values into the appropriate parameters in the Concentration Measurement TB.

Parameter name	Description
Extrapolation Limit	*Extrapolation Alert Limit* The point, in percent, at which an extrapolation alert will be posted.
Density Low	Enable low density extrapolation alarm (write `1` to enable; `0` to disable).
Density High	Enable high density extrapolation alarm (write `1` to enable; `0` to disable).
Temperature Low	Enable low temperature extrapolation alarm (write `1` to enable; `0` to disable).
Temperature High	Enable high temperature extrapolation alarm (write `1` to enable; `0` to disable).

Extrapolation alert in action

If the following conditions exist, the high temperature extrapolation alert will be posted when the line temperature exceeds 82 °F (27.8 °C):

- The Extrapolation Alert Limit is set to 5%
- The high temperature alarm is enabled
- The active matrix is built for a temperature range of 40 °F (4.4 °C) to 80 °F (26.7 °C)

Select the active concentration matrix using a basic FF host

You must select the concentration matrix to be used for measurement. Although the transmitter can store up to six concentration matrices, only one matrix can be used for measurement at any one time.

Procedure

Choose the matrix you want to use by writing to the **Matrix Being Configured** parameter in the Concentration Measurement TB. Each saved matrix has a unique value of 0 through 5.

6 Configure advanced options for process measurement

6.1 Configure Response Time

Display	**Menu → Configuration → Process Measurement → Response Time**
ProLink III	**Device Tools → Configuration → Process Measurement → Response Time**
Field communicator	Not available
Enhanced FF host	Not available
Basic FF host	Not available

Response Time controls the speed of various internal processes that are involved in retrieving electronic data from the sensor and converting it to process data.

Response Time affects all process and diagnostic variables.

Restriction

Response Time is configurable only if you are using the enhanced core processor. If you are using the standard core processor, **Response Time** is set to Low Filtering and cannot be changed.

Procedure

Set **Response Time** as desired.

Option	Description
Normal	Appropriate for typical applications.
High Filtering	Slower response. Appropriate for applications with significant amount of entrained gas or process noise.
Low Filtering	Fastest response. Appropriate for proving or filling applications.
Service	Do not select unless directed by Micro Motion personnel.

6.2 Detect and report two-phase flow

Two-phase flow (gas in a liquid process or liquid in a gas process) can cause a variety of process control issues. The transmitter provides two methods to detect and report or respond to two-phase flow.

6.2.1 Detect two-phase flow using density

Display	**Menu → Configuration → Process Measurement → Density**
ProLink III	**Device Tools → Configuration → Process Measurement → Density**
Field communicator	**Configure → Manual Setup → Measurements → Density → Slug Low Limit** **Configure → Manual Setup → Measurements → Density → Slug High Limit** **Configure → Manual Setup → Measurements → Density → Slug Duration**
Enhanced FF host	**Configure → Manual Setup → Measurements → Two-Phase Flow → Low Limit** **Configure → Manual Setup → Measurements → Two-Phase Flow → High Limit** **Configure → Manual Setup → Measurements → Two-Phase Flow → Duration**
Basic FF host	**Measurement TB → Two Phase Flow Setup** (OD Index 91–94)

The transmitter can use line density data to detect two-phase flow (gas in a liquid process or liquid in a gas process). The density limits are user-specified. When two-phase flow is detected, an alert is posted.

Procedure

1. Set **Two-Phase Flow Low Limit** to the lowest density value that is considered normal in your process.

   Values below this will cause the transmitter to post a Process Aberration alert.

   Tip
   Gas entrainment can cause your process density to drop temporarily. To reduce the occurrence of two-phase flow alerts that are not significant to your process, set **Two-Phase Flow Low Limit** slightly below your expected lowest process density.

   You must enter **Two-Phase Flow Low Limit** in g/cm³, even if you configured another unit for density measurement.

   - Default: 0 g/cm³
   - Range: 0 g/cm³ to the sensor limit

2. Set **Two-Phase Flow High Limit** to the highest density value that is considered normal in your process.

   Values above this will cause the transmitter to post a Process Aberration alert.

   Tip
   To reduce the occurrence of two-phase flow alerts that are not significant to your process, set **Two-Phase Flow High Limit** slightly above your expected highest process density.

   You must enter **Two-Phase Flow High Limit** in g/cm³, even if you configured another unit for density measurement.

   - Default: 5 g/cm³
   - Range: 5 g/cm³ to the sensor limit

3. Set **Two-Phase Flow Timeout** to the number of seconds that the transmitter will wait for a two-phase flow condition to clear before posting the alert.
    - Default: 0 seconds, meaning that the alert will be posted immediately
    - Range: 0 to 60 seconds

6.2.2 Detect two-phase flow using sensor diagnostics

Display	**Menu → Configuration → Inputs/Outputs → Channel B → I/O Settings → Source**
ProLink III	**Device Tools → Configuration → I/O → Outputs → mA Output**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → mA Output *x* → mAOxSource**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel B**
Basic FF host	**Device TB → mAO Source Variable** (OD Index 94)

The transmitter always monitors sensor diagnostics and applies a two-phase flow algorithm. You can assign an mA Output to report the results of this calculation: single-phase flow, moderate two-phase flow, or severe two-phase flow. Severe two-phase flow can cause the meter to stop functioning.

Procedure

Set **mA Output Source** to Two-Phase Flow Detection.

The signal from the mA Output indicates the current state of the process:

- 12 mA: Single-phase flow
- 16 mA: Moderate two-phase flow
- 20 mA: Severe two-phase flow

6.3 Configure Flow Rate Switch

Display	**Menu → Configuration → Alert Setup → Enhanced Events → Flow Rate Switch**
ProLink III	**Device Tools → Configuration → I/O → Outputs → Discrete Output → Source → Flow Switch Indication**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → Discrete Output *x* → Flow Switch**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel C**
Basic FF host	**Device TB → Flow Rate Switch** (OD Index 129–132)

Flow Rate Switch is used to indicate that the flow rate has moved past a user-specified setpoint, in either direction. The flow rate switch is implemented with a user-configurable hysteresis.

Typically, a Discrete Output is assigned as the flow rate switch indicator. The Discrete Output can be wired to an external device such as a light or a horn.

Prerequisites

A channel must be configured as a Discrete Output, and the Discrete Output must be available for this use.

Procedure

1. Set **Discrete Output Source** to Flow Switch, if you have not already done so.
2. Set **Flow Switch Variable** to the flow variable that you want to use to control the flow rate switch.
3. Set **Flow Switch Setpoint** to the value at which the flow switch will be triggered (after **Hysteresis** is applied).

   Depending on the polarity of the Discrete Output:

   - If the flow rate is below this value, the Discrete Output is ON.
   - If the flow rate is above this value, the Discrete Output is OFF.

4. Set **Hysteresis** to the percentage of variation above and below the setpoint that will operate as a deadband.

   Hysteresis defines a range around the setpoint within which the flow rate switch will not change.

   - Default: 5%
   - Range: 0.1% to 10%

   #### Example

   If **Flow Switch Setpoint** = `100` g/sec and **Hysteresis** = `5%`, and the first measured flow rate is above 100 g/sec, the discrete output is OFF. It will remain OFF unless the flow rate drops below 95 g/sec. If this happens, the discrete output will turn ON, and remain ON until the flow rate rises above 105 g/sec. At this point it turns OFF and will remain OFF until the flow rate drops below 95 g/sec.

Related information

Configure a Discrete Output

6.4 Configure events

An event occurs when the real-time value of a user-specified process variable moves past a user-defined setpoint. Events are used to provide notification of process changes or to perform specific transmitter actions if a process change occurs.

Related information

Configure an enhanced event

6.4.1 Configure an enhanced event

Display	**Menu → Configuration → Alert Setup → Enhanced Events**
ProLink III	**Device Tools → Configuration → Events → Enhanced Events**
Field communicator	**Configure → Alert Setup → Enhanced Events**
Enhanced FF host	**Configure → Manual Setup → Events → Configure Events**
Basic FF host	**Device TB → Discrete Events** (OD Index 153–159)

An enhanced event is used to provide notification of process changes and, optionally, to perform specific transmitter actions if the event occurs. An enhanced event occurs (is ON) if the real-time value of a user-specified process variable moves above (HI) or below (LO) a user-defined setpoint, or in range (IN) or out of range (OUT) with respect to two user-defined setpoints.

You can define up to five enhanced events. For each enhanced event, you can assign one or more actions that the transmitter will perform if the enhanced event occurs.

Procedure

1. Select the event that you want to configure.
2. Assign a process variable to the event.
3. Specify **Event Type**.

Option	Description
HI	$x > A$ The event occurs when the value of the assigned process variable (x) is greater than the setpoint (**Setpoint A**), endpoint not included.
LO	$x < A$ The event occurs when the value of the assigned process variable (x) is less than the setpoint (**Setpoint A**), endpoint not included.
IN	$A \le x \le B$ The event occurs when the value of the assigned process variable (x) is *in range,* that is, between **Setpoint A** and **Setpoint B**, endpoints included.
OUT	$x \le A$ or $x \ge B$ The event occurs when the value of the assigned process variable (x) is *out of range,* that is, less than **Setpoint A** or greater than **Setpoint B**, endpoints included.

4. Set values for the required setpoints.
   - For HI and LO events, set **Setpoint A**.
   - For IN and OUT events, set **Setpoint A** and **Setpoint B**.
5. Optional: Configure a Discrete Output to switch states in response to the event status.
6. Optional: Specify the action or actions that the transmitter will perform when the event occurs.

Option	Description
Display	**Menu** → **Configuration** → **Alert Setup** → **Enhanced Events**, select any enhanced event, and choose **Assign Actions**
ProLink III	**Device Tools** → **Configuration** → **I/O** → **Inputs** → **Action Assignment**
Field communicator	**Configure** → **Alert Setup** → **Enhanced Events**

Related information

Configure Discrete Output Source

Options for Enhanced Event Action

Action	Label			
	Display	**ProLink III**	**Field communicator or enhanced FF host**	**Basic FF host code**
Standard				
Start sensor zero	Start Zero Calibration	Start Sensor Zero	Start Sensor Zero	**Start Sensor Zero**
Totalizers				
Start/stop all totalizers and inventories	Start/stop all totalizers	Start or Stop All Totalizers	Start/Stop All Totals	Start/Stop All Totals
Reset totalizer X	Reset Total X	Totalizer X	Reset Total X	Reset Total X
Reset all totalizers and inventories	Reset All Totals	Reset All Totals	Reset All Totals	Reset All Totals
Concentration measurement				
Increment CM matrix	Increment Matrix	Increment ED Curve	Increment Curve	**Increment CM Curve**
Meter verification				
Start meter verification test	Start SMV	Start Meter Verification	Start Smart Meter Verification	Start Smart Meter Verification

6.5 Configure totalizers and inventories

Display	**Menu → Configuration → Process Measurement → Totalizers & Inventories**
ProLink III	**Device Tools → Totalizer Control → Totalizers**
Field communicator	**Configure → Manual Setup → Measurements → Optional Setup → Configure Totalizers**
Enhanced FF host	**Configure → Manual Setup → Measurements → Optional Setup → Configure Totalizers/Inventories**
Basic FF host	**Totalizers and Inventories TB**

The transmitter provides seven configurable totalizers and seven configurable inventories. Each totalizer and each inventory can be configured independently.

Totalizers track the process since the last totalizer reset. Inventories track the process since the last inventory reset. Inventories are typically used to track the process across totalizer resets.

Tip
The default configurations cover the most typical uses of totalizers and inventories. You may not need to change any configurations.

Prerequisites

Before configuring the totalizers and inventories, ensure that the process variables you plan to track are available on the transmitter.

Procedure

1. Select the totalizer or inventory that you want to configure.

2. Set **Totalizer Source** or **Inventory Source** to the process variable that the totalizer or inventory will track.

Option	Description
Mass flow	The totalizer or inventory will track Mass Flow Rate and calculate total mass since the last reset.
Volume flow	The totalizer or inventory will track Volume Flow Rate and calculate total volume since the last reset.
Gas standard volume flow	The totalizer or inventory will track Gas Standard Volume Flow Rate and calculate total volume since the last reset.
Temperature-corrected volume flow	The totalizer or inventory will track Temperature-Corrected Volume Flow Rate and calculate total volume since the last reset.
Standard volume flow	The totalizer or inventory will track Standard Volume Flow Rate and calculate total volume since the last reset.
Net mass flow	The totalizer or inventory will track Net Mass Flow Rate and calculate total mass since the last reset.
Net volume flow	The totalizer or inventory will track Net Volume Flow Rate and calculate total volume since the last reset.

Note
The totalizer/inventory value will not automatically be reset when the source is changed. The user must manually reset the totalizer/inventory.

Tip
If you are using the API Referral application and you want to measure batch-weighted average density or batch-weighted average temperature, you must have a totalizer configured to measure temperature-corrected volume flow.

3. Set **Totalizer Direction** to specify how the totalizer or inventory will respond to forward or reverse flow.

Option	Flow direction	Totalizer and inventory behavior
Forward Only	Forward	Totals increment
	Reverse	Totals do not change
Reverse Only	Forward	Totals do not change
	Reverse	Totals increment
Bidirectional	Forward	Totals increment
	Reverse	Totals decrement
Absolute Value	Forward	Totals increment
	Reverse	Totals increment

Important
Actual flow direction interacts with **Sensor Flow Direction Arrow** to determine the flow direction that the transmitter uses in processing. See the following table.

Table 6-1: Interaction between actual flow direction and Sensor Flow Direction Arrow

Actual flow direction	Setting of Sensor Flow Direction Arrow	Flow direction sent to outputs and totalizers
Forward (same direction as Flow arrow on sensor)	With Arrow	Forward
	Against Arrow	Reverse
Reverse (opposite from Flow arrow on sensor)	With Arrow	Reverse
	Against Arrow	Forward

4. Optional: Set **User Name** to the name you want to use for the inventory or totalizer.

   User Name can have a maximum of 16 characters.

   The transmitter automatically generates a name for each totalizer and inventory, based on its source, direction, and type.

   #### Example

   - **Totalizer Source**=Mass Flow
   - **Totalizer Direction**=Forward Only
   - Totalizer name=`Mass Fwd Total`

   #### Example

   - **Inventory Source**=Gas Standard Volume Flow
   - **Inventory Direction**=Bidirectional
   - Inventory name = `GSV Bidir Inv`

   The specified name is used on the transmitter display and on all interfaces that support it. If **User Name** contains only spaces, the transmitter-generated name is used. Not all interfaces support totalizer and inventory names.

Example: Checking for backflow

You suspect that there is a significant amount of backflow through the sensor. To collect data, configure two totalizers as follows:

- **Source**=Mass Flow, **Direction**=Forward Only
- **Source**=Mass Flow, **Direction**=Reverse Only

Reset both totalizers, allow them to run for an appropriate period, then look at the amount of reverse flow as a percentage of forward flow.

Example: Tracking three different process fluids

Three tanks are connected to a loading dock through a single meter. Each tank contains a different process fluid. You want to track each process fluid separately.

1. Set up three totalizers, one for each tank.
2. Name the totalizers `Tank 1`, `Tank 2`, and `Tank 3`.

3. Configure each totalizer as required for the corresponding process fluid.
4. Stop and reset all three totalizers to ensure that the beginning values are 0.
5. When loading from a tank, start the corresponding totalizer, and stop it when the load is finished.

6.5.1 Default settings for totalizers and inventories

Totalizer or inventory	Source (process variable assignment	Direction	Name of totalizer Name of inventory
1	Mass flow	Forward Only	Mass Fwd Total Mass Fwd Inv
2	Volume flow	Forward Only	Volume Fwd Total Volume Fwd Inv
3	Temperature-corrected volume flow	Forward Only	API Volume Fwd Total API Volume Fwd Inv
4	Gas standard volume flow	Forward Only	GSV Fwd Total GSV Fwd Inv
5	Standard volume flow	Forward Only	Standard Vol Fwd Total Standard Vol Fwd Inv
6	Net mass flow	Forward Only	Net Mass Fwd Total Net Mass Fwd Inv
7	Net volume flow	Forward Only	Net Vol Fwd Total Net Vol Fwd Inv

6.6 Configure logging for totalizers and inventories

Display	**Menu → Configuration → Totalizer Log**
ProLink III	**Device Tools → Configuration → Totalizer Log**
Field communicator	Not available
Enhanced FF host	Not available
Basic FF host	Not available

The transmitter can write the current value of four totalizers or inventories to a log, at user-specified intervals. You can generate a log file from this data for viewing and analysis.

Procedure

1. Specify the date on which totalizer logging will begin.

   You must specify a future date. If you try to specify the current date, the transmitter will reject the setting.

2. Specify the time at which totalizer logging will begin.
3. Specify the number of hours between records.
4. Select up to four totalizers or inventories to be logged.

6.7 Configure Process Variable Fault Action

Display	**Menu → Configuration → Alert Setup → Output Fault Actions**
ProLink III	**Device Tools → Configuration → Fault Processing**
Field communicator	**Configure → Alert Setup → Output Fault Actions → Process Var Fault Action**
Enhanced FF host	**Configure → Alert Setup → Output Fault Actions → Fault Setting**
Basic FF host	**Device TB → Fault Limit** (OD Index 47)

Process Variable Fault Action specifies the values that will be reported via the display and digital communications if the device encounters a fault condition. The values are also sent to the outputs for processing against their configured fault actions.

Procedure

Set **Process Variable Fault Action** as desired.

Default: None

Restriction

If you set **Process Variable Fault Action** to NAN, you cannot set **mA Output Fault Action** or **Frequency Output Fault Action** to None. If you try to do this, the transmitter will not accept the configuration.

Important

- If you want the mA Output to continue reporting process data during fault conditions, you must set both **Process Variable Fault Action** and **mA Output Fault Action** to **None**. If **mA Output Fault Action** is set to **None** and **Process Variable Fault Action** is set to any other option, the mA Output will produce the signal associated with the selection.
- If you want the Frequency Output to continue reporting process data during fault conditions, you must set both **Process Variable Fault Action** and **Frequency Output Fault Action** to **None**. If **Frequency Output Fault Action** is set to **None** and **Process Variable Fault Action** is set to any other option, the Frequency Output will produce the signal associated with the selection.

6.7.1 Options for Process Variable Fault Action

Label				Description
Display	**ProLink III**	**Field communicator**	**Fieldbus host**	
Upscale	Upscale	Upscale	Upscale	• Process variable values indicate that the value is greater than the upper sensor limit. • Totalizers stop incrementing.
Downscale	Downscale	Downscale	Downscale	• Process variable values indicate that the value is lower than the lower sensor limit. • Totalizers stop incrementing.

Label				Description
Display	**ProLink III**	**Field communicator**	**Fieldbus host**	
Zero	Zero	IntZero-All 0	Zero	• Flow rate variables go to the value that represents a flow rate of 0 (zero). • Density is reported as `0`. • Temperature is reported as `0 °C`, or the equivalent if other units are used (e.g., `32 °F`. • Drive gain is reported as measured. • Totalizers stop incrementing.
Not-a-Number (NAN)	Not a Number	Not-a-Number	NAN	• Process variables are reported as `IEEE NAN`. • Drive gain is reported as measured. • Modbus scaled integers are reported as `Max Int`. • Totalizers stop incrementing.
Flow to Zero	Flow to Zero	IntZero-Flow 0	Flow goes to zero	• Flow rates are reported as `0`. • Other process variables are reported as measured. • Totalizers stop incrementing.
None (default)	None	None (default)	None	• All process variables are reported as measured. • Totalizers increment if they are running.

6.7.2 Interaction between Process Variable Fault Action and other fault actions

The setting of **Process Variable Fault Action** affects the operation of the mA Outputs, Frequency Outputs, and Discrete Outputs if the corresponding output fault actions are set to None.

Interaction between Process Variable Fault Action and mA Output Fault Action

If **mA Output Fault Action** is set to None, the mA Output signal depends on the setting of **Process Variable Fault Action**.

If the device detects a fault condition:

1. **Process Variable Fault Action** is evaluated and applied.
2. **mA Output Fault Action** is evaluated.

- If it is set to None, the output reports the value associated with the setting of **Process Variable Fault Action**.
- If it is set to any other option, the output performs the specified fault action.

If you want the mA Output to continue to report process data during fault conditions, you must set both **mA Output Fault Action** and **Process Variable Fault Action** to None.

Interaction between Process Variable Fault Action and Frequency Output Fault Action

If **Frequency Output Fault Action** is set to None, the Frequency Output signal depends on the setting of **Process Variable Fault Action**.

If the device detects a fault condition:

1. **Process Variable Fault Action** is evaluated and applied.
2. **Frequency Output Fault Action** is evaluated.
   - If it is set to None, the output reports the value associated with the setting of **Process Variable Fault Action**.
   - If it is set to any other option, the output performs the specified fault action.

If you want the Frequency Output to continue to report process data during fault conditions, you must set both **Frequency Output Fault Action** and **Process Variable Fault Action** to None.

Interaction between Process Variable Fault Action and Discrete Output Fault Action

If **Discrete Output Fault Action** is set to None and **Discrete Output Source** is set to Flow Rate Switch, the Discrete Output state during a fault depends on the setting of **Process Variable Fault Action**.

If the device detects a fault condition:

1. **Process Variable Fault Action** is evaluated and applied.
2. **Discrete Output Fault Action** is evaluated.
   - If it is set to None, and **Discrete Output Source** is set to Flow Rate Switch, the Discrete Output will use the value determined by the current setting of **Process Variable Fault Action** to determine if a flow rate switch has occurred.
   - If **Discrete Output Source** is set to any other option, the setting of **Process Variable Fault Action** is irrelevant to the behavior of the Discrete Output during fault conditions. The Discrete Output is set to the specified fault action.

If you want the Discrete Output to report a flow rate switch appropriately during fault conditions, you must set both **Discrete Output Fault Action** and **Process Variable Fault Action** to None.

Related information

Configure mA Output Fault Action
Configure Frequency Output Fault Action
Configure Discrete Output Fault Action

7 Configure device options and preferences

7.1 Configure the transmitter display

You can control the language used on the display, the process variables shown on the display, and a variety of display behaviors.

7.1.1 Configure the language used on the display

Display	**Menu → Configuration → Display Settings → Language**
ProLink III	**Device Tools → Configuration → Local Display Settings → Transmitter Display → General → Language**
Field communicator	**Configure → Manual Setup → Display → Display Language → Language**
Enhanced FF host	**Configure → Manual Setup → Display → Language**
Basic FF host	**Device TB → Language** (OD Index 61)

Language controls the language that the display uses for process data, menus, and information.

The languages available depend on your transmitter model and version.

Procedure

Set **Language** to the desired language.

7.1.2 Configure the process variables shown on the display

Display	**Menu → Configuration → Display Settings → Display Variables**
ProLink III	**Device Tools → Configuration → Transmitter Display → Display Variables**
Field communicator	**Configure → Manual Setup → Display → Display Variables**
Enhanced FF host	**Configure → Manual Setup → Display → Display Variables**
Basic FF host	**Device TB → Variable 1–15** (OD Index 69–83)

You can control the process variables shown on the display and the order in which they appear. The display can scroll through up to 15 process variables in any order you choose. This configuration applies to both auto-scroll and manual scrolling.

By default, one process variable is shown at a time. You can configure a custom display screen that shows two process variables at a time.

Restriction

You cannot remove all display variables. At least one display variable must be configured.

Notes

- If you have a display variable configured to show a volume process variable, and you change **Volume Flow Type** to Gas Standard Volume, the display variable is automatically changed to the equivalent GSV variable, and vice versa.

- For all other display variables, if the process variable becomes unavailable due to changes in configuration, the transmitter will not display that variable.

Procedure

For each display variable, select the process variable to be shown in that position in the rotation.

You can skip positions and you can repeat process variables.

Table 7-1: Default configuration for display variables

Display variable	Process variable assignment
Display Variable 1	Mass flow rate
Display Variable 2	Mass total
Display Variable 3	Volume flow rate
Display Variable 4	Volume total
Display Variable 5	Density
Display Variable 6	Temperature
Display Variable 7	Drive gain
Display Variable 8	None
Display Variable 9	None
Display Variable 10	None
Display Variable 11	None
Display Variable 12	None
Display Variable 13	None
Display Variable 14	None
Display Variable 15	None

7.1.3 Configure a two-line display screen

Display	**Menu → Configuration → Display Settings → Display Variables → 2-Value View**
ProLink III	**Device Tools → Configuration → Transmitter Display → Display Variables → 2 PV Screen Slot #*X***
Field communicator	**Configure → Manual Setup → Display → Display Variables → Display: Two-Variable View**
Enhanced FF host	**Configure → Manual Setup → Display → Display Variables → Two Variable Screen**
Basic FF host	**Device TB → Two PV Variable 1** (OD Index 84) **Device TB → Two PV Variable 2** (OD Index 85)

You can configure one display screen to show two process variables at a time. For each of these process variables, the current value and the measurement is shown.

The two-line display screen operates like one of the basic 15 screens. You can use ⌄ and ⌃ to scroll to it. If Auto Scroll is enabled, the two-line screen will be the last screen in the cycle.

7.1.4 Configure the number of decimal places (precision) shown on the display

Display	**Menu → Configuration → Display Settings → Decimals on Display**
ProLink III	**Device Tools → Configuration → Transmitter Display → Display Variables → Decimal Places for x**
Field communicator	**Configure → Manual Setup → Display → Decimal Places**
Enhanced FF host	**Configure → Manual Setup → Display → Decimal Places**
Basic FF host	**Device TB → Process Variable** (OD Index 86) **Device TB → Decimal Places** (OD Index 87)

You can specify the precision (the number of decimal places) that the display uses for each display variable. You can set the precision independently for each display variable.

The display precision does not affect the actual value of the variable, the value used in calculations, or the value reported via outputs or digital communications.

Procedure

1. Select a process variable or a diagnostic variable.

   You can configure the precision for all variables, whether or not they are assigned as display variables. The configured precision will be stored and used when applicable.

2. Set **Number of Decimal Places** to the number of decimal places to be used when this variable is shown on the display.

   - Default:
     - Temperature variables: 2
     - All other variables: 4
   - Range: 0 to 5

   Tip
   The lower the precision, the greater the change must be for it to be reflected on the display. Do not set **Number of Decimal Places** too low to be useful.

7.1.5 Turn on and turn off automatic scrolling through the display variables

Display	**Menu → Configuration → Display Settings → Auto Scroll**
ProLink III	**Device Tools → Configuration → Transmitter Display → General → Auto Scroll**
Field communicator	**Configure → Manual Setup → Display → Display Behavior → Auto Scroll**
Enhanced FF host	**Configure → Manual Setup → Display → Display Behavior → Auto Scroll**
Basic FF host	**Device TB → Auto Scroll** (OD Index 65) **Device TB → Scroll Time (1–30)** (OD Index 66)

You can configure the display to automatically scroll through the list of display variables or to show a single display variable until the operator activates **Scroll**. If **Auto Scroll** is turned on, you can configure the number of seconds that each display variable will be shown.

Procedure

1. Turn on or turn off **Auto Scroll** as desired.

Option	Description
On	The display automatically shows each display variable for the number of seconds specified by **Scroll Rate**, then shows the next display variable. The operator can move to the next display variable at any time by activating **Scroll**.
Off	The display shows Display Variable 1 and does not scroll automatically. The operator can move to the next display variable at any time by activating **Scroll**.

   Default: Off

2. If you turned on **Auto Scroll**, set **Scroll Rate** as desired.
   - Default: 10
   - Range: 1 to 30 seconds

   Tip
   Scroll Rate may not be available until you apply **Auto Scroll**.

7.1.6 Configure the display backlight

Display	**Menu → Configuration → Display Settings**
ProLink III	**Device Tools → Configuration → Transmitter Display → General → Backlight**
Field communicator	**Configure → Manual Setup → Display → Backlight**
Enhanced FF host	**Device Tools → Configuration → Transmitter Display → Backlight**
Basic FF host	**Device TB → Backlight Control** (OD Index 62)

You can control the intensity and contrast of the backlight on the display's LCD panel.

Procedure

1. Set **Intensity** as desired.
   - Default: 50
   - Range: 0 to 100
2. Set **Contrast** as desired.
   - Default: 50
   - Range: 0 to 100

7.1.7 Configure security for the display

Display	**Menu → Configuration → Security → Display Security**
ProLink III	**Device Tools → Configuration → Transmitter Display → Display Security**
Field communicator	**Configure → Manual Setup → Display → Display Menus**
Enhanced FF host	**Configure → Manual Setup → Display → Display Menus**
Basic FF host	**Device TB → Offline Menu Passcode Required (OD Index 67)** **Device TB → Passcode (4 Digits alphanumeric) (OD Index 68)** **Device TB → Alert Passcode (OD Index 89)**

When using the display, you can require users to enter a password to do any of the following tasks:

- Enter the main menu
- Change a parameter
- Access alert data through the display
- Start, stop, or reset totalizers or inventories via the context menu

The display password can be the same or different from the totalizer/inventory context menu control password. If different, the display password is used to reset, start, and stop totalizers or inventories using **Menu → Operations → Totalizers**.

Procedure

1. Configure **Password Required** as desired.

Option	Description
At Write	When an user chooses an action that leads to a configuration change, they are prompted to enter the display password.
Enter Menu	When the menu is selected from the process variable screen, the display password will be immediately required if **Password Required** is set.
Never (default)	When a user chooses an action that leads to a configuration change, they are prompted to activate ⇦⇧⇩⇨. This is designed to protect against accidental changes to configuration. It is not a security measure.

2. If the At Write or Enter Menu option was selected, enable or disable alert security as desired.

Option	Description
Enabled	If an alert is active, the alert symbol ⓘ is shown in the upper right corner of the display but the alert banner is not displayed. If the operator attempts to enter the alert menu, they are prompted to enter the display password.
Disabled	If an alert is active, the alert symbol ⓘ is shown in the upper right corner of the display and the alert banner is displayed automatically. No password or confirmation is required to enter the alert menu.

Restriction

You cannot set Password Required to Never and enable alert security.

- If you did not enable **Password Required**, alert security is disabled and cannot be enabled.
- Alert security is disabled automatically if you set **Password Required** to Never after:
  - **Password Required** is initially set to either At Write or Enter Menu
  - Alert security is enabled

3. If **Password Required** has been set to At Write or Enter Menu, you will be prompted to enter the desired password.
   - Default: AAAA
   - Range: Any four alphanumeric characters
   - **Password Required** must be set to At Write or Enter Menu to enable the totalizer/inventory control context menu password option.

Important

If you enable **Password Required** but you do not change the display password, the transmitter will post a configuration alert.

4. Configure **Main Menu Available** as desired.

Option	Description
Enabled	The local display **Menu** option from the process variable screen will be accessible.
Disabled	The local display **Menu** option from the process variable screen will not be accessible.

Important

Once **Main Menu Available** has been disabled, you cannot enable it from the local display. Use another configuration tool, such as ProLink III, to re-enable main menu access from the local display.

7.1.8 Configure totalizer and inventory control

Display	**Menu → Configuration → Security → Display Security → Totalizers & Inventories**
ProLink III	**Device Tools → Configuration → Totalizer Control Methods**
Field communicator	**Configure → Manual Setup → Display → Display Behavior**
Enhanced FF host	**Configure → Manual Setup → Display → Display Behavior**
Basic FF host	**Device TB → Totalizer Reset** (OD Index 63) **Device TB → Start/Stop Totalizers** (OD Index 64)

You can enable or disable the operator's ability to start, stop, or reset totalizers or inventories. The totalizer/inventory control context menus password can also be configured. The context menu is accessed by selecting the options menu from the process variable screen when a total or inventory is displayed.

These parameters do not affect the operator's ability to start, stop, or reset totalizers or inventories using another tool.

Procedure

1. Enable or disable **Reset Totalizers**, as desired.

   Default = Enable

2. Enable or disable **Start/Stop Totalizers**, as desired.

   Default = Enable

3. Enable or disable **Reset Inventory**, as desired.

   Default = Disable

4. Enable or disable **Start/Stop Inventory**, as desired.

   Default = Disable

5. If required, configure the totalizer/inventory control context menu password.

Option	Description
No password (default)	Start, stop or reset totalizer/inventory actions via the context menu do not require a password.
Password Required	When a user selects **Start/Stop** or **Reset** from the context menu and the password is enabled for totalizer/inventory control, the user is required to enter a password before the action occurs.

   If the context menu password option has been set to **Password Required**, you will be prompted to enter the password.

   - Default: AAAA
   - Range: Any four alphanumeric characters
   - The display **Password Required** must be set to At Write or Enter Menu to enable the totalizer/inventory control context menu password option.

   Important
   If you enable **Password Required** for totalizers and inventories, but you do not change the password from the default, the transmitter will post a configuration alert.

7.2 Configure the transmitter's response to alerts

7.2.1 Configure the transmitter's response to alerts using the display

For some alerts, you can change the transmitter's response to an alert by setting the alert severity. You can also configure the transmitter to ignore some alerts and conditions.

The transmitter implements the NAMUR NE 107 specification for alerts. NAMUR NE 107 categorizes alerts by the suggested operator action, not by cause or symptom. Each alert has one or more associated conditions.

Important
The transmitter reports all the process and device conditions that were reported by previous transmitters. However, the transmitter does not report them as individual alerts. Instead, the transmitter reports them as conditions associated with alerts.

Procedure

- To change the severity of an alert:
  a) Choose **Menu** → **Configuration** → **Alert Setup** → **Response to Alerts**.
  b) Select the alert.
  c) Set **Alert Severity** as desired.

Option	Description
Failure	The event is serious enough to require fault actions by the transmitter. The event may be either device-related or process-related. Operator action is strongly recommended.
Function Check	Configuration change or device testing. No fault actions are performed. The operator may need to complete a procedure.
Out of Specification	The process is outside user-specified limits or device limits. No fault actions are performed. The operator should check the process.
Maintenance Required	Device maintenance is recommended, either near-term or mid-term.

- To ignore an alert:
  a) Choose **Menu** → **Configuration** → **Alert Setup** → **Response to Alerts**
  b) Select the alert.
  c) Set **Alert Detection** to Ignore.

  If an alert is ignored, any occurrence of this alert is not posted to the alert list and the status LED on the transmitter does not change color. The occurrence is posted to alert history.
- To ignore a condition:
  a) Choose **Menu** → **Configuration** → **Alert Setup** → **Response to Alerts**
  b) Select the alert associated with the condition.
  c) Select Condition Detection.
  d) Select the condition and set it to Ignore.

  If a condition is ignored, any occurrence of this condition is not posted to the alert list and the status LED on the transmitter does not change color. The occurrence is posted to alert history.

7.2.2 Configure the transmitter's response to alerts using ProLink III

For some alerts, you can change the transmitter's response to an alert by setting the alert severity. You can also configure the transmitter to ignore some alerts and conditions.

The transmitter implements the NAMUR NE 107 specification for alerts. NAMUR NE 107 categorizes alerts by the suggested operator action, not by cause or symptom. Each alert has one or more associated conditions.

Important
The transmitter reports all the process and device conditions that were reported by previous transmitters. However, the transmitter does not report them as individual alerts. Instead, the transmitter reports them as conditions associated with alerts.

Procedure

- To change the severity of an alert:
  a) Choose **Device Tools** → **Configuration** → **Alert Severity**.
  b) Select the alert.
  c) Set the severity as desired.

Option	Description
Failure	The event is serious enough to require fault actions by the transmitter. The event may be either device-related or process-related. Operator action is strongly recommended.
Function Check	Configuration change or device testing. No fault actions are performed. The operator may need to complete a procedure.
Out of Specification	The process is outside user-specified limits or device limits. No fault actions are performed. The operator should check the process.
Maintenance Required	Device maintenance is recommended, either near-term or mid-term.

- To ignore an alert:
  a) Choose **Device Tools** → **Configuration** → **Alert Severity**.
  b) Select the alert.
  c) Set the severity to Ignore.

  If an alert is ignored, any occurrence of this alert is not posted to the alert list and the status LED on the transmitter does not change color. The occurrence is posted to alert history.
- To ignore a condition:
  a) Choose **Menu** → **Configuration** → **Alert Setup** → **Response to Alerts**.
  b) Select the alert associated with the condition and expand it.
  c) Select the condition and set it to Ignore.

  If a condition is ignored, any occurrence of this condition is not posted to the alert list and the status LED on the transmitter does not change color. The occurrence is posted to alert history.

7.2.3 Configure the transmitter's response to alerts using a field communicator

For some alerts, you can change the transmitter's response to an alert by setting the alert severity. You can also configure the transmitter to ignore some alerts and conditions.

The transmitter implements the NAMUR NE 107 specification for alerts. NAMUR NE 107 categorizes alerts by the suggested operator action, not by cause or symptom. Each alert has one or more associated conditions.

Important
The transmitter reports all the process and device conditions that were reported by previous transmitters. However, the transmitter does not report them as individual alerts. Instead, the transmitter reports them as conditions associated with alerts.

Procedure

- To change the severity of an alert:
  a) Choose **Configure** → **Alert Setup**.
  b) Choose the category of the alert: Sensor, Configuration, Process, or Output.
  c) Select the alert.
  d) Set the severity as desired.

Option	Description
Failure	The event is serious enough to require fault actions by the transmitter. The event may be either device-related or process-related. Operator action is strongly recommended.
Function Check	Configuration change or device testing. No fault actions are performed. The operator may need to complete a procedure.
Out of Specification	The process is outside user-specified limits or device limits. No fault actions are performed. The operator should check the process.
Maintenance Required	Device maintenance is recommended, either near-term or mid-term.

- To ignore an alert:
  a) Choose **Configure** → **Alert Setup**.
  b) Choose the category of the alert: Sensor, Configuration, Process, or Output.
  c) Select the alert.
  d) Set the severity to No Effect.

  If an alert is ignored, any occurrence of this alert is not posted to the alert list and the status LED on the transmitter does not change color. The occurrence is posted to alert history.
- To ignore a condition:
  a) Choose **Configure** → **Alert Setup**.
  b) Choose the category of the alert: Sensor, Configuration, Process, or Output.
  c) Select the alert.
  d) Choose **Set Conditions**.
  e) Select the condition and set it to OFF.

  If a condition is ignored, any occurrence of this condition is not posted to the alert list and the status LED on the transmitter does not change color. The occurrence is posted to alert history.

7.2.4 Configure Fault Timeout

Display	**Menu → Configuration → Alert Setup → Output Fault Actions → Fault Timeout (sec)**
ProLink III	**Device Tools → Configuration → Fault Processing → Fault Timeout**
Field communicator	**Configure → Alert Setup → Output Fault Actions → General → Fault Timeout**
Enhanced FF host	**Configure → Alert Setup → Output Fault Actions → Fault Timeout**
Basic FF host	**Device TB → Fault Timeout** (OD Index 48)

Fault Timeout controls the delay before fault actions are performed.

The fault timeout period begins when the transmitter detects an alert condition.

- During the fault timeout period, the transmitter continues to report its last valid measurements.
- If the fault timeout period expires while the alert is still active, the fault actions are performed.
- If the alert condition clears before the fault timeout expires, no fault actions are performed.

Restriction

- **Fault Timeout** is not applied to all alerts. For some alerts, fault actions are performed as soon as the alert condition is detected. See the list of alerts and conditions for details.
- **Fault Timeout** is applicable only when **Alert Severity** = Failure. For all other settings of **Alert Severity**, **Fault Timeout** is irrelevant.

Procedure

Set **Fault Timeout** as desired.

- Default: 0 seconds
- Range: 0 to 60 seconds

If you set **Fault Timeout** to 0, fault actions are performed as soon as the alert condition is detected.

7.2.5 Alerts, conditions, and configuration options

For more information on these alerts, see Status alerts, causes, and recommendations.

Configuration Error

Default severity: Failure
Severity configurable: No
Fault Timeout applicable: No

Table 7-2: Configuration Error conditions

Name	Ignorable
[021] Incorrect Sensor Type	Yes
[030] Incorrect Board Type	No
[120] Curve Fit Failure	No
Core Has Incompatible ETO	No

Table 7-2: Configuration Error conditions *(continued)*

Name	Ignorable
Core Software Update Failed	Yes
Time Not Set	Yes
Watercut Limited at 0%	Yes
Watercut Limited at 100%	Yes

Core Low Power

Default severity: Failure
Severity configurable: No
Fault Timeout applicable: No

Table 7-3: Core Low Power conditions

Name	Ignorable
[031] Low Power - Core	No

Data Loss Possible

Default severity: Maintenance Required
Severity configurable: Yes
Fault Timeout applicable: No

Table 7-4: Data Loss Possible conditions

Name	Ignorable
[103] Data Loss Possible	Yes
Clock is Constant	Yes
Firmware Update Failed	No
Internal Memory Full	No
No Permanent License	No
SD Card Not Present	No

Drive Over Range

Default severity: Maintenance
Severity configurable: Yes
Fault Timeout applicable: Yes

Table 7-5: Drive Over-Range conditions

Name	Ignorable
[102] Drive Overrange	Yes

Electronics Failed

Default severity: Failure
Severity configurable: No
Fault Timeout applicable: No

Table 7-6: Electronics Failed conditions

Name	Ignorable
[002] RAM Error (Core Processor)	No
[018] EEPROM Error (Transmitter)	No
[019] RAM Error (Transmitter)	No
[022] Configuration Database Corrupt (Core Processor)	No
[024] Program Corrupt (Core Processor)	No
Watchdog Error	No

Event Active

Default severity: Out of Speculation
Severity configurable: Yes
Fault Timeout applicable: Yes

Table 7-7: Event Active conditions

Name	Ignorable
Discrete Event [1 - 5] Active	Yes

Extreme PPV

Default severity: Failure
Severity configurable: Yes
Fault Timeout applicable: Yes

Table 7-8: Extreme PPV conditions

Name	Ignorable
[005] Mass Flow Rate Overrange	Yes
[008] Density Overrange	Yes

Flowmeter Init

Default severity: Failure
Severity configurable: No
Fault Timeout applicable: No

Table 7-9: Flowmeter Init conditions

Name	Ignorable
[009] Transmitter Initializing	No

Function Check

Table 7-10: Function Check conditions

Name	Ignorable
Out of Service	No

Function Check Failed or Smart Meter Verification Aborted

Default severity: Maintenance Required
Severity configurable: Yes
Fault Timeout applicable: No

Table 7-11: Function Check Failed or Smart Meter Verification Aborted conditions

Name	Ignorable
[010] Calibration Failed	No
[034] Smart Meter Verification Failed	Yes
[035] Smart Meter Verification Aborted	Yes

Function Check in Progress

Default severity: Function Check
Severity configurable: No
Fault Timeout applicable: No

Table 7-12: Function Check in Progress conditions

Name	Ignorable
[104] Calibration in Progress	No
[131] Smart Meter Verification in Progress	Yes

Output Fixed

Default severity: Function Check
Severity configurable: Yes
Fault Timeout applicable: No

Table 7-13: Output Fixed conditions

Name	Ignorable
[111] Frequency Output 1 Fixed	No
[119] Discrete Output 2 Fixed	No
mA Output 2 Fixed	No

Output Saturated

Default severity: Out of Speculation
Severity configurable: Yes

Fault Timeout applicable: No

Table 7-14: Output Saturated conditions

Name	Ignorable
[110] Frequency Output 1 Saturated	Yes
mA Output 3 Saturated	Yes

Process Aberration

Default severity: Out of Speculation
Severity configurable: Yes
Fault Timeout applicable: Yes

Table 7-15: Process Aberration conditions

Name	Ignorable
[105] Two-Phase Flow	Yes
[115] No Input	Yes
[116] Temperature Out of Range	Yes
[117] Density Out of Range	Yes
[121] Extrapolation Alert	Yes
Phase Genius Detected Moderate Severity	Yes

Sensor Being Simulated

Default severity: Function Check
Severity configurable: No
Fault Timeout applicable: No

Table 7-16: Sensor Being Simulated conditions

Name	Ignorable
[132] Sensor Simulation Active	No

Sensor Failed

Default severity: Failure
Severity configurable: No
Fault Timeout applicable: Yes

Table 7-17: Sensor Failed conditions

Name	Ignorable
[003] Sensor Failed	No
[016] Sensor Temperature (RTD) Failure	No
[017] Sensor Case Temperature (RTD) Failure	No

Sensor-Transmitter Communication Error

Default severity: Failure
Severity configurable: No
Fault Timeout applicable: Yes

Table 7-18: Sensor-Transmitter Communication Error conditions

Name	Ignorable
[026] Sensor/Transmitter Communications Failure	No
[028] Core Process Write Failure	No

Tube Not Full

Default severity: Failure
Severity configurable: Yes
Fault Timeout applicable: Yes

Table 7-19: Tube Not Full conditions

Name	Ignorable
[033] Tube Not Full	No

8 Integrate the meter with the control system

8.1 Configure FOUNDATION Fieldbus Channel A

Display	**Menu → Configuration → Fieldbus Settings → Function Block → Analog Input [1–4]**
ProLink III	**Device Tools → Configuration → Communications → Communications (Foundation Fieldbus)**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel A**
Enhanced FF host	For information about setting up function blocks, see FOUNDATION Fieldbus function blocks.
Basic FF host	**AI Block [1–4]**

Channel A is exclusively used for FOUNDATION Fieldbus communication. The four AI function blocks function as independent channels, each of them able to report a different process variable.

8.2 Configure mA Output Channel B

Display	**Menu → Configuration → Inputs/Outputs → Channel B → I/O Type**
ProLink III	**Device Tools → Configuration → I/O → Channels**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel B**
Basic FF host	**Device TB → Channel B Assigment** (OD Index 92)

Channel B is exclusively used for a mA Output. It can be disabled using a fieldbus host or ProLink III.

8.2.1 Configure an mA Output

Use an mA Output to report current values of process variables. The mA signal varies between 4 mA and 20 mA in proportion to the current value of the assigned process variable.

Depending on your purchase order and channel configuration, your transmitter may have 0–3 mA Outputs. Channel A is always mA Output 1, and Channel B and Channel C can be configured as mA Output 2 and mA Output 3 respectively.

Configure mA Output Source

Display	**Menu → Configuration → Inputs/Outputs → Channel B → I/O Settings → Source**
ProLink III	**Device Tools → Configuration → I/O → Outputs → mA Output**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → mA Output *x* → mAO*x*Source**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel B**
Basic FF host	**Device TB → mAO Source Variable** (OD Index 94)

mA Output Source specifies the process variable that is reported by the mA Output.

Prerequisites

- If you plan to configure the output to report volume flow, ensure that you have set **Volume Flow Type** as desired: Liquid or Gas Standard Volume.
- If you plan to configure an output to report a concentration measurement process variable, API Referral, or Advance Phase Measurement process variable, ensure that the concentration measurement application, API Referral, or Advance Phase Measurement application respectively, is configured so that the desired variable is available.

Procedure

Set **mA Output Process Variable** as desired.

Default: mA Output 1: Mass Flow Rate

Postrequisites

If you change the configuration of **mA Output Source**, verify the settings of **Lower Range Value** and **Upper Range Value**. The transmitter automatically loads a set of values, and these values may not be appropriate for your application.

Related information

Configure Lower Range Value (LRV) and Upper Range Value (URV) for the mA Output

Options for mA Output Source

The transmitter provides a basic set of options for **mA Output Source**, plus several application-specific options. Different communications tools may use different labels for the options.

Process variable	Label			
	Display	**ProLink III**	**Enhanced FF host**	**Basic FF host**
Standard				
Mass flow rate	Mass Flow Rate	Mass Flow Rate	Mass Flow Rate	0
Volume flow rate	Volume Flow Rate	Volume Flow Rate	Volume Flow Rate	5
Gas standard volume flow rate	GSV Flow Rate	Gas Standard Volume Flow Rate	Gas Standard Volume Flow Rate	62
Temperature	Temperature	Temperature	Temperature	1
Density	Density	Density	Density	3
External pressure	External Pressure	External Pressure	External Input Pressure	53
External temperature	External Temperature	External Temperature	External Input Temperature	55
Diagnostics				
Velocity	Velocity	Velocity	Mass Flow Velocity	208
Two-phase flow detection	Phase	Phase Flow Severity	Phase Genius Flow Severity	228

Process variable	Label			
	Display	**ProLink III**	**Enhanced FF host**	**Basic FF host**
Drive gain	Drive Gain	Drive Gain	Drive Gain	47
API Referral				
Temperature-corrected density	Referred Density	Density at Reference Temperature	API: Corr Density	15
Temperature-corrected (standard) volume flow rate	Referred Volume Flow	Volume Flow Rate at Reference Temperature	API: Corr Volume Flow	16
Average temperature-corrected density	Average Line Density	Average Density	API: Average Density	19
Average temperature	Average Temperature	Average Temperature	API: Average Temperature	20
Concentration measurement				
Density at reference	Referred Density	Density at Reference Temperature	CM: Density at Ref	21
Specific gravity	Specific Gravity	Density (Fixed SG Units)	CM: Density (SGU)	22
Standard volume flow rate	Standard Vol Flow	Volume Flow Rate at Reference Temperature	CM: Standard Volume Flow Rate	23
Net mass flow rate	Net Mass Flow	Net Mass Flow Rate	CM: Net Mass Flow Rate	26
Net volume flow rate	Net Volume Flow Rate	Net Volume Flow Rate	CM: Net Volume Flow rate	29
Concentration	Concentration	Concentration	CM: Concentration	32
Baume	Baume	Baume	CM: Density (Baume)	56
Advanced Phase Measurement				
Net oil flow at line	NetOilFlow @ Line	Net Oil Flow @ Line	APM: Net Oil Flow at Line	73
Water cut at line	Watercut @ Line	Watercut @ Line	APM: Watercut at Line	74
Net water flow at line	NetWaterFlow @ Line	Net Water Flow @ Line	APM: Net Water Flow at Line	75
Net oil flow at reference	NetOilFlow @ Ref	Net Oil Flow @ Ref	APM: Net Oil Flow at Reference	78
Water cut at reference	Watercut @ Ref	Watercut @ Ref	APM: Watercut at Ref	79
Net water flow at reference	NetWaterFlow @ Ref	Net Water Flow @ Ref	APM: Net Flow Water at Ref	81
Gas void fraction	Gas Void Fraction	Gas Void Fraction	APM: Gas Void Fraction	205

Configure Lower Range Value (LRV) and Upper Range Value (URV) for the mA Output

Display	**Menu → Configuration → Inputs/Outputs → Channel B → I/O Settings → Lower Range Value Menu → Configuration → Inputs/Outputs → Channel B → I/O Settings → Upper Range Value**
ProLink III	**Device Tools → Configuration → I/O → Outputs → mA Output → Lower Range Value** **Device Tools → Configuration → I/O → Outputs → mA Output → Upper Range Value**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → mA Output *x* → mA Output *x*Settings → Lower Range Value** **Configure → Manual Setup → Inputs/Outputs → Channel *x* → mA Output *x* → mA Output *x*Settings → Upper Range Value**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel B**
Basic FF host	**Device TB → mAO Lower Range Value** (OD Index 97) **Device TB → mAO Upper Range Value** (OD Index 98)

The **Lower Range Value** (LRV) and **Upper Range Value** (URV) are used to scale the mA Output, that is, to define the relationship between **mA Output Process Variable** and the mA Output signal.

LRV is the value of **mA Output Source** represented by an output of 4 mA. **URV** is the value of **mA Output Source** represented by an output of 20 mA. Between **LRV** and **URV**, the mA Output is linear with the process variable. If the process variable drops below **LRV** or rises above **URV**, the transmitter posts an output saturation alert.

Procedure

Set **LRV** and **URV** as desired.

Enter **LRV** and **URV** in the measurement units used for **mA Output Source**.

- Defaults: Specific to each process variable
- Range: Unlimited

Note

You can set **URV** below **LRV**. For example, you can set **URV** to `50` and **LRV** to `100`. If you do this, the mA Output will be inversely proportional to the value of **mA Output Source**.

Tip

For best performance:

- Set **LRV** ≥ **LSL** (lower sensor limit).
- Set **URV** ≤ **USL** (upper sensor limit).
- Set these values so that the difference between **URV** and **LRV** is ≥ **Min Span** (minimum span).

This ensures that the resolution of the mA Output signal is within the range of the bit precision of the D/A converter.

Note

The transmitter always stores **LRV** and **URV** for the current process variable and the previous process variable. If **mA Output Source** is set to Mass Flow Rate and you set **LRV** and **URV** for this configuration, then you change **mA Output Source** to Volume Flow Rate and set **LRV** and **URV**, then change **mA Output Source** back to Mass Flow Rate, the corresponding **LRV** and **URV** are restored automatically. However, if you changed **mA Output Source** to Volume Flow Rate, then to Phase Genius Flow Severity, and then back to Mass Flow Rate, the configured **LRV** and **URV** for Mass Flow Rate are no longer available. The sensor's lower limit and upper limit are used instead.

Configure mA Output Direction

Display	**Menu → Configuration → Inputs/Outputs → Channel B → I/O Settings → Direction**
ProLink III	**Device Tools → Configuration → I/O → Outputs → mA Output → Direction**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → mA Output *x* → mAO*x* Fault Settings → mAO*x* Direction**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel B**
Basic FF host	**Device TB → mAO Direction** (OD Index 103)

mA Output Direction controls how conditions of forward flow and reverse flow affect the flow rates reported by the mA Output.

Actual flow direction interacts with **Sensor Flow Direction Arrow** to determine the flow direction that the transmitter uses in processing. See the following table.

Table 8-1: Interaction between actual flow direction and Sensor Flow Direction Arrow

Actual flow direction	Setting of Sensor Flow Direction Arrow	Flow direction sent to outputs and totalizers
Forward (same direction as Flow arrow on sensor)	With Arrow	Forward
	Against Arrow	Reverse
Reverse (opposite from Flow arrow on sensor)	With Arrow	Reverse
	Against Arrow	Forward

Procedure

Set **mA Output Direction** as desired.

Option	Description
Normal (default)	Appropriate when your application needs to distinguish between forward flow and reverse flow.
Absolute Value	Appropriate when your application does not need to distinguish between forward flow and reverse flow.

Important
mA Output Direction interacts with **Lower Range Value** (LRV). The effect of **mA Output Direction** on the mA Output varies, depending on whether LRV < 0 or LRV ≥ 0.

Related information

Configure Sensor Flow Direction Arrow

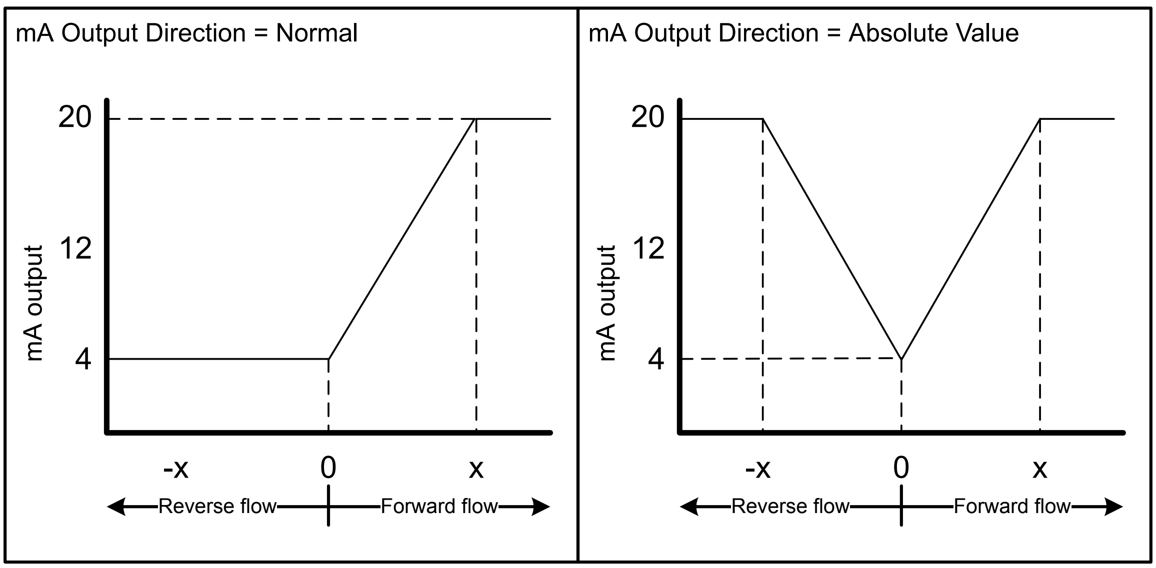
Effect of mA Output Direction on an mA Output

mA Output Direction affects how the transmitter reports flow values via an mA Output. An mA Output is affected by **mA Output Direction** only if **mA Output Source** is set to a flow variable.

The effect of **mA Output Direction** depends on the setting of **Lower Range Value** (LRV).

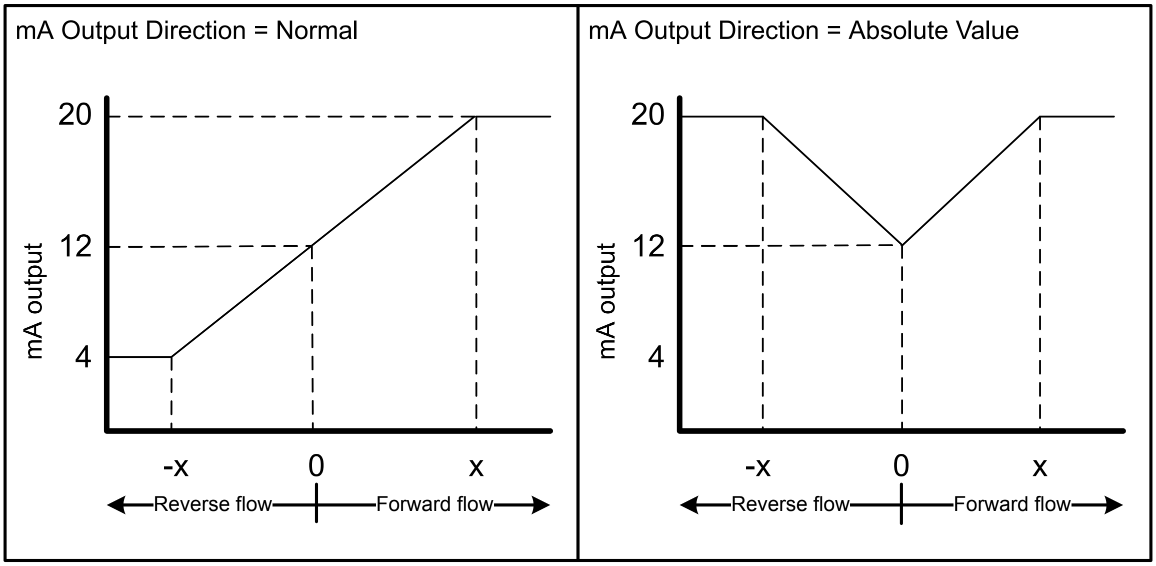
- If **Lower Range Value** = 0, see Figure 8-1.
- If **Lower Range Value** > 0, see Figure 8-1 and adapt the chart.
- If **Lower Range Value** < 0, see Figure 8-2.

Figure 8-1: Effect of mA Output Direction on an mA Output: Lower Range Value = 0



- **Lower Range Value** = 0
- **Upper Range Value** = x

Figure 8-2: Effect of mA Output Direction on an mA Output: Lower Range Value < 0



- **Lower Range Value** = −x
- **Upper Range Value** = x

Example: mA Output Direction = **Normal and** Lower Range Value = **0**

Configuration:

- **mA Output Direction** = Normal
- **Lower Range Value** = 0 g/sec
- **Upper Range Value** = 100 g/sec

Result:

- Under conditions of reverse flow or zero flow, the mA Output is 4 mA.
- Under conditions of forward flow, up to a flow rate of 100 g/sec, the mA Output varies between 4 mA and 20 mA in proportion to the flow rate.
- Under conditions of forward flow, if the flow rate equals or exceeds 100 g/sec, the mA Output will be proportional to the flow rate up to 20.5 mA, and will be level at 20.5 mA at higher flow rates.

Example: mA Output Direction = **Normal and** Lower Range Value **< 0**

Configuration:

- **mA Output Direction** = Normal
- **Lower Range Value** = −100 g/sec
- **Upper Range Value** = +100 g/sec

Result:

- Under conditions of zero flow, the mA Output is 12 mA.
- Under conditions of forward flow, for flow rates between 0 and +100 g/sec, the mA Output varies between 12 mA and 20 mA in proportion to (the absolute value of) the flow rate.
- Under conditions of forward flow, if (the absolute value of) the flow rate equals or exceeds 100 g/sec, the mA Output is proportional to the flow rate up to 20.5 mA, and will be level at 20.5 mA at higher flow rates.
- Under conditions of reverse flow, for flow rates between 0 and −100 g/sec, the mA Output varies between 4 mA and 12 mA in inverse proportion to the absolute value of the flow rate.
- Under conditions of reverse flow, if the absolute value of the flow rate equals or exceeds 100 g/sec, the mA Output is inversely proportional to the flow rate down to 3.8 mA, and will be level at 3.8 mA at higher absolute values.

Configure mA Output Cutoff

Display	**Menu → Configuration → Inputs/Outputs → Channel B → I/O Settings → MAO Cutoff**
ProLink III	**Device Tools → Configuration → I/O → Outputs → mA Output → Flow Rate Cutoff**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → mA Output *x* → mA Output *x* Settings → mAO Flow Rate Cutoff**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel B**
Basic FF host	**Device TB → mA Output Flow Rate Cutoff** (OD Index 104)

mA Output Cutoff specifies the lowest flow rate that will be reported through the mA Output. All flow rates below the specified value are reported as 0.

mA Output Cutoff is applicable only when **mA Output Source** is set to a flow rate variable. It is applied to whatever flow variable is assigned to the mA Output.

Procedure

Set **mA Output Cutoff** as desired.

Set **mA Output Cutoff** in the measurement units used for the process variable. If you change the measurement unit, **mA Output Cutoff** is adjusted automatically.

- Default: 0
- Range: 0 or any positive value

Tip
For most applications the default value of **mA Output Cutoff** should be used. Contact customer service before changing **mA Output Cutoff**.

Interaction between mA Output Cutoff and process variable cutoffs

When **mA Output Process Variable** is set to a flow variable (for example, mass flow rate or volume flow rate), **mA Output Cutoff** interacts with **Mass Flow Cutoff** or **Volume Flow Cutoff**. The transmitter puts the cutoff into effect at the highest flow rate at which a cutoff is applicable.

Configure mA Output Damping

Display	**Menu → Configuration → Inputs/Outputs → Channel *x* → I/O Settings → MAO Damping**
ProLink III	**Device Tools → Configuration → I/O → Outputs → mA Output → Added Damping**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → mA Output *x* → mA Output *x* Settings → Added Damping**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel B**
Basic FF host	**Device TB → mAO Added Damping** (OD Index 96)

mA Output Damping controls the amount of damping that will be applied to the mA Output.

Damping is used to smooth out small, rapid fluctuations in process measurement. The damping value specifies the time period, in seconds, over which the transmitter will spread changes in the process variable. At the end of the interval, the value reported by the mA Output will reflect 63% of the change in the actual measured value.

mA Output Damping affects a process variable only when it is reported via the mA Output. If the process variable is read from the display or digitally, **mA Output Damping** is not applied.

Procedure

Set **mA Output Damping** to the desired value.

- Default: 0.0 seconds
- Range: 0.0 to 440 seconds

Tip

- A high damping value makes the process variable appear smoother because the reported value changes slowly.
- A low damping value makes the process variable appear more erratic because the reported value changes more quickly.
- The combination of a high damping value and rapid, large changes in the process variable assigned to the mA Output can result in increased measurement error.
- Whenever the damping value is non-zero, the damped value will lag the actual measurement because the damped value is being averaged over time.
- In general, lower damping values are preferable because there is less chance of data loss, and less lag time between the actual measurement and the damped value.

Interaction between mA Output Damping and process variable damping

When **mA Output Source** is set to a flow rate variable, density, or temperature, **mA Output Damping** interacts with **Flow Damping**, **Density Damping**, or **Temperature Damping**. If multiple damping parameters are applicable, the effect of damping the process variable is calculated first, and the mA Output damping calculation is applied to the result of that calculation.

Example: Damping interaction

Configuration:

- **Flow Damping** = `1` second
- **mA Output Source** = Mass Flow Rate
- **mA Output Damping** = `2` seconds

Result: A change in the mass flow rate will be reflected in the mA Output over a time period that is greater than 3 seconds. The exact time period is calculated by the transmitter according to internal algorithms which are not configurable.

Configure mA Output Fault Action

Display	**Menu → Configuration → Inputs/Outputs → Channel B → I/O Settings → Fault Action**
ProLink III	**Device Tools → Configuration → I/O → Outputs → mA Output *x* → Fault Action**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → mA Output *x* → mAOxFault Settings → mAO*x* Fault Action**
Enhanced FF host	**Configure → Alert Setup → Output Fault Actions → Channel B → Fault Action**
Basic FF host	**Device TB → mAO Fault Action** (OD Index 99)

mA Output Fault Action controls the behavior of the mA Output if the transmitter detects a fault condition.

Important

- The fault action is implemented only if **Alert Severity** is set to Failure. If **Alert Severity** is set to any other option, the fault action is not implemented.
- For some faults only: If **Fault Timeout** is set to a non-zero value, the transmitter will not implement the fault action until the timeout has elapsed.

Procedure

1. Set **mA Output Fault Action** as desired.

   Default: Downscale

   Important
   If you set **mA Output Fault Action** to None, the mA Output will be controlled by the setting of **Process Variable Fault Action**. In most cases, if you set **mA Output Fault Action** to None, you should also set **Process Variable Fault Action** to None.

2. If you set **mA Output Fault Action** to **Upscale** or **Downscale**, set **mA Output Fault Level** to the signal that the mA Output will produce during a fault.

Related information

Configure Process Variable Fault Action
Interaction between Process Variable Fault Action and other fault actions

Options for mAO Fault Action and mAO Fault Level

Option	mA Output behavior	mA Output Fault Level
Upscale	Goes to the configured fault level	Default: 22.0 mA Range: 21.0 to 23.0 mA
Downscale (default)	Goes to the configured fault level	Default: 2.0 mA Range: 1.0 to 3.6 mA
Internal Zero	Goes to the mA Output level associated with a process variable value of 0 (zero), as determined by **Lower Range Value** and **Upper Range Value** settings	Not applicable
None	Determined by the setting of **Process Variable Fault Action**	Not applicable

8.3 Configure FO/DO Channel C

Display	**Menu → Configuration → Inputs/Outputs → Channel C → I/O Type**
ProLink III	**Device Tools → Configuration → I/O → Channels**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel C**
Basic FF host	**Device TB → Channel C Assignment** (OD Index 93)

Channel C can be used for a Frequency Output or a Discrete Output. It can also be disabled using a fieldbus host or ProLink III.

8.3.1 Configure a Frequency Output

Use a Frequency Output to report current values of process variables. The frequency varies between 0 Hz and 14500 Hz in proportion to the current value of the assigned process variable.

Related information

Configure Frequency Output Source
Configure Frequency Output Scaling
Configure Frequency Output Direction
Configure Frequency Output Fault Action

Configure Frequency Output Source

Display	**Menu → Configuration → Inputs/Outputs → Channel C → I/O Type → Frequency Output**
ProLink III	
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → Frequency Output *x***
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel C**
Basic FF host	**Device TB → Frequency Output** (OD Index 111)

Frequency Output Source specifies the process variable that is reported by the Frequency Output.

Prerequisites

- If you plan to configure the output to report volume flow, ensure that you have set **Volume Flow Type** as desired: Liquid or Gas Standard Volume.
- If you plan to configure an output to report a concentration measurement process variable, ensure that the concentration measurement application is configured so that the desired variable is available.

Procedure

Set **Frequency Output Source** as desired.

Default: Frequency Output 1: Mass Flow Rate

Postrequisites

If you change the configuration of **Frequency Output Source**, verify the Frequency Output scaling. The transmitter automatically loads the most recent values for the scaling parameters, and they may not be appropriate for your application.

Related information

Configure Frequency Output Scaling

Options for Frequency Output Source

The transmitter provides a basic set of options for **Frequency Output Source**, plus several application-specific options. Different communications tools may use different labels for the options.

Process variable	Label			
	Display	PLIII	Enhanced FF host	Basic FF code
Standard				
Mass flow rate	Mass Flow Rate	Mass Flow Rate	Mass Flow Rate	0
Volume flow rate	Volume Flow Rate	Volume Flow Rate	Volume Flow Rate	5
Gas Standard Volume flow rate	GSV Flow Rate	Gas Standard Volume Flow Rate	Gas Standard Volume Flow	62
API Referral				
Temperature-corrected (standard) volume flow rate	Referred Volume Flow	Volume Flow Rate at Reference Temperature	API: Corr Volume Flow	16
Concentration measurement				
Standard volume flow rate	Standard Vol Flow	Volume Flow Rate at Reference Temperature	CM: Standard Volume Flow Rate	23
Net mass flow rate	Net Mass Flow	Net Mass Flow Rate	CM: Net Volume Flow Rate	26
Net volume flow rate	Net Volume Flow Rate	Net Volume Flow Rate	CM: Net Volume Flow Rate	29

Process variable	Label			
	Display	**PLIII**	**Enhanced FF host**	**Basic FF code**
Advanced Phase Measurement				
Net Oil Flow At Line	NetOilFlow @ Line	Net Oil Flow @ Line	APM: Net Flow Oil At Line	73
Net Water Flow At Line	NetWaterFlow @ Line	Net Water Flow @ Line	APM: Net Flow Water At Line	75
Net Oil Flow At Ref	NetOilFlow @ Ref	Net Oil Flow @ Ref	APM: Net Flow Oil At Ref	78
Net Water Flow At Ref	NetWaterFlow @ Ref	Net Water Flow @ Ref	APM: Net Flow Water At Ref	81
Unremediated Mass Flow	Unremediated Mass Flow	Unremediated Mass Flow	APM: Unremediated Mass Flow	210
Unremediated Volume Flow	Unremediated Vol Flow	Unremediated Volume Flow	APM: Unremediated Vol Flow	212
Liquid Mass Flow	Liquid Mass Flow	Liquid Mass Flow	APM: TMR Liquid Flow	230

Configure Frequency Output Scaling

Display	**Menu → Configuration → Inputs/Outputs → Channel C → I/O Settings → Scaling Method**
ProLink III	**Device Tools → Configuration → I/O → Outputs → Frequency Output → Scaling Method**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → Frequency Output *x* → FO*x*Scaling**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel C**
Basic FF host	**Device TB → Frequency Output Scaling Method** (OD Index 120)

Frequency output scaling defines the relationship between **Frequency Output Source** and the pulse of the Frequency Output. Scale the Frequency Output to provide the data in the form required by your frequency receiving device.

Procedure

1. Set **Frequency Output Scaling Method**.

Option	Description
Frequency=Flow (default)	Frequency calculated from flow rate
Pulses/Unit	A user-specified number of pulses represents one flow unit
Units/Pulse	A pulse represents a user-specified number of flow units

2. Set additional required parameters.
   - If you set **Frequency Output Scaling Method** to Frequency=Flow, set **Rate Factor** and **Frequency Factor**.
   - If you set **Frequency Output Scaling Method** to Pulses/Unit, define the number of pulses that will represent one flow unit.

- If you set **Frequency Output Scaling Method** to Units/Pulse, define the number of units that each pulse will indicate.

Calculate frequency from flow rate

The Frequency=Flow option is used to customize the Frequency Output for your application when you do not know appropriate values for Units/Pulse or Pulses/Unit.

If you specify Frequency=Flow, you must provide values for **Rate Factor** and **Frequency Factor**:

Rate Factor The maximum flow rate that you want the Frequency Output to report.

Frequency Factor A value calculated as follows:

$$FrequencyFactor \frac{RateFactor}{T} \times N$$

where:

T Factor to convert selected time base to seconds

N Number of pulses per flow unit, as configured in the receiving device

The resulting **Frequency Factor** must be within the range of the Frequency Output :

- If **Frequency Factor** is less than 1 Hz, reconfigure the receiving device for a higher pulses/unit setting.

Example: Configure Frequency=Flow

You want the Frequency Output to report all flow rates up to 2000 kg/min.

The frequency receiving device is configured for 10 pulses/kg.

Solution:

$$FrequencyFactor \frac{RateFactor}{T} \times N$$

$$FrequencyFactor \frac{2000}{60} \times 10$$

$$FrequencyFactor = 333.33$$

Set parameters as follows:

- **Rate Factor**: `2000`
- **Frequency Factor**: `333.33`

Configure Frequency Output Direction

Display	**Menu → Configuration → Inputs/Outputs → Channel x → I/O Settings → Direction**
ProLink III	**Device Tools → Configuration → I/O → Outputs → Frequency Output x → Direction**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → Frequency Output *x* → FO*x*Settings**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel C**
Basic FF host	**Device TB → Frequency Output Direction** (OD Index 119)

Frequency Output Direction controls how conditions of forward flow and reverse flow affect the flow rates reported by the Frequency Output.

Actual flow direction interacts with **Sensor Flow Direction Arrow** to determine the flow direction that the transmitter uses in processing. See the following table.

Table 8-2: Interaction between actual flow direction and Sensor Flow Direction Arrow

Actual flow direction	Setting of Sensor Flow Direction Arrow	Flow direction sent to outputs and totalizers
Forward (same direction as Flow arrow on sensor)	With Arrow	Forward
	Against Arrow	Reverse
Reverse (opposite from Flow arrow on sensor)	With Arrow	Reverse
	Against Arrow	Forward

Procedure

Set **Frequency Output Direction** as desired.

Option	Description
Positive Flow Only	• Forward flow: The Frequency Output reports the flow rate according to the configured scaling method. • Reverse flow: The Frequency Output is 0 Hz.
Negative Flow Only	• Forward flow: The Frequency Output is 0 Hz. • Reverse flow: The Frequency Output reports the absolute value of the flow rate according to the configured scaling method.
Both Positive and Negative Flow	The Frequency Output reports the absolute value of the flow rate according to the configured scaling method. It is not possible to distinguish between forward flow and reverse flow from the Frequency Output alone. This setting is typically used in combination with a discrete output configured to report flow direction.

Related information

Configure Sensor Flow Direction Arrow
Configure Discrete Output Source

Configure Frequency Output Fault Action

Display	**Menu → Configuration → Inputs/Outputs → Channel C → I/O Settings → Fault Action**
ProLink III	**Device Tools → Configuration → I/O → Outputs → Frequency Output x → Fault Action**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → Frequency Output *x* → FO*x*Fault Settings → FO*x* Fault Action**
Enhanced FF host	**Configure → Alert Setup → Output Fault Actions → Channel C**
Basic FF host	**Device TB → FO Fault Action** (OD Index 117)

Frequency Output Fault Action controls the behavior of the Frequency Output if the transmitter detects a fault condition.

Important

- The fault action is implemented only if **Alert Severity** is set to Failure. If **Alert Severity** is set to any other option, the fault action is not implemented.
- For some faults only: If **Fault Timeout** is set to a non-zero value, the transmitter will not implement the fault action until the timeout has elapsed.

Procedure

1. Set **Frequency Output Fault Action** as desired.

   Default: Downscale

   Important
   If you set **Frequency Output Fault Action** to None, the Frequency Output will be controlled by the setting of **Process Variable Fault Action**. In most cases, if you set **Frequency Output Fault Action** to None, you should also set **Process Variable Fault Action** to None.

2. If you set **Frequency Output Fault Action** to Upscale, set **Frequency Fault Level** to the desired value.
   - Default: 14500 Hz
   - Range: 10 Hz to 14500 Hz

Related information

Configure Process Variable Fault Action

Options for Frequency Output Fault Action

Label	Frequency Output behavior
Upscale	Goes to configured Upscale value: • Default: 14500 Hz • Range: 10 Hz to 14500 Hz
Downscale	0 Hz
Internal Zero	0 Hz
None (default)	Determined by the setting of **Process Variable Fault Action**

8.3.2 Configure a Discrete Output

Use a Discrete Output to report specific meter or process conditions.

Related information

Configure Discrete Output Source
Configure Discrete Output Polarity
Configure Discrete Output Fault Action

Configure Discrete Output Source

Display	**Menu → Configuration → Inputs/Outputs → Channel C → I/O Settings → Source**
ProLink III	**Device Tools → Configuration → I/O → Outputs → Discrete Output → Source**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel x → Discrete Output x → DOx Source**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel C**
Basic FF host	**Device TB → DO Source** (OD Index 124)

Discrete Output Source specifies the process condition or device condition that is reported by a Discrete Output.

Procedure

Set **Discrete Output Source** to the desired option.

Default: Forward/Reverse

Postrequisites

If you set **Discrete Output Source** to Flow Switch, additional configuration is required.

Related information

Configure Flow Rate Switch

Options for Discrete Output Source

Option	Label				State	DO voltage
	Display	PLIII	Enhanced FF host	Basic FF host code		
Enhanced Event 1–5 (1)	Enhanced Event x	Enhanced Event x	Discrete Event x	57–61	ON	Externally powered: Site-specific
					OFF	0 V
Flow Rate Switch	Flow Rate Switch	Flow Switch Indicator	Flow Switch Indicator	101	ON	Externally powered: Site-specific
					OFF	0 V
Forward/ Reverse Indicator	Flow Direction	Forward Reverse Indicator	Forward/ Reverse Indication	102	Forward flow	0 V
					Reverse flow	Externally powered: Site-specific
Calibration in Progress	Zero in Progress	Calibration in Progress	Zero Calibration is in Progress	103	ON	Externally powered: Site-specific
					OFF	0 V
Fault	Fault	Fault Indication	Fault Condition Indication	104	ON	Externally powered: Site-specific
					OFF	0 V

Option	Label				State	DO voltage
	Display	PLIII	Enhanced FF host	Basic FF host code		
Meter Verification Failure	Meter Verification Fail	Meter Verification Failure	Meter Verification Failure	216	ON	Externally powered: Site-specific
					OFF	0 V
APM Remediation	APM Remediation	APM Remediation	APM Remediation	97	ON OFF	Externally powered: Site-specific O V

(1) Events configured using the enhanced event model.

Important

This table assumes that **Discrete Output Polarity** is set to Active High. If **Discrete Output Polarity** is set to Active Low, reverse the voltage values.

Important

Actual flow direction interacts with **Sensor Flow Direction Arrow** to determine the flow direction that the transmitter uses in processing. See the following table.

Table 8-3: Interaction between actual flow direction and Sensor Flow Direction Arrow

Actual flow direction	Setting of Sensor Flow Direction Arrow	Flow direction sent to outputs and totalizers
Forward (same direction as Flow arrow on sensor)	With Arrow	Forward
	Against Arrow	Reverse
Reverse (opposite from Flow arrow on sensor)	With Arrow	Reverse
	Against Arrow	Forward

Configure Discrete Output Polarity

Display	**Menu → Configuration → Inputs/Outputs → Channel C → I/O Settings → Polarity**
ProLink III	**Device Tools → Configuration → I/O → Outputs → Discrete Output → Polarity**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel x → Discrete Output x → DOx Polarity**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel C**
Basic FF host	**Device TB → DO Polarity** (OD Index 125)

A Discrete Output has two states: ON (active, asserted) and OFF (inactive). Two different voltages are used to represent these states. Discrete Output Polarity controls which voltage represents which state.

Procedure

Set **Discrete Output Polarity** as desired.

Default: Active High

Configure Discrete Output Fault Action

Display	
ProLink III	**Device Tools → Configuration → I/O → Outputs → Discrete Output → Fault Action**
Field communicator	**Configure → Manual Setup → Inputs/Outputs → Channel *x* → Discrete Output *x* → DO *x* Fault Action**
Enhanced FF host	**Configure → Manual Setup → Inputs/Outputs → Channel C**
Basic FF host	**Device TB → DO Fault Action** (OD Index 126)

Discrete Output Fault Action controls the behavior of a Discrete Output if the transmitter detects a fault condition.

Important

- The fault action is implemented only if **Alert Severity** is set to Failure. If **Alert Severity** is set to any other option, the fault action is not implemented.
- For some faults only: If **Fault Timeout** is set to a non-zero value, the transmitter will not implement the fault action until the timeout has elapsed.

NOTICE

Do not use **Discrete Output Source** as a fault indicator. If you do, you may not be able to distinguish a fault condition from a normal operating condition. If you want to use the Discrete Output as a fault indicator, see Fault indication with a Discrete Output.

Procedure

Set **Discrete Output Fault Action** as desired.

Default: None

Related information

Interaction between Process Variable Fault Action and other fault actions

Options for Discrete Output Fault Action

Label	Discrete Output behavior	
	Polarity=Active High	**Polarity=Active Low**
Upscale	• Fault: Discrete Output is ON (24 VDC or site-specific voltage) • No fault: Discrete Output is controlled by its assignment	• Fault: Discrete Output is OFF (0 V • No fault: Discrete Output is controlled by its assignment
Downscale	• Fault: Discrete Output is OFF (0 V • No fault: Discrete Output is controlled by its assignment	• Fault: Discrete Output is ON (24 VDC or site-specific voltage) • No fault: Discrete Output is controlled by its assignment
None (default)	Discrete Output is controlled by its assignment	

Fault indication with a Discrete Output

To indicate faults via a Discrete Output, set **Discrete Output Source** to Fault. Then, if a fault occurs, the Discrete Output is always ON and the setting of **Discrete Output Fault Action** is ignored.

9 Complete the configuration

9.1 Test or tune the system using sensor simulation

Display	**Menu → Startup Tasks → Commissioning Tools → Sensor Simulation**
ProLink III	**Device Tools → Diagnostics → Testing → Sensor Simulation**
Field communicator	**Service Tools → Simulate → Simulate Sensor**
Enhanced FF host	**Service Tools → Simulate → Process Variable**
Basic FF host	**Measurement TB → Process Variable Simulation** (OD Index 136–143)

Use sensor simulation to test the system's response to a variety of process conditions, including boundary conditions, problem conditions, or alert conditions, or to tune the loop.

Restriction
Sensor simulation is available only on flow meters with the enhanced core processor.

Prerequisites

Before enabling sensor simulation, ensure that your process can tolerate the effects of the simulated process values.

Procedure

1. Enable sensor simulation.
2. For mass flow, set **Wave Form** as desired and enter the required values.

Option	Required values
Fixed	Fixed Value
Sawtooth	Period Minimum Maximum
Sine	Period Minimum Maximum

3. For density, set **Wave Form** as desired and enter the required values.

Option	Required values
Fixed	Fixed Value
Sawtooth	Period Minimum Maximum
Sine	Period Minimum Maximum

4. For temperature, set **Wave Form** as desired and enter the required values.

Option	Required values
Fixed	Fixed Value
Sawtooth	Period Minimum Maximum
Sine	Period Minimum Maximum

5. Observe the system response to the simulated values and make any appropriate changes to the transmitter configuration or to the system.
6. Modify the simulated values and repeat.
7. When you have finished testing or tuning, disable sensor simulation.

9.1.1 Sensor simulation

Sensor simulation allows you to test the system or tune the loop without having to create the test conditions in your process. When sensor simulation is enabled, the transmitter reports the simulated values for mass flow, density, and temperature, and takes all appropriate actions. For example, the transmitter might apply a cutoff, activate an event, or post an alert.

When sensor simulation is enabled, the simulated values are stored in the same memory locations used for process data from the sensor. The simulated values are then used throughout transmitter functioning. For example, sensor simulation will affect:

- All mass flow rate, temperature, and density values displayed or reported via outputs or digital communications
- The mass total and mass inventory values
- All volume calculations and data, including reported values, volume totals, and volume inventories
- All mass, temperature, density, or volume values logged to Data Logger

Sensor simulation does not affect any diagnostic values.

Unlike actual mass flow rate and density values, the simulated values are not temperature-compensated (adjusted for the effect of temperature on the sensor's flow tubes).

9.2 Enable or disable software write-protection

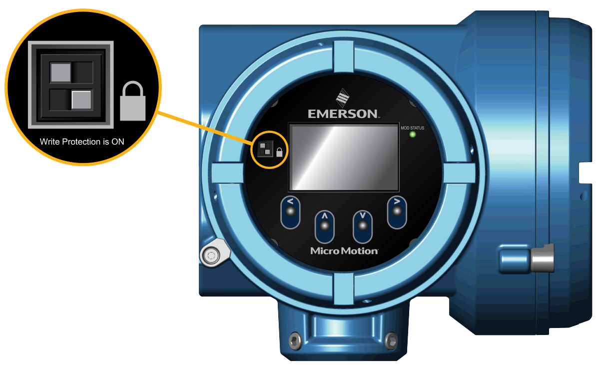
Display	Use the mechanical switch on the display.
ProLink III	**Device Tools** → **Configuration** → **Write-Protection**
Field communicator	**Configure** → **Manual Setup** → **Security** → **Lock/Unlock Device**
Enhanced FF host	**Configure** → **Manual Setup** → **Security** → **FOUNDATION Fieldbus** → **Write Lock**
Basic FF host	**Resource Block** → **Write Lock** (OD Index 34)

When enabled, **Write-Protection** prevents changes to the transmitter configuration. You can perform all other functions, and you can view the transmitter configuration parameters.

Note

The write protection setting via software methods (such as ProLink III) is available only on transmitters without a display.

For transmitters with a display, write protection is available only using the lock switch on the display. See Lock or unlock the transmitter.



Write-protecting the transmitter primarily prevents accidental changes to configuration, not intentional changes. Any user who can make changes to the configuration can disable write protection.

10 Transmitter operation

10.1 View process and diagnostic variables

Process variables provide information about the state of the process fluid. Diagnostic variables provide data about device operation. You can use this data to monitor and troubleshoot your process.

10.1.1 View process and diagnostic variables using the display

The display reports the name of the variable (for example, *Density*), the current value of the variable, and the associated unit of measure (for example, kg/m^3).

Prerequisites

For a process or diagnostic variable to be viewed using the display, it must be configured as a display variable.

Procedure

- If **Auto Scroll** is not enabled, activate ⇩ or ⇧ to move through the list of display variables.
- If **Auto Scroll** is enabled, wait until the variable is displayed automatically. If you do not want to wait, you can activate ⇩ or ⇧ to force the display to scroll.

10.1.2 View process variables and other data using ProLink III

Monitor process variables, diagnostic variables, and other data to maintain process quality.

ProLink III automatically displays process variables, diagnostic variables, and other data on the main screen.

Tip
ProLink III allows you to choose the process variables that appear on the main screen. You can also choose whether to view data in Analog Gauge view or digital view, and you can customize the gauge settings. For more information, see the *Micro Motion ProLink III with ProcessViz Software User Manual*.

10.1.3 View process variables and other data using a field communicator

Monitor process variables, diagnostic variables, and other data to maintain process quality.

Procedure

- To view current values of basic process variables, choose **Overview**.
- To view a more complete set of process variables, plus the current state of the outputs, choose **Service Tools** → **Variables**.
- To view diagnostic variables, choose **Service Tools** → **Maintenance** → **Diagnostic Variables**.

10.1.4 Effect of Sensor Flow Direction Arrow on digital communications

Flow rates on the transmitter display or reported via digital communications are shown as positive or negative. The sign depends on the interaction between **Sensor Flow Direction Arrow** and the actual flow direction.

This interaction affects flow rates shown on the transmitter display, ProLink III, and all other user interfaces.

Actual flow direction	Setting of Sensor Flow Direction Arrow	Flow rate value	
		Transmitter display	Digital communications
Forward (same direction as Flow arrow on sensor)	With Arrow	Positive (no sign)	Positive
	Against Arrow	Negative	Negative
Reverse (opposite from Flow arrow on sensor)	With Arrow	Negative	Negative
	Against Arrow	Positive (no sign)	Positive

10.2 View and acknowledge status alerts

The transmitter posts a status alert whenever one of the specified conditions occurs. You can view active alerts and you can acknowledge alerts. You do not have to acknowledge alerts: The transmitter will perform normal measurement and reporting functions with unacknowledged alerts.

10.2.1 View and acknowledge alerts using the display

You can view information about all active or unacknowledged alerts, and you can acknowledge alerts.

The display uses the alert banner and the alert symbol ⓘ to provide information about alerts.

Table 10-1: Alert information on display

Display status	Cause	User action
Alert banner	One or more alerts are active.	Resolve the conditions to clear the alert. When the alert is cleared or acknowledged, the banner will be removed.
Alert symbol ⓘ	One or more alerts are unacknowledged.	Acknowledge the alert. When all alerts are acknowledged, the alert icon will be removed.

If alert security is enabled, the alert banner is never displayed. To view detailed information, you must use the alert menu: **Menu** → **(i) Alert List**.

Note
Certain alerts do not clear until the transmitter is rebooted.

Procedure

- If the alert banner appears:
    a) Activate **Info** to view information about the alert.
    b) Take appropriate steps to clear the alert.
    c) Activate **Ack** to acknowledge the alert.

- If ⓘ appears:
    a) Choose **Menu** → **(i) Alert List**.
    b) Select an alert to view more information about the specific alert or to acknowledge it individually.
    c) Choose **Acknowledge All Alerts** to acknowledge all alerts on the list.

10.2.2 View and acknowledge alerts using ProLink III

You can view a list containing all alerts that are active, or inactive but unacknowledged. From this list, you can acknowledge individual alerts or choose to acknowledge all alerts at once.

Note
Certain alerts do not clear until the transmitter is rebooted.

Procedure

1. View alerts on the ProLink III main screen under **Alerts**.

   All active or unacknowledged alerts are listed. Take appropriate steps to clear all active alerts.

2. To acknowledge a single alert, check the **Ack** check box for that alert. To acknowledge all alerts at once, select **Ack All**.

10.2.3 View alerts using a field communicator

You can view a list containing all alerts that are active, or inactive but unacknowledged.

Restriction
You cannot use a field communicator to acknowledge alerts. You can only view alerts. To acknowledge alerts, use the display or make a connection to the transmitter using a different tool.

Procedure

- To view active or unacknowledged alerts, choose **Service Tools** → **Alerts**.

  All active alerts and unacknowledged alerts are listed. Select an alert to view detailed information.

- To refresh the list, choose **Service Tools** → **Alerts** → **Refresh Alerts**.

10.3 Read totalizer and inventory values

Display	**Menu** → **Operations** → **Totalizers** → **See Totals**
ProLink III	**Device Tools** → **Totalizer Control** → **Totalizers** **Device Tools** → **Totalizer Control** → **Inventories**
Field communicator	**Overview** → **Totalizer Control**
Enhanced FF host	**Overview** → **Totalizer Control** → **Totalizers (1–7)** **Overview** → **Totalizer Control** → **Inventories (1–7)**
Basic FF host	**Totalizer Inventory TB**

Totalizers keep track of the total amount of mass or volume measured by the transmitter since the last totalizer reset. Inventories keep track of the total amount of mass or volume measured by the transmitter since the last inventory reset.

10.4 Start, stop, and reset totalizers and inventories

When a totalizer or inventory is started, its value increases or decreases depending on the interaction of the flow direction parameters. It continues tracking flow until it is stopped.

When a totalizer or inventory is reset, its value is set to 0. You can reset a totalizer or inventory while it is started or while it is stopped.

- You can start, stop, or reset each totalizer or inventory independently.
- You can start, stop, or reset all totalizers and inventories as a group.

10.4.1 Start, stop, and reset totalizers using the display

Prerequisites

To stop, start, or reset a single totalizer or inventory, the totalizer or inventory must be configured as a display variable.

To reset an inventory using the display, this function must be enabled. To enable inventory reset using the display, choose **Menu** → **Configuration** → **Security** and set **Totalizer Reset** to Allowed. Note that this affects only the display functions. Resetting inventories using other tools is not affected.

Procedure

- To start or stop a single totalizer or inventory:
    a) Wait or scroll until the totalizer or inventory appears on the display.
    b) Choose **Options**.
    c) Choose **Start** or **Stop**.
- To start or stop all totalizers and inventories as a group:
    a) Choose **Menu** → **Operations** → **Totalizers**.
    b) Choose **Start** or **Stop**.
- To reset a single totalizer or inventory:
    a) Wait or scroll until the totalizer or inventory appears on the display.
    b) Choose **Options**.
    c) Choose **Reset**.
- To reset all totalizers and inventories as a group:
    a) Choose **Menu** → **Operations** → **Totalizers**.
    b) Choose **Reset All**.

10.4.2 Start, stop, and reset totalizers using ProLink III

Prerequisites

To reset an inventory using ProLink III, this function must be enabled. To enable inventory reset using ProLink III, choose **Tools** → **Options** and enable **Reset Inventories from ProLink III**. Note that this affects only ProLink III. Resetting inventories using other tools is not affected.

Procedure

- To start or stop a single totalizer:
  a) Choose **Device Tools** → **Totalizer Control** → **Totalizers**.
  b) Scroll to the totalizer that you want to start or stop, and click **Start** or **Stop**.
- To start or stop a single inventory:
  a) Choose **Device Tools** → **Totalizer Control** → **Inventories**.
  b) Scroll to the inventory that you want to start or stop, and click **Start** or **Stop**.
- To start or stop all totalizers as a group:
  a) Choose **Device Tools** → **Totalizer Control** → **Totalizers** or **Device Tools** → **Totalizer Control** → **Inventories**.
  b) Select **Start All Totals** or **Stop All Totals**.
- To reset a single totalizer:
  a) Choose **Device Tools** → **Totalizer Control** → **Totalizers**.
  b) Scroll to the totalizer that you want to reset, and click **Reset**.
- To reset a single inventory:
  a) Choose **Device Tools** → **Totalizer Control** → **Inventories**.
  b) Scroll to the inventory that you want to reset, and click **Reset**.
- To reset all totalizers as a group:
  a) Choose **Device Tools** → **Totalizer Control** → **Totalizers**.
  b) Select **Reset All Totals**.
- To reset all inventories as a group:
  a) Choose **Device Tools** → **Totalizer Control** → **Inventories**.
  b) Select **Reset All Inventories**.

10.4.3 Start, stop, and reset totalizers using a field communicator or an enhanced FF host

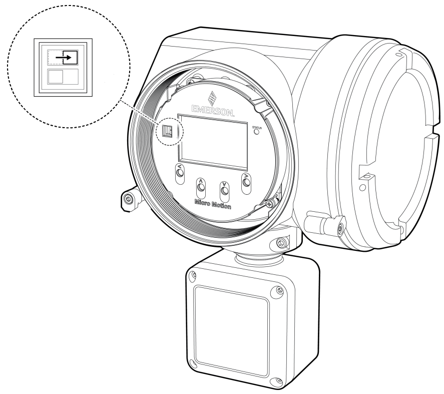
Procedure

- To start or stop a single totalizer:
  a) Choose **Overview** → **Totalizer Control** → **Totalizers 1-7**.
  b) Select the totalizer that you want to start or stop.
  c) Choose **Start** or **Stop**.
- To start or stop a single inventory:
  a) Choose **Overview** → **Totalizer Control** → **Inventories 1-7**.
  b) Select the inventory that you want to start or stop.
  c) Choose **Start** or **Stop**.
- To start or stop all totalizers and inventories as a group:
  a) Choose **Overview** → **Totalizer Control**.
  b) Click **Start Totalizers** or **Stop Totalizers**.
- To reset a single totalizer:
  a) Choose **Overview** → **Totalizer Control** → **Totalizers 1-7**.
  b) Select the totalizer that you want to reset.
  c) Choose **Reset**.
- To reset a single inventory:
  a) Choose **Overview** → **Totalizer Control** → **Inventories 1-7**.
  b) Select the inventory that you want to reset.
  c) Choose **Reset**.
- To reset all totalizers as a group, choose **Overview** → **Totalizer Control** → **Reset All Totals**.
- To reset all inventories as a group, choose **Overview** → **Totalizer Control** → **Reset All Inventories**.

10.5 Enable or disable fieldbus simulation mode

The transmitter has a mechanical switch on the display that permits the transmitter to function in simulation mode as defined in the FOUNDATION Fieldbus function block specification. When the switch is in the left position, simulation mode is disabled. When the switch is in the right position, simulation mode is enabled.

Figure 10-1: Fieldbus simulate switch on transmitter display (enabled)

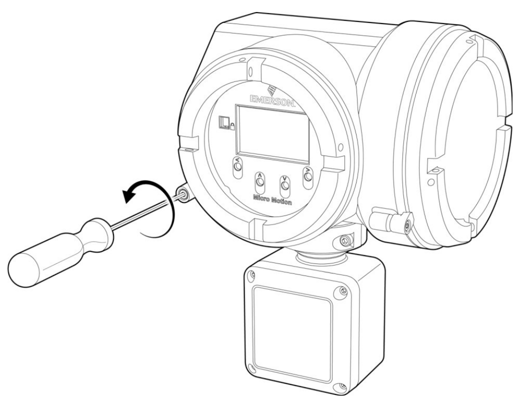


Procedure

1. If you are in a hazardous area, power down the transmitter.
2. **WARNING**
   If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

   Remove the transmitter housing cover.

Figure 10-2: Removing the transmitter housing cover



3. Using a fine-pointed tool, move the switch to the desired position.
4. Replace the transmitter housing cover.
5. If necessary, power up the transmitter.

11 Measurement support

11.1 Use Smart Meter Verification

Smart Meter Verification™ provides in-process flow meter health verification by analyzing the meter components related to measurement performance. You can run Smart Meter Verification without stopping the process. Use this section to run a Smart Meter Verification test, view and interpret the results, set up automatic execution, and check if a field reference point has been established.

Important
Run the first Smart Meter Verification Basic or Professional test when the flow meter is installed in the pipeline and the flow meter is at its normal operating conditions.

Prerequisites

The following information pertains to 5700 FOUNDATION Fieldbus firmware ≥ v1.40.

- To avoid or reduce corrosion, erosion, and other process effects, make sure the sensor tube material is compatible with the process fluid in use. For more information, see the *Micro Motion Corrosion Guide*.
- **Important**
  Micro Motion highly recommends:
  - Running the first Smart Meter Verification test when the flow meter is installed in the pipeline according to the installation instructions, and the process is running at its normal operating conditions
  - Running all tests thereafter at similar operating conditions
- The Smart Meter Verification test runs best when process conditions are stable. If process conditions are too unstable, the test will abort. To maximize process stability:
  - Maintain a constant fluid temperature and pressure.
  - Maintain a constant flow rate. If possible, stop flow through the sensor. The sensor should be full of process fluid.
  - Avoid changes to fluid composition; for example, two-phase flow or settling.
- For all applications, run Smart Meter Verification while commissioning the meter at normal operating conditions and then run it regularly. Micro Motion also recommends using Smart Meter Verification results along with other diagnostics like drive gain and density to help determine the health of a sensor.
- In certain scenarios, Smart Meter Verification field upgrades for pre-installed meters are possible. Contact factory support to discuss pre-installed meter upgrades.

11.1.1 Smart Meter Verification capabilities

Capability	Basic	Professional
	Included	90-day trial, licensed
Calibration coefficients audit	•	•
Zero audit	•	•
Electronics verification	•	•

Capability	Basic	Professional
	Included	90-day trial, licensed
Automatic test scheduler	•	•
History of previous 20 results	•	•
Verification report		•(1)
Non-uniform coating diagnostic		•
Multiphase diagnostic		•(2)
Flow range diagnostic		•(2)

(1) Create and export with ProLink III, web page, or AMS SNAP-ON.
(2) 24-hour historian visualization in ProLink III Professional

11.1.2 Run a Smart Meter Verification test

Run a Smart Meter Verification Basic or Professional test to diagnose the flow meter (and flow meter system) and verify if the flow meter is functioning properly and performing within factory specifications.

Important
Run the first Smart Meter Verification Basic or Professional test when the flow meter is installed in the pipeline and the flow meter is at its normal operating conditions.

Run a Smart Meter Verification test using the display

Procedure

1. Read the Smart Meter Verification prerequisites in Use Smart Meter Verification if you have not done so already.
2. Choose **Menu** → **Operations** → **Smart Meter Verification** → **Run Verification**.
3. Select the desired output behavior.

Option	Description
Continue Measuring	During the test, all outputs will continue to report their assigned process variables. The test will run for approximately 90 seconds.
Fix at Last Measured Value	During the test, all outputs will report the last measured value of their assigned process variable. The test will run for approximately 140 seconds.
Fix at Fault	During the test, all outputs will go to their configured fault action. The test will run for approximately 140 seconds.

The test starts immediately.
4. Wait for the test to complete.

Note
At any time during the process, you can abort the test. If the outputs were fixed, they will return to normal behavior.

Run a Smart Meter Verification test using ProLink III Basic or Professional

Procedure

1. Read the Smart Meter Verification prerequisites in Use Smart Meter Verification if you have not done so already.
2. Run Smart Meter Verification Basic or Professional using ProLink III Basic or Professional:
   - Smart Meter Verification Basic: **Device Tools** → **Diagnostics** → **Meter Verification** → **Basic Meter Verification**
   - Smart Meter Verification Professional: **Smart Meter Verification Overview** → **Meter Verification** → **Run Verification**
   - Smart Meter Verification Professional: **Device Tools** → **Diagnostics** → **Meter Verification** → **Run Test**
3. In the *SMV Test Definition* window, enter any desired information and click **Next**.

   None of this information is required. It does not affect Smart Meter Verification processing.

   ProLink III stores this information in the Smart Meter Verification database on the PC. It is not saved to the transmitter.
4. Select the desired output behavior.

Option	Description
Continue Measuring	During the test, all outputs will continue to report their assigned process variables. The test will run for approximately 90 seconds.
Fix at Last Measured Value	During the test, all outputs will report the last measured value of their assigned process variable. The test will run for approximately 140 seconds.
Fix at Fault	During the test, all outputs will go to their configured fault action. The test will run for approximately 140 seconds.

5. Select **Start** and wait for the test to complete.

   Note
   At any time during the process, you can abort the test. If the outputs were fixed, they will return to normal behavior.

Run a Smart Meter Verification test using a basic FF host

Procedure

1. Read the Smart Meter Verification prerequisites in Use Smart Meter Verification if you have not done so already.
2. Write to the SMV Enable parameter of the Meter Verification TB.

Option	Description
1	Fixed output mode
6	Continue measurement mode

3. Wait for the test to complete.

Note
At any time during the process, you can abort the test. If the outputs were fixed, they will return to normal behavior.

- If Smart Meter Verification results show that the meter has passed, then measurements meet specifications.
- If Smart Meter Verification results show that the meter has failed, measurement may be affected.
- If Smart Meter Verification results show that the meter has aborted, then either a problem occurred with the meter verification test (e.g., process instability) or you stopped the test manually.

Run a Smart Meter Verification test using a field communicatorRun a Smart Meter Verification test using a field communicator or an enhanced FF host

Field communicator	**Service Tools → Maintenance → Routine Maintenance → SMV → Manual Verification → Start**
Enhanced FF host	**Service Tools → Maintenance → Routine Maintenance → Smart Meter Verification → Manual Verification → Smart Meter Verification**

Procedure

1. Read the Smart Meter Verification prerequisites in Use Smart Meter Verification if you have not done so already.
2. Select the desired output behavior.

Option	Description
Continue Measuring	During the test, all outputs will continue to report their assigned process variables. The test will run for approximately 90 seconds.
Fix at Last Measured Value	During the test, all outputs will report the last measured value of their assigned process variable. The test will run for approximately 140 seconds.
Fix at Fault	During the test, all outputs will go to their configured fault action. The test will run for approximately 140 seconds.

The test starts immediately.

3. Wait for the test to complete.

Note
At any time during the process, you can abort the test. If the outputs were fixed, they will return to normal behavior.

11.1.3 View Smart Meter Verification test results

When the Smart Meter Verification Basic test is complete, a pass/fail result is displayed. With Smart Meter Verification Professional, detailed results and reports are available.

Note
With Smart Meter Verification Professional, the twenty most recent results are available. If viewed using ProLink III Basic or Professional, results for all tests that are in the PC database are available.

View Smart Meter Verification test results using the display

Results of the current Smart Meter Verification Basic or Professional test display automatically after the test is complete.

With Smart Meter Verification Professional, use the following procedure to view previous test results.

Procedure

1. Choose **Menu** → **Operations** → **Smart Meter Verification** → **Read Verification History**.
2. To view detailed data for an individual test, select it from the list.

View Smart Meter Verification test results using ProLink III Basic or Professional

Results of the current Smart Meter Verification Basic or Professional test display automatically after the test is complete.

With Smart Meter Verification Professional, use the following procedure to view previous test results.

To generate a previous test report, the Smart Meter Verification Professional test must have been run on the current PC in use.

Procedure

1. Choose one of the following options:
   - **Device Tools** → **Diagnostics** → **Meter Verification** → **View Previous Test Results**
   - **Smart Meter Verification Overview** → **Meter Verification** → **History**
2. To view details, choose the results of interest: **Show Report** (or **Next** to show the report).
   ProLink III displays a report containing details of the most recent tests. The report is automatically saved to the Smart Meter Verification database. You can print or export the report.

View Smart Meter Verification test results using a field communicator

In addition to test results, some field communicator brands provide a trend chart.

Results of the current Smart Meter Verification Basic or Professional test display automatically after the test is complete.

With Smart Meter Verification Professional, use the following procedure to view previous test results.

Procedure

1. Choose **Service Tools** → **Maintenance** → **Routine Maintenance** → **SMV** → **Manual Verification**.
2. Choose **Upload Results Data from Device**.

The field communicator stores only the most recent test result. To view earlier results, you must upload them from the device. They will be available only for the current session.

3. Choose **Show Results Table**.
   The field communicator displays detailed results for the first test.
4. Press **OK** to move through all test records in the local database.

View Smart Meter Verification test results using an enhanced FF host

Results of the current Smart Meter Verification Basic or Professional test display automatically after the test is complete.

With Smart Meter Verification Professional, use the following procedure to view previous test results.

Procedure

- To view the previous Smart Meter Verification test:
  a) Choose **Service Tools** → **Maintenance** → **Routine Maintenance** → **Smart Meter Verification** → **Manual Verification**.
  b) Choose **Most Recent Test Result**.
- To view the previous 20 Smart Meter Verification test results:
  a) Choose **Service Tools** → **Maintenance** → **Routine Maintenance** → **Smart Meter Verification** → **Manual Verification**.
  b) Choose **Show Last 20 Results**.

Interpreting Smart Meter Verification results

When the Smart Meter Verification Basic or Professional test is completed, the result is reported as Pass, Fail, or Abort. (Some tools report the Fail result as `Advisory` instead.)

Pass The meter is performing within factory specifications.

Abort When you execute a Smart Meter Verification Basic or Professional test, the test performs a self-diagnostic check to ensure that the flow meter is stable prior to running the test. In the rare case that this check reveals an issue, Smart Meter Verification will report an abort code.

If you manually cancel an in-process Smart Meter Verification Basic or Professional test, the test result displays `Abort Code 1: User-Initiated Abort`. In this case, you can restart Smart Meter Verification without any further action. In the rare case any other abort occurs, contact factory support.

In all cases where a Smart Meter Verification Professional test aborts, no report will be generated.

Fail If a Smart Meter Verification Basic or Professional test ran at normal operating conditions while conditions were stable and failed, see Resolve a failed Smart Meter Verification test to determine the appropriate actions.

11.1.4 Resolve a failed Smart Meter Verification test

Use this procedure if a Smart Meter Verification Basic or Professional test ran at normal operating conditions while conditions were stable and failed.

Procedure

1. Verify the sensor by performing a visual inspection, density verification, or field proving.
2. If possible, run Smart Meter Verification Professional with ProLink III Basic or Professional and save the results as follows:
   - In a `.csv` file
   - In a report
   - If the transmitter has a historian, retrieve the Smart Meter Verification results from the service or historian files.
3. Contact the factory for further evaluation and instructions.

11.1.5 Set up Smart Meter Verification automatic execution

You can execute a Smart Meter Verification Basic or Professional test on demand or automatically schedule future runs. You can schedule future runs via two different options: as a single test at a user-defined future time, or automatically on a regular schedule.

Tip
The time between test runs must be between 1 and 1000 hours. The time for the first test run can be any positive floating number.

Set up Smart Meter Verification automatic execution using the display

Procedure

1. Choose **Menu** → **Operations** → **Smart Meter Verification** → **Schedule Verification**.
2. To schedule a single test:
   a) Set **Hours to 1st Run** to the number of hours to elapse before the test is run.
   b) Set **Hours Between** to `0`.
3. To schedule a recurring execution:
   a) Set **Specify Time Until Next Run** to the number of days, hours, and minutes to elapse before the first test is run.
   b) Set **Specify Time Between Recurring Runs** to the number of days, hours, and minutes to elapse between runs.
4. To disable scheduled execution:
   a) Set **Specify Time Until Next Run** to `0` **days**, `0` **hours**, and `0` **minutes**.
   b) Set **Specify Time Between Recurring Runs** to `0` **days**, `0` **hours**, and `0` **minutes**.

Set up Smart Meter Verification automatic execution using ProLink III Basic or Professional

Procedure

1. Select one of the following paths to access the Smart Meter Verification scheduler .
   - ProLink III Basic or Professional: Choose **Device Tools** → **Diagnostics** → **Meter Verification** → **Schedule Meter Verification**.
   - ProLink III Professional: Choose **Smart Meter Verification Overview** → **Tools** → **Schedule Smart Meter Verification**.
2. To schedule a single test:
   a) Set **Specify Time Until Next Run** to the number of days, hours, and minutes to elapse before the test is run.
   b) Set **Specify Time Between Recurring Runs** to `0` **days**, `0` **hours**, and `0` **minutes**.
3. To schedule a recurring execution:
   a) Set **Specify Time Until Next Run** to the number of days, hours, and minutes to elapse before the first test is run.
   b) Set **Specify Time Between Recurring Runs** to the number of days, hours, and minutes to elapse between runs.
4. To disable scheduled execution, choose **Disable Scheduled Execution**.

Set up Smart Meter Verification automatic execution using a field communicator or an enhanced FF host

Field communicator	**Service Tools** → **Maintenance** → **Routine Maintenance** → **SMV** → **Automatic Verification**
Enhanced FF host	**Service Tools** → **Maintenance** → **Routine Maintenance** → **Smart Meter Verification** → **Automatic Verification** → **Schedule**

Procedure

1. To schedule a single test:
   a) Set **Hrs Until Next Run** to the number of hours to elapse before the test is run.
   b) Set **Recurring Hours** to `0`.
2. To schedule a recurring execution:
   a) Set **Hrs Until Next Run** to the number of hours to elapse before the first test is run.
   b) Set **Recurring Hours** to the number of hours to elapse between runs.
3. To disable scheduled execution, select **Turn Off Schedule**.

Check for a field reference point

Use this procedure to check if a field reference point was created.

Prerequisites

- Smart Meter Verification Professional
- ProLink III Basic or Professional
- 5700 FOUNDATION Fieldbus firmware ≥ v1.40

Procedure

1. From ProLink III Basic or Professional, choose one of the following options:
   - **Device Tools** → **Diagnostics** → **Meter Verification** → **View Previous Test Results**
   - **Smart Meter Verification Overview** → **Meter Verification** → **History**
2. Select **Export Data to CSV File**.
3. Save the CSV file to your computer.
4. Locate and open the CSV file.
5. Locate and examine the two columns labeled, **SMV Meter Factor LPO** and **SMV Meter Factor RPO**.
   - If the field reference point has not been established, the numbers in both columns will be exactly 1.
   - If the field reference point has been established, the numbers located in both columns will be close to 1. The **SMV Meter Factor LPO** and **SMV Meter Factor RPO** numbers do not have to match.

11.2 Advanced Phase Measurement

Micro Motion Advanced Phase Measurement software improves long-term flow reporting and measurement performance in processes with intermittent periods of two-phase flow, including liquids with entrained gas or gas with entrained liquid. If Advanced Phase Measurement is combined with the Net Oil or concentration measurement software options, the software can also report liquid concentration, Net Oil, and/or Gas Void Fraction (GVF) during the same two-phase conditions. For more information, see the *Micro Motion Advanced Phase Measurement Application Manual*.

The following measurement options are available with Advanced Phase Measurement software:

- Net Oil
- Liquid with Gas
- Gas with Liquid

Note
Each option is licensed separately in the transmitter. Field upgrades are permitted.

Table 11-1: Net oil

License option (ordering code)	Description	Availability
PO — Net Oil	Suitable for mixtures of oil and water. Add PL option to remediate for gas.	Can be combined with APM license code PL. PL is recommended since most net oil applications contain gas.

Table 11-2: Liquid with gas

License option (ordering code)	Description	Availability
PL — Advanced Phase Measurement Liquid with Gas	Suitable for any liquid with entrained gas.	Can be combined with APM license code PO. Can be combined with license code concentration measurement (CM).

Table 11-3: Gas with liquid

License option (ordering code)	Description	Availability
PG — Advanced Phase Measurement Gas with Liquid	Suitable for any gas that may contain entrained liquids (mist).	Cannot be activated with any other license code.

11.3 Zero the meter

Display	**Menu → Service Tools → Verification & Calibration → Meter Zero → Zero Calibration**
ProLink III	**Device Tools → Calibration → Smart Zero Verification and Calibration → Calibrate Zero**
Field communicator	**Service Tools → Maintenance → Calibration → Zero Calibration → Perform Auto Zero**
Enhanced FF host	**Service Tools → Maintenance → Calibration → Zero Calibration → Setting → Perform Auto Zero**
Basic FF host	**Measurement TB → Zero Calibration**

Zeroing the meter establishes a baseline for process measurement by analyzing the sensor's output when there is no flow through the sensor tubes.

Important
In most cases, the factory zero is more accurate than the field zero. Do not zero the meter unless one of the following is true:

- The zero is required by site procedures.
- The stored zero value fails the zero verification procedure.

Do not verify the zero or zero the meter if a high-severity alert is active. Correct the problem, then verify the zero or zero the meter. You may verify the zero or zero the meter if a low-severity alert is active.

Prerequisites

Before performing a field zero, execute the zero verification procedure to see whether or not a field zero can improve measurement accuracy.

Important
Do not verify the zero or zero the meter if a high-severity alert is active. Correct the problem, then verify the zero or zero the meter. You may verify the zero or zero the meter if a low-severity alert is active.

Procedure

1. Prepare the meter:
    a) Allow the meter to warm up for at least 20 minutes after applying power.
    b) Run the process fluid through the sensor until the sensor temperature reaches the normal process operating temperature.

c) Stop flow through the sensor by shutting the downstream valve, and then the upstream valve if available.

d) Verify that the sensor is blocked in, that flow has stopped, and that the sensor is completely full of process fluid.

e) Observe the drive gain, temperature, and density readings. If they are stable, check the **Live Zero** or **Field Verification Zero** value. If the average value is close to 0, you should not need to zero the meter.

2. Modify **Zero Time**, if desired.

   Zero Time controls the amount of time the transmitter takes to determine its zero-flow reference point. The default **Zero Time** is 20 seconds. For most applications, the default **Zero Time** is appropriate.

3. Start the zero procedure and wait until it completes.
   When the calibration is complete:

   - If the zero procedure was successful, a `Calibration Success` message and a new zero value are displayed.
   - If the zero procedure failed, a `Calibration Failed` message is displayed.

Postrequisites

Restore normal flow through the sensor by opening the valves.

Need help?

If the zero fails:

- Ensure that there is no flow through the sensor, then retry.
- Remove or reduce sources of electromechanical noise, then retry.
- Set **Zero Time** to a lower value, then retry.
- If the zero continues to fail, contact customer service.
- If you want to restore the most recent valid value from transmitter memory:
  — Using the display: **Menu** → **Service Tools** → **Verification and Calibration** → **Meter Zero** → **Restore Zero** → **Restore Previous Zero**
  — Using ProLink III: **Device Tools** → **Calibration** → **Smart Zero Verification and Calibration** → **Calibrate Zero** → **Restore Prior Zero**
  — Using a field communicator: Not available
  — Using a basic FF host: **Measurement TB** → **Restore Previous Zero**
  — Using an enhanced FF host: **Service Tools** → **Maintenance** → **Calibration** → **Zero Calibration** → **Setting** → **Restore Previous Zero**
- If you want to restore the factory zero:
  — Using the display: **Menu** → **Service Tools** → **Verification and Calibration** → **Meter Zero** → **Restore Zero** → **Restore Factory Zero**
  — Using ProLink III: **Device Tools** → **Calibration** → **Smart Zero Verification and Calibration** → **Calibrate Zero** → **Restore Factory Zero**

- Using a field communicator: **Service Tools** → **Maintenance** → **Calibration** → **Zero Calibration** → **Restore Factory Zero**
- Using a basic FF host: **Measurement TB** → **Restore Factory Configuration**
- Using an enhanced FF host: **Service Tools** → **Maintenance** → **Calibration** → **Zero Calibration** → **Setting** → **Restore Factory Zero**

Restriction
Restore the factory zero only if your meter was purchased as a unit, it was zeroed at the factory, and you are using the original components.

Related information

Verify the zero

11.3.1 Terminology used with zero verification and zero calibration

Term	Definition
Zero	In general, the offset required to synchronize the left pickoff and the right pickoff under conditions of zero flow. Unit = microseconds.
Factory Zero	The zero value obtained at the factory, under laboratory conditions.
Field Zero	The zero value obtained by performing a zero calibration outside the factory.
Prior Zero	The zero value stored in the transmitter at the time a field zero calibration is begun. May be the factory zero or a previous field zero.
Manual Zero	The zero value stored in the transmitter, typically obtained from a zero calibration procedure. It may also be configured manually. Also called “mechanical zero” or “stored zero”.
Live Zero	The real-time bidirectional mass flow rate with no flow damping or mass flow cutoff applied. An adaptive damping value is applied only when the mass flow rate changes dramatically over a very short interval. Unit = configured mass flow measurement unit.
Zero Stability	A laboratory-derived value used to calculate the expected accuracy for a sensor. Under laboratory conditions at zero flow, the average flow rate is expected to fall within the range defined by the Zero Stability value (0 ± Zero Stability). Each sensor size and model has a unique Zero Stability value.
Zero Calibration	The procedure used to determine the zero value.
Zero Time	The time period over which the Zero Calibration procedure is performed. Unit = seconds.
Field Verification Zero	A 3-minute running average of the Live Zero value, calculated by the transmitter. Unit = configured mass flow measurement unit.
Zero Verification	A procedure used to evaluate the stored zero and determine whether or not a field zero can improve measurement accuracy.

11.4 Set up pressure compensation

Pressure compensation adjusts process measurement to compensate for the pressure effect on the sensor. The pressure effect is the change in the sensor's sensitivity to flow and density caused by the difference between the calibration pressure and the process pressure.

Tip
Not all sensors or applications require pressure compensation. The pressure effect for a specific sensor model can be found in the product data sheet located at www.emerson.com. If you are uncertain about implementing pressure compensation, contact customer service.

Prerequisites

You will need the flow factor, density factor, and calibration pressure values for your sensor.

- For the flow factor and density factor, see the product data sheet for your sensor.
- For the calibration pressure, see the calibration sheet for your sensor. If the data is unavailable, use 20 psi (1.38 bar).

You must be able to supply pressure data to the transmitter.

11.4.1 Set up pressure compensation using the display

Procedure

1. Choose **Menu** → **Configuration** → **Process Measurement** → **Pressure**.
2. Set **Units** to the pressure unit used by the external pressure device.
3. Enter **Flow Factor** for your sensor.

   The flow factor is the percent change in the flow rate per PSI. When entering the value, reverse the sign.

   Example

   If the flow factor is −0.0002 % per PSI, enter `+0.0002 % per PSI`.

4. Enter **Density Factor** for your sensor.

   The density factor is the change in fluid density, in g/cm^3/PSI. When entering the value, reverse the sign.

   Example

   If the density factor is −0.000006 g/cm^3/PSI, enter `+0.000006` g/cm3/PSI.

5. Set **Calibration Pressure** to the pressure at which your sensor was calibrated.

   The calibration pressure is the pressure at which your sensor was calibrated, and defines the pressure at which there is no pressure effect. If the data is unavailable, enter `20` PSI.

Postrequisites

Option	Description	Setup
Digital communications	A host writes pressure data to the meter at appropriate intervals.	1. Set **Pressure Source** to Fixed Value or Digital Communications. 2. Perform the necessary host programming and communications setup to write pressure data to the meter at appropriate intervals.

Choose **Menu** → **Service Tools** → **Service Data** → **View Process Variables** and verify the external pressure value.

Need help?

If the value is not correct:

- Ensure that the external device and the meter are using the same measurement unit.
- For digital communications:
  - Verify that the host has access to the required data.
  - Verify that the output variable is being correctly received and processed by the transmitter.

11.4.2 Set up pressure compensation using ProLink III

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Pressure Compensation**.
2. Set **Pressure Compensation Status** to Enabled.
3. Set **Pressure Unit** to the unit used by the external pressure device.
4. Enter the **Density Factor** and **Flow Factor** for your sensor.
   a) Set **Process Fluid** to Liquid Volume or Gas Standard Volume, as appropriate.
   b) Compare the values shown in **Recommended Density Factor** and **Recommended Flow Factor** to the values from the product data sheet.
   c) To use the recommended values, click **Accept Recommended Values**.
   d) To use different factors, enter your values in the **Density Factor** and **Flow Factor** fields.

      The density factor is the change in fluid density, in g/cm^3/PSI. When entering the value, reverse the sign.

      Example

      If the density factor is −0.000006 g/cm^3/PSI, enter `+0.000006` g/cm3/PSI.

      The flow factor is the percent change in the flow rate per PSI. When entering the value, reverse the sign.

      Example

      If the flow factor is −0.0002 % per PSI, enter `+0.0002` % per PSI.

5. Set **Flow Calibration Pressure** to the pressure at which your sensor was calibrated.

   The calibration pressure is the pressure at which your sensor was calibrated, and defines the pressure at which there is no pressure effect. If the data is unavailable, enter `20` PSI.

6. Choose the method you will use to supply pressure data, and perform the required setup.

Option	Description	Setup
Digital communications	A host writes pressure data to the meter at appropriate intervals.	a. Set **Pressure Source** to Fixed Value or Digital Communications. b. Perform the necessary host programming and communications setup to write pressure data to the meter at appropriate intervals.

Postrequisites

The current pressure value is displayed in the **External Pressure** field. Verify that the value is correct.

Need help?

If the value is not correct:

- Ensure that the external device and the meter are using the same measurement unit.
- For digital communications:
  - Verify that the host has access to the required data.
  - Verify that the output variable is being correctly received and processed by the transmitter.

11.4.3 Configure pressure compensation using a field communicator or an enhanced FF host

Field communicator	**Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Pressure/Temperature** → **Pressure**
Enhanced FF host	**Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Variables** → **Pressure**

Procedure

1. Set **Pressure Unit** to the unit used by the external pressure device.
2. Enable **Pressure Compensation**.
3. Set **Flow Calibration Pressure** to the pressure at which your sensor was calibrated.

   The calibration pressure is the pressure at which your sensor was calibrated, and defines the pressure at which there is no pressure effect. If the data is unavailable, enter `20` PSI.

4. Enter **Flow Press Factor** for your sensor.

   The flow factor is the percent change in the flow rate per PSI. When entering the value, reverse the sign.

Example

If the flow factor is −0.0002 % per PSI, enter `+0.0002 %` per PSI.

5. Enter **Density Pressure Factor** for your sensor.

   The density factor is the change in fluid density, in g/cm³/PSI. When entering the value, reverse the sign.

Example

If the density factor is −0.000006 g/cm³/PSI, enter `+0.000006` g/cm³/PSI.

6. Choose the method to be used to supply pressure data, and perform the required setup.

Method	Description	Setup
Digital communications	A host writes pressure data to the meter at appropriate intervals.	a. Using a field communicator, choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Pressure/Temperature** → **Pressure**. b. Using an enhanced FF host, choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **External Variables** → **Pressure**. c. Set **Pressure Compensation** to Enable. d. Perform the necessary host programming and communications setup to write pressure data to the transmitter at appropriate intervals.

11.5 Validate the meter

Display	**Menu → Configuration → Process Measurement → Flow Variables → Mass Flow Settings → Meter Factor** **Menu → Configuration → Process Measurement → Flow Variables → Volume Flow Settings → Meter Factor** **Menu → Configuration → Process Measurement → Density → Meter Factor**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Mass Flow Rate Meter Factor** **Device Tools → Configuration → Process Measurement → Flow → Volume Flow Rate Meter Factor** **Device Tools → Configuration → Process Measurement → Density → Density Meter Factor**
Field communicator	**Configure → Manual Setup → Measurements → Flow → Mass Factor** **Configure → Manual Setup → Measurements → Flow → Volume Factor** **Configure → Manual Setup → Measurements → Density → Density Factor**
Enhanced FF host	**Configure → Manual Setup → Measurements → Mass Flow → Factor** **Configure → Manual Setup → Measurements → Volume Flow → Factor** **Configure → Manual Setup → Measurements → Density → Factor**
Basic FF host	**Measurement TB → Mass Flow Factor** **Measurement TB → Volume Flow Factor** **Measurement TB → Density Factor**

Meter validation compares flow meter measurements reported by the transmitter to an external measurement standard. If the transmitter value for mass flow, volume flow, or density measurement is significantly different from the external measurement standard, you may want to adjust the corresponding meter factor. The flow meter's actual measurement is multiplied by the meter factor, and the resulting value is reported and used in further processing.

Prerequisites

Identify the meter factor(s) that you will calculate and set. You may set any combination of the three meter factors: mass flow, volume flow, and density. Note that all three meter factors are independent:

- The meter factor for mass flow affects only the value reported for mass flow.
- The meter factor for density affects only the value reported for density.
- The meter factor for volume flow affects only the value reported for volume flow or gas standard volume flow.

Important
To adjust volume flow, you must set the meter factor for volume flow. Setting a meter factor for mass flow and a meter factor for density will not produce the desired result. The volume flow calculations are based on original mass flow and density values, before the corresponding meter factors have been applied.

If you plan to calculate the meter factor for volume flow, be aware that validating volume in the field may be expensive, and the procedure may be hazardous for some process fluids. Therefore, because volume is inversely proportional to density, an alternative to direct measurement is to calculate the meter factor for volume flow from the meter factor for density. For instructions on this method, see Alternate method for calculating the meter factor for volume flow.

Obtain a reference device (external measurement device) for the appropriate process variable.

Important
For good results, the reference device must be highly accurate.

Procedure

1. Determine the meter factor as follows:
   a) Use the flow meter to take a sample measurement.
   b) Measure the same sample using the reference device.
   c) Calculate the meter factor using the following formula:

$$NewMeterFactor = ConfiguredMeterFactor \times \left(\frac{ReferenceMeasurement}{FlowmeterMeasurement}\right)$$

2. Ensure that the calculated meter factor does not fall outside 0.98 and 1.02. If the meter factor is outside these limits, contact customer service.
3. Configure the meter factor in the transmitter.

Calculating the meter factor for mass flow

The flow meter is installed and validated for the first time. The mass flow measurement from the transmitter is 250.27 lb. The mass flow measurement from the reference device is 250 lb. The mass flow meter factor is calculated as follows:

$$MeterFlow_{MassFlow} = 1 \text{ x} \left(\frac{250}{250.27}\right) = 0.9989$$

The first meter factor for mass flow is 0.9989.

One year later, the flow meter is validated again. The mass flow measurement from the transmitter is 250.07 lb. The mass flow measurement from the reference device is 250.25 lb. The new mass flow meter factor is calculated as follows:

$$MeterFlow_{MassFlow} = 0.9989 \text{ x} \left(\frac{250.25}{250.07}\right) = 0.9996$$

The new meter factor for mass flow is 0.9996.

11.5.1 Alternate method for calculating the meter factor for volume flow

The alternate method for calculating the meter factor for volume flow is used to avoid the difficulties that may be associated with the standard method.

This alternate method is based on the fact that volume is inversely proportional to density. It provides partial correction of the volume flow measurement by adjusting for the portion of the total offset that is caused by the density measurement offset. Use this method only when a volume flow reference is not available, but a density reference is available.

Procedure

1. Calculate the meter factor for density, using the standard method.
2. Calculate the meter factor for volume flow from the meter factor for density:

   $$MeterFactor_{Volume} = \left(\frac{1}{MeterFactor_{Density}}\right)$$

   The following equation is mathematically equivalent to the first equation. You may use whichever version you prefer.

   $$MeterFactor_{Volume} = ConfiguredMeterFactor_{Density} \times \left(\frac{Density_{Flowmeter}}{Density_{ReferenceDevice}}\right)$$

3. Ensure that the calculated meter factor does not fall outside 0.98 and 1.02. If the meter factor is outside these limits, contact customer service.
4. Configure the meter factor for volume flow in the transmitter.

11.6 Perform a (standard) D1 and D2 density calibration

Density calibration establishes the relationship between the density of the calibration fluids and the signal produced at the sensor. Density calibration includes the calibration of the D1 (low-density) and D2 (high-density) calibration points.

Important
Micro Motion flow meters are calibrated at the factory, and normally do not need to be calibrated in the field. Calibrate the flow meter only if you must do so to meet regulatory requirements. Contact customer support before calibrating the flow meter.

Tip
Use meter validation and meter factors, rather than calibration, to prove the meter against a regulatory standard or to correct measurement error.

Prerequisites

- During density calibration, the sensor must be completely filled with the calibration fluid, and flow through the sensor must be at the lowest rate allowed by your application. This is usually accomplished by closing the shutoff valve downstream from the sensor, then filling the sensor with the appropriate fluid.
- D1 and D2 density calibration require a D1 (low-density) fluid and a D2 (high-density) fluid. You may use air and water.
- If **LD Optimization** is enabled on your meter, disable it. To do this using a field communicator, choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **LD Optimization**. **LD Optimization** is used only with large sensors in hydrocarbon applications. If you are not using a field communicator, contact Micro Motion before continuing.
- The calibrations must be performed without interruption, in the order shown. Make sure that you are prepared to complete the process without interruption.
- Before performing the calibration, record your current calibration parameters. You can do this by saving the current configuration to a file on the PC. If the calibration fails, restore the known values.

Restriction
For T-Series sensors, the D1 calibration must be performed on air and the D2 calibration must be performed on water.

11.6.1 Perform a D1 and D2 density calibration using the display

Procedure

1. Read the Prerequisites in Perform a (standard) D1 and D2 density calibration if you have not already done so.
2. Close the shutoff valve downstream from the sensor.
3. Fill the sensor with the D1 fluid and allow the sensor to achieve thermal equilibrium.
4. Choose **Menu** → **Service Tools** → **Verification and Calibration** → **Density Calibration**.
5. Perform the D1 calibration.
   a) Choose **D1 (Air)**.
   b) Enter the density of your D1 fluid.
   c) Choose **Start Calibration**.
   d) Wait for the calibration to complete.
   e) Choose **Finished**.
6. Fill the sensor with the D2 fluid and allow the sensor to achieve thermal equilibrium.
7. Perform the D2 calibration.
   a) Choose **D2 (Water)**.
   b) Enter the density of your D2 fluid.
   c) Choose **Start Calibration**.
   d) Wait for the calibration to complete.
   e) Choose **Finished**.

8. Open the shutoff valve.

11.6.2 Perform a D1 and D2 density calibration using ProLink III

Procedure

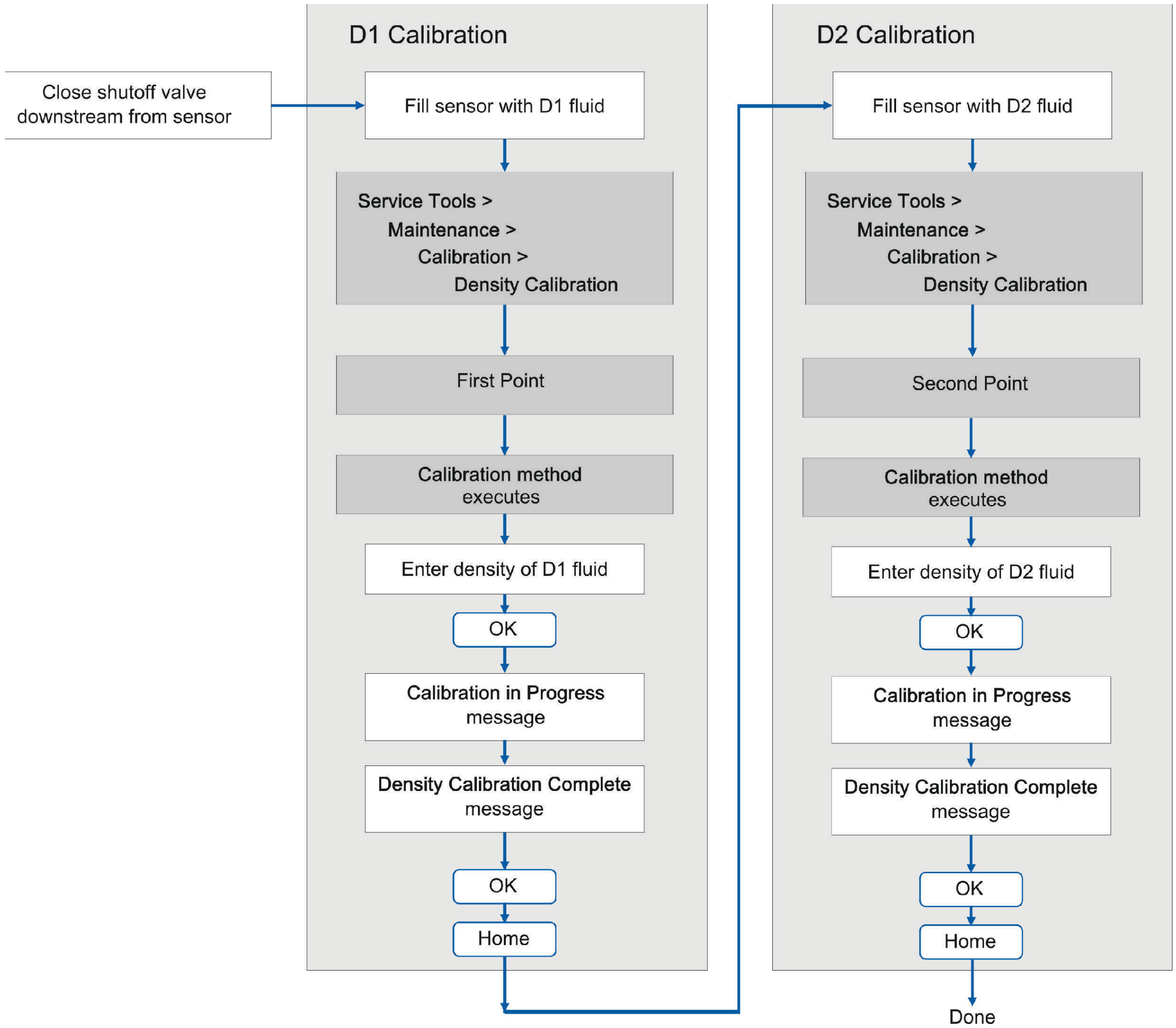
1. Read the Prerequisites in Perform a (standard) D1 and D2 density calibration if you have not already done so.
2. See the following figure.

11.6.3 Perform a D1 and D2 density calibration using a field communicator or an enhanced FF host

Procedure

1. Read the Prerequisites in Perform a (standard) D1 and D2 density calibration if you have not already done so.

2. See the following figure.



11.7 Adjust concentration measurement with Trim Slope and Trim Offset

Trim Slope and **Trim Offset** adjust the meter's concentration measurement to match a reference value.

Tip

You can adjust concentration measurement by applying the trim offset only, or by applying both the trim offset and the trim slope. For most applications, the trim offset is sufficient.

Prerequisites

Ensure that the active matrix is the one that you want to trim. You can set the offset and slope separately for each matrix on your transmitter.

You must be able to take measurements of your process fluid at two different concentrations.

You must be able to take a sample of your process fluid at each of these concentrations.

For each sample, you must be able to obtain a laboratory concentration value at line density and line temperature.

Procedure

1. Collect data for Comparison 1.
   a) Take a concentration reading from the meter and record line density and line temperature.
   b) Take a sample of the process fluid at the current concentration.
   c) Obtain a laboratory value for concentration at line density and line temperature, in the units used by the meter.
2. Collect data for Comparison 2.
   a) Change the concentration of your process fluid.
   b) Take a concentration reading from the meter and record line density and line temperature.
   c) Take a sample of the process fluid at the current concentration.
   d) Obtain a laboratory value for concentration at line density and line temperature, in the units used by the meter.
3. Populate the following equation with values from each comparison.

$$\text{Concentration}_{\text{Lab}} = (A \times \text{Concentration}_{\text{Meter}}) + B$$

4. Solve for A (slope).
5. Solve for B (offset), using the calculated slope and one set of values.
6. Enter the results as the trim slope and the trim offset.
   - Using ProLink III: Choose **Device Tools** → **Configuration** → **Process Measurement** → **Concentration Measurement**, set **Matrix Being Configured** to your matrix, and enter **Trim Slope** and **Trim Offset**.
   - Using a field communicator: Choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **Conc Measurement** → **Configure Matrix** and set **Matrix Being Configured** to your matrix. Then choose **Service Tools** → **Maintenance** → **Calibration** → **Trim CM Process Variables** and enter **Concentration Slope** and **Concentration Offset**.
   - Using an enhanced FF host: Choose **Configure** → **Manual Setup** → **Measurement** → **Optional Setup** → **Concentration Measurement** → **Trim CM Process Variables** and set **Matrix Being Configured** to your matrix, and enter **Trim Slope** and **Trim Offset**.
   - Using a basic FF host:
     — **Concentration Measurement TB** → **Slope Trim**
     — **Concentration Measurement TB** → **Offset Trim**
7. Take another concentration reading from the meter, and compare it to the laboratory value.
   - If the two values are acceptably close, the trim is complete.
   - If the two values are not acceptably close, repeat this procedure.

Calculating the trim slope and the trim offset

Comparison 1	Laboratory value	50.00%

	Meter value	49.98%
Comparison 2	Laboratory value	16.00%
	Meter value	15.99%

Populate the equations:

$$50 = (A \times 49.98) + B$$

$$16 = (A \times 15.99) + B$$

Solve for A:

$$50.00 - 16.00 = 34.00$$

$$49.98 - 15.99 = 39.99$$

$$34 = A \times 33.99$$

$$A = 1.00029$$

Solve for B:

$$50.00 = (1.00029 \times 49.98) + B$$

$$50.00 = 49.99449 + B$$

$$B = 0.00551$$

Concentration slope (A): 1.00029

Concentration offset (B): 0.00551

12 Maintenance

12.1 Install a new transmitter license

Display	**Menu → Service Tools → License Manager**
ProLink III	**Device Tools → Configuration → Feature License**
Field communicator	**Overview → Device Information → Licenses**
Enhanced FF host	**Overview → Device Information → Licenses**
Basic FF host	**Device TB → Permanent License Key**(OD Index 138) **Device TB → Temporary License Key** (OD Index 139)

Whenever you purchase additional features or request a trial license, you must install a new transmitter license. The new license makes the new features available on your transmitter. For concentration measurement and API Referral, you may still need to enable the application.

Prerequisites

- You must have a license file provided by Micro Motion:
  - `perm.lic`: Permanent license file
  - `temp.lic`: Temporary license file
- A USB drive

If you are planning to use the USB drive, the service port must be enabled. It is enabled by default. However, if you need to enable it, choose **Menu → Configuration → Security** and set **Service Port** to On.

Procedure

- To install a license using the display:
  a) Copy the license file to a folder on a USB drive.

  Important
  You must copy the license file to a folder. You cannot put it in the root.

  b) **WARNING**
  If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

  Open the wiring compartment on the transmitter and insert the USB drive into the service port.

  c) Choose **Menu → USB Options → USB Drive → Transmitter → Load License File**.

  d) Select the folder containing the license file and follow the prompts.

- To install a license using ProLink III:
    a) Open the license file.
    b) Choose **Device Tools** → **Configuration** → **Feature License**.
    c) Copy the license from the file to the appropriate **License Key** field.
- To install a license using an enhanced FF host:
    a) Choose **Overview** → **Device Information** → **Licenses** → **Upload License**.
    b) Select the license feature to upload, Permanent Feature or Temporary Feature.
    c) Write the license key.
- To install a license using a basic FF host, write the 16 digit license key into the appropriate parameter on the Device TB.

The features supported by the new license are displayed.

If you installed a temporary license, the transmitter will revert to its original feature set when the license period has expired. To purchase a feature for permanent use, contact customer support.

Postrequisites

If you installed a permanent license, update the options model code to match the new license. The options model code represents the installed features.

12.2 Upgrade the transmitter firmware

You can upgrade the transmitter firmware to stay current with development and to take advantage of any new features.

12.2.1 Using a USB drive with the display

You can upgrade the transmitter firmware to stay current with development and to take advantage of any new features.

Prerequisites

You must have the firmware upgrade files provided by Micro Motion.

The service port must be enabled. It is enabled by default. However, if you need to enable it, choose **Menu** → **Configuration** → **Security** and set **Service Port** to On.

Procedure

1. Copy the folder containing the firmware upgrade files to a USB drive.
2. **WARNING**
   If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

   Open the wiring compartment and insert the USB drive into the service port.
3. Follow the prompts once the transmitter recognizes the USB drive.
4. Select **USB Drive –> Transmitter**.

5. Select **Update Device Software**.
6. Select the firmware upgrade folder and follow the prompts.

   Note
   If required, the transmitter upgrade procedure automatically includes an upgrade to the core processor software.

   If you chose to reboot the transmitter at a later date, you can reboot it from the menu, or you can power-cycle it.
7. Verify the transmitter configuration and all safety parameters.
8. Enable write-protection.

12.2.2 Using the USB service port and ProLink III

You can upgrade the transmitter firmware to stay current with development and to take advantage of any new features.

WARNING
If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

Prerequisites

You must have the firmware upgrade files provided by Emerson.

Procedure

1. Choose **Device Tools** → **Transmitter Software Update**.
2. Navigate to the folder containing the firmware upgrade files.
3. Select **Update**.

   Note
   If required, the transmitter upgrade procedure automatically includes an upgrade to the core processor software.

   If you chose to reboot the transmitter at a later date, you can reboot it from the display, or you can power-cycle it.
4. Verify the transmitter configuration and all safety parameters.
5. Enable write-protection.

12.3 Reboot the transmitter

Display	**Menu → Service Tools → Reboot Transmitter**
ProLink III	Not available
Field communicator	**Service Tools → Maintenance → Reset/Restore → Device Reset**
Enhanced FF host	**Service Tools → Maintenance → Reset/Restore → Device Reset**
Basic FF host	Not available

For certain configuration changes to take effect, the transmitter must be rebooted. You must also reboot the transmitter in order to clear certain status alerts.

Rebooting the transmitter has the same effect as power-cycling the transmitter.

Prerequisites

Follow appropriate procedures to select the appropriate time for rebooting the transmitter. The reboot typically takes about 10 seconds.

Postrequisites

Check the transmitter clock. During the reboot, the transmitter clock is powered by the battery, therefore the transmitter clock and all timestamps should be accurate. If the transmitter clock is not correct, the battery may need replacement.

12.4 Battery replacement

The transmitter contains a battery that is used to power the clock when the transmitter is not powered up. Users cannot service or replace the battery. If the battery requires replacement, contact customer support.

If the battery is non-functional and the transmitter is powered down, then powered up, the clock will restart from the time of the power-down. All timestamps will be affected. You can correct the issue by resetting the transmitter clock. For a permanent resolution, the battery must be replaced.

13 Log files, history files, and service files

13.1 Generate history files

Display	**Menu → USB Options → Transmitter –> USB Drive → Download Historical Files**
ProLink III	**Device Tools → Configuration Transfer → Download Historical Files**
Field communicator	Not available
Enhanced FF host	Not available
Basic FF host	Not available

The transmitter automatically saves historical data of several types, including process and diagnostic variables, Smart Meter Verification test results, and totalizer values. To access the historical data, you can generate a log file, then view it on your PC.

WARNING

If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

Prerequisites

If you want to generate a totalizer log, you must have previously configured the transmitter to record totalizer data. However, there is a totalizer history that is logged automatically.

If you plan to use the transmitter display:

- The service port must be enabled. It is enabled by default. However, if you need to enable it, choose **Menu → Configuration → Security** and set **Service Port** to On.
- You must have a USB drive.

Procedure

1. **WARNING**

   If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

   If you are using the transmitter display, open the wiring compartment and insert the USB drive into the service port.
2. Select the type of log file that you want to generate.
3. If you selected historian data (process and diagnostic variables):
   a) Set the date and time for the first entry in the historian log file.
   b) Set the number of days that the log file will include.
   c) Select the record type.

Option	Description
1 Second Raw Data	The current values of process and diagnostic variables, recorded at 1-second intervals.
5 Min Average Data	The minimum and maximum values of the 1-second raw data over the last 5 minutes, plus the average and the standard deviation, recorded at 5-minute intervals.

The system provides an estimated file size or transfer time.

4. Specify the location where the log file will be saved.
   - If you are using the display, the log file is written to the USB drive.
   - If you are using ProLink III, the log file is written to a folder on your PC.

The log file is written to the specified location. File names are assigned as follows:

- Historian files: The file name is based on the transmitter tag, the starting date of the log contents, and the record type. The record type is shown as F or S:
  - F=Fast, for 1-second raw data
  - S=Slow, for 5-minute average data
- SMV files:
  - `SmvLast20Data.csv`
  - `SmvLongTermData.csv`
- Totalizer history files: `TotLog.txt`

13.1.1 Historian data and log

The transmitter automatically saves information about specific process and diagnostic variables to its working memory. You can generate a log from this data that tracks all 14 totalizers with 21 days worth of data. The historian log is an ASCII file in `.csv` format.

Contents of the historian log

There are two types of historian records:

1-second raw data	The current values of process and diagnostic variables, recorded at 1-second intervals.
5-minute average data	The minimum and maximum values of the 1-second raw data, plus the average and the standard deviation, calculated and recorded at 5-minute intervals.

When you generate the log, you can specify which type of record you want to see.

The historian in the transmitter's working memory contains a minimum of 4 weeks of 1-second raw data and 10 years of 5-minute average data.

Each record contains data for the following process and diagnostic variables:

- Timestamp
  - Format: Military time

  - Time and time zone: Transmitter clock
- Mass flow rate (kg/sec)
- Volume flow rate (l/sec) or GSV flow rate
- Density (g/cm³)
- Line temperature (°C)
- External temperature (if available)
- Pressure (if available)
- If concentration measurement is enabled:
  - Standard volume flow rate
  - Net mass flow rate
  - Net volume flow rate
  - Referred density
  - Concentration
- If API Referral is enabled:
  - CTPL or CTL
  - Corrected density
  - Corrected volume flow rate
- Alert status registers (hexadecimal format)
- Live zero (kg/sec)
- Tube frequency (Hz)
- Drive gain (%)
- Left pickoff (filtered) (V)
- Right pickoff (filtered (V)
- Left pickoff (raw) (V)
- Delta T
- Case temperature (°C)
- Voltage applied to the core processor (V)
- Temperature of the core processor board (°C)
- Temperature of the transmitter electronics (°C)

Historian data and power-cycles

Historian data is maintained across transmitter reboots and power-cycles.

Historian data and configuration files

If you restore the factory configuration or upload a configuration file, existing historian data is not affected.

Example: Historian log, 5-minute average data

S TAG:SUPPLY UID:22729F1F SW:000000045 800:000000402	MassFlow	MassFlow	MassFlow	MassFlow	...
DST ON:Mountain GMT-7.0 SM:T075 SN:000000000	kg/s Max	kg/s Min	kg/s Avg	kg/s Std	...
8/25/2020 9:58	0.0082359	0	0.00091223	9.76E-05	...
8/25/2020 10:03	0.001018	0.00084441	0.00091756	1.61E-05	...
8/25/2020 10:08	0.00099489	0.00086279	0.00092519	1.44E-05	...
8/25/2020 10:13	0.0010835	0.00080879	0.00093774	2.01E-05	...
8/25/2020 10:18	0.0011767	0.00084206	0.00094224	2.11E-05	...
8/25/2020 10:23	0.0010243	0.00086888	0.00094534	1.85E-05	...
8/25/2020 10:28	0.0010903	0.00084823	0.00094747	1.81E-05	...
8/25/2020 10:33	0.0010319	0.00085327	0.00095123	1.67E-05	...
8/25/2020 10:38	0.0011232	0.00088614	0.00095222	1.59E-05	...
8/25/2020 10:43	0.0010841	0.00081306	0.00095126	1.99E-05	...
8/25/2020 10:48	0.0010999	0.00086106	0.00095333	1.93E-05	...
8/25/2020 10:53	0.0011523	0.00085537	0.00095528	2.01E-05	...
...					

Note
The historian log displays only in English.

13.1.2 Smart Meter Verification history and log

The transmitter automatically saves test data for all Smart Meter Verification tests. You can generate a log containing data for the 20 most recent tests or for all Smart Meter Verification tests. The log is an ASCII file in `.csv` format.

Contents of Smart Meter Verification log

Each record in the Smart Meter Verification log represents a Smart Meter Verification test. Each record contains the following information:

- Date and time of test
- Data collected during the test
- The abort code (15=test completed normally)
- A pass/fail result for the left pickoff (0=Pass, 1=fail)
- A pass/fail result for the right pickoff (0=Pass, 1=fail)
- The sensor type code
- The sensor serial number

Smart Meter Verification history and power-cycles

If the transmitter is rebooted or power-cycled, Smart Meter Verification history is not affected.

Smart Meter Verification history and configuration files

If you restore the factory configuration or upload a configuration file, Smart Meter Verification history is not affected.

Example: Smart Meter Verification log

Device UID: 577937183

Device Tag: SUPPLY

Time Zone: GMT -7.00

Date Time	LPO Stiff	RPO Stiff	LPO Mass	RPO Mass	Damping	Drv mA	...
8/13/2020 19:27	0.285876	0.289738	0.155294	0.158114	4.41E-05	1.301	...
8/14/2020 7:27	-0.06137	-0.05808	0.154748	0.157556	4.02E-05	1.304	...
8/14/2020 19:27	0.204754	0.20932	0.155185	0.158004	4.35E-05	1.308	...
8/15/2020 7:27	-0.15382	-0.15216	0.154612	0.157416	3.93E-05	1.307	...
8/18/2020 16:27	0.251067	0.251782	0.155217	0.158031	4.34E-05	1.308	...
8/19/2020 19:27	-0.13654	-0.14112	0.154602	0.157396	3.89E-05	1.287	...
8/20/2020 16:27	-0.20837	-0.20671	0.154502	0.157304	3.85E-05	1.291	...
8/21/2020 17:10	-0.11062	-0.11566	0.154641	0.157435	3.84E-05	1.288	...
8/22/2020 10:40	-0.15852	-0.16036	0.154512	0.157308	3.86E-05	1.284	...
8/25/2020 15:40	-0.00172	0.002301	0.154788	0.157599	4E-05	1.295	...
8/27/2020 23:16	0.132787	0.13684	0.155034	0.15785	4.08E-05	1.275	...
8/28/2020 11:16	0.04456	0.046158	0.154845	0.157653	3.99E-05	1.277	...

...

Note
The Smart Meter Verification log displays only in English.

13.1.3 Totalizer log

The totalizer log can track four configurable totals. The period is configurable; you can configure the transmitter to save totalizer and inventory values at a user-specified interval and then generate a totalizer log. The totalizer log is an ASCII file.

Contents of totalizer log

The totalizer log contains one record for each logged totalizer or inventory value. Each record contains the following information:

- Default totalizer or inventory name (user-specified names are not used)
- Value and measurement unit
- Timestamp

- Format: Military time
- Time and time zone: Transmitter clock

The totalizer log also contains a line item for each totalizer or inventory reset.

Totalizer logs and power cycles

If the transmitter is rebooted or power-cycled, the totalizer log is not affected.

Totalizer logs and configuration files

If you restore the factory configuration or upload a configuration file, the totalizer log is not affected.

Example: Totalizer log

```
==============================================================================
Device UID: 22729F1F                          Device Tag: SUPPLY
Name                 Value                    Units                 Time Zone: GMT-7.00
==============================================================================
Mass Fwd Total       61.74707                 grams                 9/12/2020 20:00
Mass Fwd Inv         61.74705                 grams                 9/12/2020 20:00
Mass Fwd Total       61.74707                 grams                 9/12/2020 21:00
Mass Fwd Inv         61.74705                 grams                 9/12/2020 21:00
Mass Fwd Total       61.74707                 grams                 9/12/2020 22:00
Mass Fwd Inv         61.74705                 grams                 9/12/2020 22:00
Mass Fwd Total       61.74707                 grams                 9/12/2020 23:00
Mass Fwd Inv         61.74705                 grams                 9/12/2020 23:00
Mass Fwd Total       61.74707                 grams                 9/13/2020 0:00
Mass Fwd Inv         61.74705                 grams                 9/13/2020 0:00
...
```

Note
The totalizer history displays only in English.

Read contract totals

You can read contract totals for the current 24-hour contract period and for the previous 24-hour contract period. Depending on the configuration of the totalizer log, you may be able to read contract totals for earlier periods.

The contract totals are derived from existing inventories. However, they are reset automatically at the beginning of each contract period. Therefore, the values shown will probably not match the values shown for the inventories.

Important
You can reset inventories manually, and you can stop and start inventories manually. However, if you do this, data for the current contract period will not reflect the entire 24-hour period. Data for earlier contract periods is not affected.

- The contract totals for the current contract period are stored in the **Today's Total [1-4]** parameters.
- The contract totals for the previous contract period are stored in the **Yesterday's Total [1-4]** parameters.
- The contract totals from earlier contract periods can be read in the totalizer log.

Configure contract totals into the totalizer log

The transmitter can be configured to store contract totals to the totalizer log. This allows you to access totals from earlier contract periods. Otherwise, the transmitter maintains data for only the current contract period (today) and the immediately preceding contract period (yesterday).

Procedure

1. Navigate to the **Totalizer Log**.

Option	Description
Display	**Menu → Configuration → Totalizer Log**
ProLink III	**Device Tools → Configuration → Totalizer Log**
Field communicator	Not available

2. Set **Log Total 1**, **Log Total 2**, **Log Total 3**, and/or **Log Total 4** to the desired contract total.

   You can configure the totalizer history log to include both Advanced Phase Measurement and standard totals.(1)

13.2 Generate service files

The transmitter automatically saves several types of service data that is useful in troubleshooting, device maintenance, and administration. You can view the data by generating a service file and downloading it to a USB drive, then using your PC to open the file.

Prerequisites

The service port must be enabled. It is enabled by default. However, if you need to enable it, choose **Menu → Configuration → Security** and set **Service Port** to On.

You must have a USB drive.

Procedure

1. **WARNING**

   If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

   Open the wiring compartment on the transmitter and insert the USB drive into the service port.
2. Choose **Menu → USB Options → Transmitter –> USB → Download Service Files**.
3. Select the service file that you want to generate.

(1) *For fieldbus version 1.x transmitters, any two of the publishable totalizers and inventories can be used, but only two at a time.*

Service file	Description	File name
Configuration Audit Log	All changes to configuration, including changes made by procedures such as zero calibration or density calibration.	`ConfgAuditLog.txt`
Alert History	All occurrences of alerts and conditions, independent of alert severity.	`AlertLog.txt`
Historian: 30 Days	5-minute average values for selected process and diagnostic variables for the last 30 days.	Concatenated from transmitter tag and date
Historian: 1 Day	Values of selected process and diagnostic variables for the last 24 hours, recorded at 1-second intervals.	Concatenated from transmitter tag and date
SMV: 20 Runs	Test data from the 20 most recent SMV tests.	`SmvLast20Data.csv`
Service Snapshot	An ASCII file containing a snapshot of the transmitter's internal database. This file is used by customer service.	`service.dump`
Factory Config File	The configuration file created for this transmitter at the factory.	`FactoryConfig.cfg`
Assert Log	A troubleshooting file used by customer service.	`AssertLog.txt`
Support Contact	A PDF file containing information for contacting customer service.	`SupportContact.pdf`
Security Log	A record of events that might indicate tampering.	`SecurityLog.txt`

4. Specify the folder on the USB drive where the log file will be saved.

13.2.1 Alert history and log

The transmitter automatically saves information about all alert occurrences to its working memory, and periodically updates an alert history file on its SD card. The alert history log is an ASCII file.

Contents of alert history

The alert history in the transmitter's working memory contains the 1000 most recent alert records. Each alert record contains the following information:

- Name of alert or condition
- Category:
  - F=Failure
  - FC=Function Check
  - M=Maintenance Required
  - OOS=Out of Specification
  - I=Ignore
- Action:
  - Active=Transition from inactive to active
  - Inactive=Transition from active to inactive

  - Toggling=More than 2 transitions in the last 60 seconds
- Timestamp
  - Format: Military time
  - Time and time zone: Transmitter clock
  - Not displayed if Action=Toggling

Alert history and power-cycles

If the transmitter is rebooted or power-cycled, the 20 most recent records in alert history are retained in the transmitter's working memory. All earlier records are cleared from working memory. The alert history file on the SD card is not cleared.

Alert history and configuration files

If you restore the factory configuration or upload a configuration file, alert history is not affected.

13.2.2 Configuration audit history and log

The transmitter automatically saves information about all configuration events to its working memory. The configuration audit log is an ASCII file.

Contents of configuration audit log

The configuration audit log contains a record for every change to transmitter configuration, including changes resulting from zero calibration, density calibration, etc. Each record contains:

- Modbus location in transmitter memory
  - C*nnn* = Coil
  - R*nnn* = Register
  - R*nnn xxx* = Array, indexed by register *xxx*
- Name of Modbus location
- Original value
- New value
- Measurement unit, if applicable
- Timestamp
  - Format: Military time
  - Time and time zone: Transmitter clock
- Host or protocol from which the change was made

Configuration audit history and power-cycles

If the transmitter is power-cycled or rebooted, the event is logged in the configuration audit history. Earlier records are not affected.

Configuration audit history and configuration files

If you restore the factory configuration or upload a configuration file, the event is logged in the configuration audit history. Earlier records are not affected.

Example: Configuration audit log

==

Device UID: 22729F1F

Device Tag: SUPPLY

Addr	Name	Old Value	New Value	Unit	Time Zone: GMT-7:00	Host
C167	SYS_CfgFile_Re	0	1		09/SEP/2019 11:35:11	Display
C167	SYS_CfgFile_Re	0	0		09/SEP/2019 11:35:12	Other
1167	IO_ChannelB_As	10	4		09/SEP/2019 11:35:12	Other
351	SNS_API2540Tab	81	100		09/SEP/2019 11:35:12	Other
40	SNS_DensityUni	91	92		09/SEP/2019 11:35:12	Other
44	SNS_PressureUn	6	12		09/SEP/2019 11:35:12	Other
14	FO_1_Source	0	5		09/SEP/2019 11:35:12	Other
1180	MAI_Source	251	55		09/SEP/2019 11:35:12	Other
275	MAI_mA20Var	0	250.0	°C	09/SEP/2019 11:35:12	Other
4961	FO_2_Source	0	5		09/SEP/2019 11:35:12	Other
68	SYS_Tag	FT-0000	SUPPLY		09/SEP/2019 11:35:12	Other
159	SNS_K1	1606.9	1606.4		09/SEP/2019 11:35:12	Other
161	SNS_K2	1606.9	7354		09/SEP/2019 11:35:12	Other
163	SNS_DensityTem	5.66	4.44		09/SEP/2019 11:35:12	Other

...

Note
The configuration audit log displays only in English.

13.2.3 Assert history and log

The transmitter automatically saves information about all asserts. You can generate an assert log for use by customer service. The assert log is an ASCII file.

Contents of assert log

The assert history contains the 1000 most recent asserts. An assert is an unusual event in the transmitter firmware that may indicate an error or malfunction. A list of asserts can be useful for troubleshooting by customer service. The assert log is not designed for customer use.

Assert history and power-cycles

Assert history is not affected by reboots or power-cycles.

Assert history and configuration files

If you restore the factory configuration or upload a configuration file, assert history is not affected.

13.2.4 Security log

The transmitter automatically saves data that helps determine if someone is tampering with the device. Counters are maintained to track the number of illegal configuration change requests, firmware upgrade failures, and failures to enter the display password. The security log is an ASCII file.

Contents of security log

The security log contains a summary of security events that have occurred since the last transmitter reboot. The following items are included:

- Device information
- Timestamp
  - Format: Military time
  - Time and time zone: Transmitter clock
- Number of password entry failures
- Number of transmitter firmware upgrade failures
- Number of database write failures

Security log and power-cycles

If the transmitter is rebooted or power-cycled, the security log is not affected.

Security log and configuration files

If you attempt to restore the factory configuration or upload a configuration file when write-protection is enabled, the Database Write Failures counter is increased.

Example: Security log file

TAG:SUPPLY	UID:22729F1F	SW:0045	DATE:23/SEP/2019 14:42:58
Device:Config I/O		GMT-7.0 DST:DST Zone:(UTC-7:00) Denver	
Addr		Name	Value

```
--------------------------------------------------------------------------------------------------------------------------------------------------
5851                    Password Failures                 0
5852                    SW Upgrade Failures               0
5853                    Database Write Failures           25636
```

Note

The security log displays only in English.

14 Troubleshooting

14.1 Status LED and device status

The status LED (**MOD STATUS**) on the transmitter display provides a quick indication of device status by changing color and flashing. If the transmitter was ordered without a display, the LEDs on the outputs board inside the transmitter provide the same information.

Table 14-1: Status LED and device status

Status LED condition	Device status
Solid green	No alerts are active.
Solid yellow	One or more alerts are active with **Alert Severity** = Out of Specification, Maintenance Required, or Function Check.
Solid red	One or more alerts are active with **Alert Severity** = Failure.
Flashing yellow (1 Hz)	The `Function Check in Progress` alert is active.

14.2 API Referral troubleshooting

14.2.1 Extrapolation alert is active

Cause

Line pressure, line temperature, or line density is outside the range of the configured API table.

Recommended actions

1. Check your process conditions against the values reported by the device.
2. Verify the configuration of the API Referral application and related parameters.

14.2.2 Inaccurate referred density reading

Cause

- Inaccurate density measurement
- Inaccurate temperature measurement
- Incorrect reference conditions
- Incorrect API table selection

Recommended actions

1. Verify the line density value.
2. Verify the line temperature value.
3. Ensure that the application is configured to use the appropriate temperature source.
4. Ensure that the pressure source is configured correctly, that the external pressure device is operating correctly, and that both devices are using the same measurement units.

5. Ensure that reference temperature and reference pressure, if applicable, are configured correctly.
6. Ensure that the selected API table is appropriate for the process fluid.

14.3 Concentration measurement troubleshooting

14.3.1 Significantly incorrect CM after loading matrix

Cause

The wrong temperature or density unit was configured when the matrix was loaded.

Recommended actions

Set the temperature and density units to the units used when the matrix was built, then reload the matrix.

For custom matrices, contact customer support.

14.3.2 Inaccurate CM reading

Cause

- Inaccurate density measurement
- Inaccurate temperature measurement
- Incorrect reference conditions
- Incorrect matrix data
- Inappropriate trim values

Recommended actions

1. Verify the line density value.
2. Verify the line temperature value.
3. Ensure that the application is configured to use the appropriate temperature source.
4. Ensure that reference temperature is configured correctly.
5. Ensure that the appropriate matrix is active.
6. Ensure that the matrix is configured correctly.
7. Adjust the extrapolation limits for the active matrix.
8. Adjust measurement with a concentration offset trim.

14.4 Alert when connecting a core processor to a remote 5700 transmitter

When connecting a core processor to a 5700, you will see the following alert from the transmitter display.

Alert

New Core Detected

Cause

A new core processor was detected.

Recommended actions

1. Select one of the following options when prompted by the screen.

Option	Description	Action
Core Only Replacement	The new core processor is replacing an old core processor and the sensor is not getting replaced. The core processor is brand new without a baseline and has default factory values, such as K1 = 1000 and K2 = 5000.	Restore configuration and verify sensor parameters.
Pre-Calibrated Core Replacement	The new core processor is pre-calibrated and matched with the sensor. You are replacing a core processor that has already been paired with a sensor that has already been characterized.	Verify the sensor parameters and save the configuration.
Not Pre-Calibrated Core Replacement	The core processor and sensor are being replaced, but the core processor has not been pre-calibrated or matched with the sensor. The sensor and core processor are being replaced but the new core processor has not been paired (characterized) with the new sensor.	Enter the sensor parameters and save the configuration.
I Don't Know	You do not know if the new core processor has been pre-calibrated and matched with the sensor.	Verify the sensor parameters and save the configuration if there was a change.

2. Select **Continue**.
3. Per the screen message, contact Micro Motion if you have any questions before you select the **Finished** button.

   These screens will not display again until another new core processor has been detected.

14.5 Density measurement troubleshooting

14.5.1 Erratic density reading

Cause

- Normal process noise

- Two-phase flow
- Line pressure too low
- The flow rate is too high for the installation
- Pipe diameter too small
- Contaminants or suspended solids in the process gas
- Contaminants or suspended solids in the process fluid
- Vibration in the pipeline
- Erosion or corrosion

Recommended actions

1. Check your process conditions against the values reported by the device.
2. Increase the density damping value.
3. Decrease the flow rate.
4. Check for two-phase flow.
5. Ensure that line pressure or sample pressure meets installation requirements.
6. Increase back pressure to minimize bubble formation.
7. Minimize vibration in the pipeline.
8. Increase the pipe diameter.
9. Install a flow control method (bypass, flow chamber, expander, etc.).
10. Perform Smart Meter Verification.

14.5.2 Inaccurate density reading

Cause

- Problem with process fluid
- Incorrect density calibration factors
- Wiring problem
- Incorrect grounding
- Two-phase flow
- Plugged or coated sensor tube
- Incorrect sensor orientation
- RTD failure
- Physical characteristics of sensor have changed

Recommended actions

1. Check the wiring between the sensor and the transmitter.
2. Check the grounding of all components.
3. Check your process conditions against the values reported by the device.

4. Ensure that all of the calibration parameters have been entered correctly. See the sensor tag or the calibration sheet for your meter.
5. Check for two-phase flow.
6. If two sensors with similar frequency are too near each other, separate them.
7. Purge the sensor tubes.
8. Perform Smart Meter Verification.

14.5.3 Unusually high density reading

Cause

- Plugged or coated sensor tube
- Incorrect density calibration factors
- Inaccurate temperature measurement
- RTD failure
- In high-frequency meters, erosion, or corrosion
- In low-frequency meters, tube fouling

Recommended actions

1. Ensure that all of the calibration parameters have been entered correctly.
   See the sensor tag or the calibration sheet for your meter.
2. Purge the sensor tubes.
3. Check for coating in the flow tubes.
4. Perform Smart Meter Verification.

14.5.4 Unusually low density reading

Cause

- Two-phase flow
- Incorrect calibration factors
- In low-frequency meters, erosion or corrosion

Recommended actions

1. Check your process conditions against the values reported by the device.
2. Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.
3. Check the wiring between the sensor and the transmitter.
4. Check for tube erosion, especially if the process fluid is abrasive.
5. Perform Smart Meter Verification.

14.6 Discrete Output troubleshooting

14.6.1 No Discrete Output

Cause

- Output not powered
- Wiring problem
- Channel not licensed
- Circuit failure

Recommended actions

1. Check the power supply and power supply wiring.
2. Verify the output wiring.
3. Verify that the channel is wired and configured as a Discrete Output.
4. Contact customer service.

14.6.2 Loop test failed

Cause

- Output not powered
- Power supply problem
- Wiring problem
- Circuit failure

Recommended actions

1. Check the power supply and power supply wiring.
2. Verify the output wiring.
3. Contact customer service.

14.6.3 Discrete Output readings reversed

Cause

- Wiring problem
- Configuration does not match wiring

Recommended actions

1. Verify the output wiring.
2. Ensure that **Discrete Output Polarity** is set correctly.

14.7 Flow measurement troubleshooting

14.7.1 Flow rate reported as zero when flow is present

Cause

The process condition is below cutoff.

Recommended action

Verify the cutoffs.

14.7.2 Flow indication at no flow conditions or zero offset

Cause

- Misaligned piping (especially in new installations)
- Open or leaking valve
- Incorrect sensor zero

Recommended actions

1. Verify all of the characterization or calibration parameters.
   See the sensor tag or the calibration sheet for your meter.
2. If the reading is not excessively high, review the live zero. You may need to restore the factory zero.
3. Check for open or leaking valves or seals.
4. Check for mounting stress on the sensor (e.g., sensor being used to support piping, misaligned piping).
5. Contact customer service.

14.7.3 Erratic non-zero flow rate at no-flow conditions

Cause

- Leaking valve or seal
- Two-phase flow
- Plugged or coated sensor tube
- Incorrect sensor orientation
- Wiring problem
- Vibration in pipeline at rate close to sensor tube frequency
- Damping value too low
- Mounting stress on sensor

Recommended actions

1. Verify that the sensor orientation is appropriate for your application.
   See the installation manual for your sensor.
2. Check the drive gain and the pickoff voltage.
3. If the wiring between the sensor and the transmitter includes a 9-wire segment, verify that the 9-wire cable shields are correctly grounded.
4. Check the wiring between the sensor and the transmitter.
5. For sensors with a junction box, check for moisture in the junction box.
6. Purge the sensor tubes.
7. Check for open or leaking valves or seals.
8. Check for sources of vibration.
9. Verify damping configuration.
10. Verify that the measurement units are configured correctly for your application.
11. Check for two-phase flow.
12. Check for radio frequency interference.
13. Contact customer service.

14.7.4 Erratic non-zero flow rate when flow is steady

Cause

- Two-phase flow
- Damping value too low
- Plugged or coated sensor tube
- Wiring problem
- Problem with receiving device

Recommended actions

1. Verify that the sensor orientation is appropriate for your application.
   See the installation manual for your sensor.
2. Check the drive gain and the pickoff voltage.
3. If the wiring between the sensor and the transmitter includes a 9-wire segment, verify that the 9-wire cable shields are correctly grounded.
4. Check for air entrainment, tube fouling, flashing, or tube damage.
5. Check the wiring between the sensor and the transmitter.
6. For sensors with a junction box, check for moisture in the junction box.
7. Purge the sensor tubes.
8. Check for open or leaking valves or seals.
9. Check for sources of vibration.
10. Verify damping configuration.
11. Verify that the measurement units are configured correctly for your application.

12. Check for two-phase flow.
13. Check for radio frequency interference.
14. Contact customer service.

14.7.5 Inaccurate flow rate

Cause

- Wiring problem
- Inappropriate measurement unit
- Incorrect flow calibration factor
- Incorrect meter factor
- Incorrect density calibration factors
- Incorrect grounding
- Two-phase flow
- Problem with receiving device
- Incorrect sensor zero

Recommended actions

1. Check the wiring between the sensor and the transmitter.
2. Verify that the measurement units are configured correctly for your application.
3. Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.
4. Zero the meter.
5. Check the grounding of all components.
6. Check for two-phase flow.
7. Verify the receiving device, and the wiring between the transmitter and the receiving device.
8. Check the sensor coils for electrical shorts. If you find problems, replace the sensor.
9. Replace the core processor or transmitter.

14.8 Frequency Output troubleshooting

14.8.1 No FO

Cause

- Stopped totalizer
- Process condition below cutoff
- Fault condition if **Fault Action** is set to Internal Zero or Downscale
- Two-phase flow
- Flow in reverse direction from configured flow direction parameter

- **Frequency Output Direction** not set correctly
- Bad frequency receiving device
- Output level not compatible with receiving device
- Bad output circuit
- Output not powered
- Wiring problem
- Channel not configured for desired output

Recommended actions

1. Verify that the process conditions are below the low-flow cutoff. Reconfigure the low-flow cutoff if necessary.
2. Check the **Fault Action** settings.
3. Verify that the totalizers are not stopped. A stopped totalizer will cause the Frequency Output to be locked.
4. Check for two-phase flow.
5. Check flow direction.
6. Check the direction parameters.
7. Verify the receiving device, and the wiring between the transmitter and the receiving device.
8. Verify that the channel is wired and configured as a Frequency Output.
9. Perform a loop test.

14.8.2 Consistently incorrect FO measurement

Cause

- Output not scaled correctly
- Incorrect measurement unit configured for process variable

Recommended actions

1. Check the scaling of the Frequency Output.
2. Verify that the measurement units are configured correctly for your application.

14.8.3 Erratic FO

Cause

There is Radio Frequency Interference (RFI) from the environment.

Recommended action

Check for radio frequency interference.

14.8.4 FO goes in and out of fault conditions

Cause

There is a problem with the interaction between the Output Saturated alert and the fault action configured for the output.

Recommended actions

1. Change the severity of the Output Saturated alert from Fault to another option.
2. Configure the transmitter to ignore the Output Saturated alert or the relevant conditions.
3. Change the configuration of **Fault Action** from Downscale to another option.

14.9 mA Output troubleshooting

14.9.1 No mAO

Cause

- Output not powered
- Power supply problem
- Wiring problem
- Circuit failure
- Channel not configured for desired output

Recommended actions

1. If applicable, check the output wiring to verify that the output is powered.
2. Check the power supply and power supply wiring.
3. Verify the output wiring.
4. Check the **Fault Action** settings.
5. Verify channel configuration for the affected mA Output.
6. Measure DC voltage across output terminals to verify that the output is active.
7. Contact customer service.

14.9.2 Loop test failed

Cause

- Output not powered
- Power supply problem
- Wiring problem
- Circuit failure

Recommended actions

1. Check the power supply and power supply wiring.

2. Verify the output wiring.
3. Check the **Fault Action** settings.
4. Verify channel configuration for the affected mA Output.
5. Contact customer service.

14.9.3 mAO below 4 mA

Cause

- Output not powered
- Open in wiring
- Bad output circuit
- Process condition below LRV
- LRV and URV are not set correctly
- Fault condition if **Fault Action** is set to Internal Zero or Downscale
- Bad mA receiving device

Recommended actions

1. Check your process conditions against the values reported by the device.
2. Verify the receiving device, and the wiring between the transmitter and the receiving device.
3. Check the settings of **Upper Range Value** and **Lower Range Value**.
4. Check the **Fault Action** settings.
5. Verify channel configuration for the affected mA Output.

14.9.4 Constant mAO

Cause

- Incorrect process variable assigned to the output
- Fault condition exists
- A loop test is in progress
- Zero calibration failure
- mA Output Direction not set correctly

Recommended actions

1. Verify the output variable assignments.
2. View and resolve any existing alert conditions.
3. Check the direction parameters.
4. Check to see if a loop test is in process (the output is fixed).
5. If related to a zero calibration failure, reboot or power-cycle the transmitter and retry the zeroing procedure.

14.9.5 mAO consistently out of range

Cause

- Incorrect process variable or units assigned to output
- Fault condition if **Fault Action** is set to Upscale or Downscale
- LRV and URV are not set correctly

Recommended actions

1. Verify the output variable assignments.
2. Verify the measurement units configured for the output.
3. Check the **Fault Action** settings.
4. Check the settings of **Upper Range Value** and **Lower Range Value**.
5. Check the mA Output trim.

14.9.6 Consistently incorrect mA measurement

Cause

- Loop problem
- Output not trimmed correctly
- Incorrect measurement unit configured for process variable
- Incorrect process variable configured
- LRV and URV are not set correctly
- mA Output Direction not set correctly

Recommended actions

1. Check the mA Output trim.
2. Verify the measurement units configured for the output.
3. Verify the process variable assigned to the mA Output.
4. Check the direction parameters.
5. Check the settings of **Upper Range Value** and **Lower Range Value**.

14.9.7 mAO correct at lower current, but incorrect at higher current

Cause

The mA loop resistance may be set too high.

Recommended actions

Verify that the mA Output load resistance is below the maximum supported load.
See the installation manual for your transmitter.

14.9.8 mAO goes in and out of fault conditions

Cause

There is a problem with the interaction between the Output Saturated alert and the fault action configured for the output.

Recommended actions

1. Change the severity of the Output Saturated alert from Fault to another option.
2. Configure the transmitter to ignore the Output Saturated alert or the relevant conditions.
3. Change the configuration of **Fault Action** from Downscale to another option.

14.10 Status alerts, causes, and recommendations

Not all of these alerts may apply to your type of transmitter.

14.10.1 [002] RAM Error - Core

Alert

Electronics Failed

Cause

The transmitter has detected a problem with the sensor's electronics.

Recommended actions

1. Cycle power to the meter.
2. If the problem persists, contact customer service.

14.10.2 [003] Sensor Failed

Alert

Sensor Failed

Cause

The sensor is not responding.

Recommended actions

1. Check for two-phase flow.
2. Check the drive gain and the pickoff voltage.
3. Check the wiring between the sensor and the transmitter.
4. Check the sensor coils for electrical shorts. If you find problems, replace the sensor. Refer to Check for internal electrical problems.
5. Check the integrity of the sensor tubes.
6. Ensure that the sensor is completely full or completely empty.
7. Replace the sensor.

8. Contact customer service.

14.10.3 [005] Mass Flow Overrange

Alert

Extreme PPV

Cause

The measured flow rate is outside the sensor's range.

Recommended actions

1. If other alerts are present, resolve those alert conditions first.
2. Check your process conditions against the values reported by the device.
3. Check for two-phase flow.

   Refer to Check for two-phase flow (slug flow).

   a) Check for two-phase alerts. If two-phase flow is the problem, alerts will be posted.

   b) Check the process for cavitation, flashing, or leaks.

   c) Monitor the density of your process fluid under normal process conditions.

4. Contact customer service.

14.10.4 [008] Density Overrange

Alert

Extreme PPV

Cause

The measured density is below 0 g/cm^3 or above 10 g/cm^3.

Recommended actions

1. If other alerts are present, resolve those alert conditions first.
2. Check your process conditions against the values reported by the device.
3. Check for two-phase flow by checking for two-phase alerts. If two-phase flow is the problem, alerts will be posted.
4. Contact customer service.

14.10.5 [009] Transmitter Initializing

Alert

Flowmeter Ini

Cause

The transmitter is in power-up mode.

Recommended actions

1. Allow the meter to complete its power-up sequence. The alert should clear automatically.
2. If the alert does not clear:
   a) If other alerts are present, resolve those alert conditions first.
   b) Verify that the transmitter is receiving sufficient power.
      - If it is not, correct the problem and cycle power to the device.
      - If it is, this suggests that the transmitter has an internal power issue. Replace the transmitter.

14.10.6 [010] Calibration Failed

Alert

Function Check Failed

Cause

The calibration failed.

Recommended actions

1. Ensure that your calibration procedure meets the documented requirements.
2. Reboot or power-cycle the transmitter.
3. Retry the procedure.
4. If this alert appears during zeroing, verify that there is no flow through the sensor, cycle power to the meter, then retry the procedure.

14.10.7 [016] Sensor Temperature (RTD) Failure

Alert

Sensor Failed

Cause

The value computed for the resistance of the line RTD is outside limits.

Recommended actions

1. Check the wiring between the sensor and the transmitter.
   a) Refer to the installation manual and ensure that the wiring has been performed according to instructions. Obey all applicable safety messages.
   b) Verify that the wires are making good contact with the terminals.
   c) Perform RTD resistance checks and check for shorts to case. If you find problems, replace the sensor.
   d) Check the continuity of all wires from the transmitter to the sensor.
2. Check your process conditions against the values reported by the device.

3. Check the feedthrough pins. Contact customer service for assistance. If you find problems, replace the sensor.
4. Check the core processor housing for moisture, corrosion, or verdigris.
5. Check the junction box for moisture, corrosion, or verdigris.
6. Contact customer service.

14.10.8 [017] Sensor Case Temperature (RTD) Failure

Alert

Sensor Failed

Cause

The values computed for the resistance of the meter and case RTDs are outside limits.

Recommended actions

1. Check the wiring between the sensor and the transmitter.
   a) Refer to the installation manual and ensure that the wiring has been performed according to instructions. Obey all applicable safety messages.
   b) Verify that the wires are making good contact with the terminals.
   c) Perform RTD resistance checks and check for shorts to case. If you find problems, replace the sensor.
   d) Check the continuity of all wires from the transmitter to the sensor.
2. Check your process conditions against the values reported by the device.
3. Contact customer service.

14.10.9 [018] EEPROM Error

Electronics Failed

Cause

There is an issue with the transmitter's non-volatile memory.

Recommended actions

1. Evaluate the environment for sources of high electromagnetic interference (EMI) and relocate the transmitter or wiring as necessary.
2. Cycle power to the meter.

   Important
   This alert will not clear until you cycle power to the meter.

3. If the problem persists, replace the transmitter.

14.10.10 [019] RAM Error (Transmitter)

Alert

Electronics Failed

Cause

There is a ROM checksum mismatch in the transmitter or the RAM address location cannot be written in the transmitter. This alert will not clear until you reboot or power cycle the transmitter.

Recommended actions

1. Ensure that all wiring compartment covers are installed correctly.
2. Ensure that all transmitter wiring meets specifications and that all cable shields are properly terminated.
3. Check the drain wires.
    a) Verify that the drain wires from the 4-wire cable are properly landed.
    b) Verify that the drain wires are landed outside the core processor housing.
    c) If the drain wires are landed inside the core processor housing, cover them by the foil shield for their full length until they land under the ground screw.
4. Ensure that all meter components are grounded properly.
5. Evaluate the environment for sources of high electromagnetic interference (EMI) and relocate the transmitter or wiring as necessary.
6. Reboot or power-cycle the transmitter to see if the alert clears.
7. If the alert persists, replace the transmitter.

14.10.11 [021] Incorrect Sensor Type

Alert

Config Error

Cause

The sensor is recognized as a straight tube but the K1 value indicates a curved tube, or vice versa.

Recommended actions

1. If **Sensor Case Temperature Failure** is active, resolve it first.
2. Check the characterization against the sensor tag. Specifically, verify the Flow FCF, K1, and K2 values.
3. Check the sensor RTD circuitry.
4. If the problem persists, contact customer service.

14.10.12 [022] Configuration Database Corrupt

Alert

Electronics Failed

Cause

There is an issue with the core processor's non-volatile memory.

Recommended actions

1. Cycle power to the meter.
2. If the problem persists, replace the core processor.

14.10.13 [024] Program Corrupt - Core

Alert

Electronics Failed

Cause

There is an issue with the core processor's non-volatile memory.

Recommended actions

1. Cycle power to the meter.
2. If the problem persists, replace the core processor.

14.10.14 [026] Sensor/Transmitter Communications Failure

Alert

Sens Xmtr Comm Error

Cause

The transmitter has lost communication with the core processor, or there have been too many communications errors.

Recommended actions

1. Check the wiring between the sensor and the transmitter.
2. Verify the power to both the transmitter and core processor.
3. Cycle power to the transmitter.
4. If the alert persists:
    a) Replace the core processor.
    b) If that does not solve the problem, restore the original core processor and replace the transmitter.
    c) If that does not solve the problem, replace both the transmitter and the core processor.

14.10.15 [028] Core Process Write Failure

Alert

Sens Xmtr Comm Error

Cause

A write to the core processor failed.

Recommended actions

1. Reboot or power-cycle the transmitter to see if the alert clears.
2. Contact customer service about servicing or replacing the core processor or transmitter.

14.10.16 [030] Incorrect Board Type

Alert

Configuration Error

Cause

The firmware or configuration loaded in the transmitter is incompatible with the board type.

Recommended actions

1. If this alarm occurred in conjunction with an effort to load a configuration into the transmitter, confirm that the transmitter is of the same model as the one the configuration came from.
2. Reboot or power-cycle the transmitter to see if the alert clears.
3. If the problem persists, contact customer service.

14.10.17 [031] Low Power

Alert

Core Low Power

Cause

The enhanced core processor is not receiving sufficient power. This alert will not clear until you reboot or power cycle the transmitter.

Recommended actions

1. Check the wiring between the sensor and the transmitter.
2. Measure the voltage at the core processor terminals and ensure that it is receiving a minimum of 11.5 volts at all times. If it is not, verify the power wiring to the transmitter.
3. Verify that the transmitter is receiving sufficient power.
    a) If it is not, correct the problem and reboot or power-cycle the transmitter.
    b) If it is, this suggests that the transmitter has an internal power issue. Replace the transmitter.

14.10.18 [033] Tube Not Full

Alert

Tube Not Full

Cause

The sensor is not responding. Settling from a two-phase or three-phase fluid can cause this alert even if the flow tubes are full. This could mean that the sensor needs to be reoriented.

Recommended actions

1. Check for possible fluid separation by monitoring the density value and comparing the results against expected density values.
2. Check for plugging, coating, or two-phase flow.
3. Verify that the sensor is oriented correctly.

   Settling from a two-phase or three-phase fluid can cause this alert even if the flow tubes are full. Refer to the sensor installation manual.

14.10.19 [034] Smart Meter Verification Failed

Alert

Function Check Failed

Cause

Smart Meter Verification has failed. The test result is not within the specification uncertainty limit.

Recommended actions

1. Rerun the test with outputs set to **Fault** or **Last Measured Value** instead of **Continue Measurement**.
2. If the meter passes the second test, ignore the first result.
3. If the meter fails the second test, the flow tubes may be damaged. Use your process knowledge to determine the possibilities for damage and the appropriate actions for each.

14.10.20 [035] Smart Meter Verification Aborted

Alert

FC Failed

Cause

The SMV test did not complete, possibly because it was manually aborted or because process conditions were too unstable.

Abort code 1

Cause

A user initiated an abort.

Recommended actions

Wait for 15 seconds before starting SMV again.

Abort code 3

Cause

Frequency drift

Recommended actions

Ensure temperature, flow, and density are stable before running SMV again.

Abort code 5

Cause

High drive gain

Recommended actions

Ensure flow is steady with minimized entrained gas before running SMV again.

Abort code 8

Cause

Unstable flow

Recommended actions

Reduce flow rate and run SMV again.

Abort code 13

Cause

No air reference

Recommended actions

Perform factory calibration on air.

Abort code 14

Cause

No water reference

Recommended actions

Perform factory calibration on water.

Abort code 15

Cause

Missing configuration

Recommended actions

Load verification parameter registers with proper values.

Abort code other

Cause

Other

Recommended actions

1. Run SMV again.
2. If abort persists, call customer support.

14.10.21 [102] Drive Overrange

Alert

Drive Over-Range

Cause

The drive power (current/ voltage) is at its maximum.

Recommended actions

1. Check your process conditions against the values reported by the device.
2. Check for air in the flow tubes, tubes not filled, foreign material in the tubes, coating in the tubes, or other process problems.
3. Verify that the tubes are full of process fluid.
4. Check the drive gain and the pickoff voltage.

   Refer to Check the pickoff voltage.
5. Check the sensor coils for electrical shorts. If you find problems, replace the sensor.

   Refer to Check for internal electrical problems.
6. Ensure that the sensor orientation is appropriate for your application.

   Settling from a two-phase or three-phase fluid can cause this alert even if the flow tubes are full.

14.10.22 [103] Data Loss Possible

Alert

Data Loss Possible

Cause

The totalizers are not being saved properly. The core processor was unable to store the totalizers on the last power down and must rely on the saved totals. The saved totals can be as much as two hours out of date.

Recommended actions

1. Make sure the transmitter and core processor are receiving sufficient power.
   - If it is not, correct the problem and reboot or power-cycle the transmitter.
   - If it is, this suggests that the transmitter has an internal power issue. Replace the transmitter.

2. Check the power supply and power supply wiring.

14.10.23 [104] Calibration in Progress

Alert

Function check in progress

Cause

A calibration procedure is in progress.

Recommended actions

1. Allow the test to complete.
2. For zero calibration procedures, you can abort the calibration, set the zero time parameter to a lower value, and restart the calibration.

14.10.24 [105] Two-Phase Flow

Alert

Process Aberration

Cause

Recommended actions

Check for two-phase flow.

Refer to Configure Lower Range Value (LRV) and Upper Range Value (URV) for the mA Output.

14.10.25 [110] Frequency Output Saturated

Alert

Output Saturated

Cause

The process variable assigned to the Frequency Output is outside the configured scale limits.

Recommended actions

1. Check the scaling of the **Frequency Output Scaling Method** parameter.
2. Check your process conditions against the values reported by the device.
3. Verify process conditions, checking especially for air in the flow tubes, tubes not filled, foreign material in the tubes, or coating in the tubes.
4. Verify that the measurement units are configured correctly for your application.
5. Purge the sensor tubes.

14.10.26 [111] Frequency Output Fixed

Alert

Output Fixed

Cause

Totalizers have been stopped or output simulation (loop testing) is enabled.

Recommended actions

1. Stop the totalizer to set the Frequency Output to zero.
2. Cycle power to the transmitter to restore the Frequency Output to normal operation.
3. Disable output simulation, if applicable.
4. Check if the output has been set to a constant value via digital communication.

14.10.27 [113] mA Output Saturated

Alert

Output Saturated

Cause

The calculated output value is outside the range of the output.

Recommended actions

1. Check the settings of **Upper Range Value** and **Lower Range Value**.

   Refer to Configure Lower Range Value (LRV) and Upper Range Value (URV) for the mA Output.
2. Check your process conditions against the values reported by the device.
3. Ensure that both devices are using the same measurement unit.
4. Purge the sensor tubes.

14.10.28 [114] mA Output Fixed

Alert

Output Fixed

Cause

Output simulation (loop testing) is enabled or mA Output trim is in progress.

Recommended actions

1. Disable output simulation, if applicable.
2. Exit mA Output trim, if applicable.
3. Check whether the output has been set to a constant value vial digital communication.

14.10.29 [115] No Input

Alert

Process Aberration

Cause

No response received from the polled device.

Recommended actions

1. Verify that the external device is operating correctly.
2. Verify the wiring between the transmitter and the external device.

14.10.30 [116] Temperature Out of Range

Alert

Process Aberration

Cause

The measured temperature is outside the range of the API table.

Recommended actions

1. Check your process conditions against the values reported by the device.
2. Verify the configuration of the API referral application and related parameters.

14.10.31 [117] Density Out of Range

Alert

Process Aberration

Cause

The measured density is below 0 g/cm^3 or above 10 g/cm^3.

Recommended actions

1. If other alerts are present, resolve those alert conditions first.
2. If the current alert persists, continue with the recommended actions.
3. Check for two-phase flow.
4. Check for foreign material in the process gas, process fluid, coating, or other process problems.
5. Verify all of the characterization or calibration parameters.
   See the sensor tag or the calibration sheet for your meter.
6. Check the drive gain and the pickoff voltage.
7. Perform Smart Meter Verification.
8. Contact customer service.

14.10.32 [119] Discrete Output Fixed

Alert

Output Fixed

Cause

Output simulation (loop testing) is enabled.

Recommended actions

Disable output simulation.

14.10.33 [120] Curve Fit Failure (Concentration)

Alert

Configuration Error

Cause

The configured density/temperature/concentration values do not result in a proper concentration measurement curve.

Recommended actions

1. Verify the configuration of the concentration measurement application.
2. Contact customer service.

14.10.34 [121] Extrapolation Alert (Concentration)

Alert

Process Aberration

Cause

The line density or line temperature is outside the range of the concentration matrix plus the configured extrapolation limit.

Recommended actions

1. Check your process conditions against the values reported by the device.
2. Verify the configuration of the concentration measurement application.

14.10.35 [123] Pressure Out of Range

Alert

Process Aberration

Cause

The line pressure is outside the range of the API table.

Recommended actions

1. Check your process conditions against the values reported by the device.
2. Verify the configuration of the API Referral application and related parameters.

14.10.36 [131] Smart Meter Verification in Progress

Alert

Function Check in Progress

Cause

A Smart Meter Verification test is running.

Recommended actions

Allow the test to complete.

14.10.37 [132] Sensor Simulation On

Alert

Sensor Being Simulated

Cause

- Simulation mode is enabled
- Device simulation is active

Recommended actions

Disable sensor simulation.

14.10.38 Core Has Incompatible ETO

Alert

Configuration Error

Cause

The core processor has an ETO installed that is incompatible with this device. The core can be updated but the ETO will be overwritten.

Recommended actions

Contact customer service to discuss options for reserving the ETO.

14.10.39 Core Processor Update Failed

Alert

Configuration Error

Cause

The core processor software update failed.

Recommended actions

1. Resolve any active alerts.
2. Check the connection between the transmitter and the core processor.
3. Reboot or power-cycle the transmitter, then retry the procedure.
4. Contact customer service.

14.10.40 Clock is Constant

Alert

Data Loss Possible

Cause

The real-time clock is not incrementing. Measurement is not affected, but log timestamps will not be accurate.

Recommended actions

Contact customer service.

14.10.41 Discrete Event [1-5] Active

Alert

Event Active

Cause

Discrete Event [1-5] has been triggered.

Recommended actions

No action required.

14.10.42 Fieldbus Bridge Communication Failure

Alert

Sens Xmtr Comm Error

Cause

The transmitter is detecting too many communication errors with the fieldbus bridge.

Recommended actions

1. Reboot or power-cycle the transmitter to see if the alert clears.
2. Contact customer service about replacing the core processor or transmitter.

14.10.43 Firmware Update Fail

Alert

Data Loss Possible

Cause

An error occurred when updating the firmware.

Recommended actions

1. Verify that the correct hex file is loaded onto the SD card.
2. Contact customer service.

14.10.44 Internal Memory Full

Alert

Data Loss Possible

Cause

The transmitter's internal memory is nearly full.

Recommended actions

Contact customer service.

14.10.45 No Permanent License

Alert

Data Loss Possible

Cause

A permanent license has not been installed in the transmitter firmware.

Recommended actions

1. If you have a permanent license, install it.
2. If you do not have a permanent license, contact customer service.

14.10.46 Out of service

Cause

One of the transducer blocks has been placed out of service.

Recommended actions

Return the block to Auto mode to resume normal operation.

14.10.47 Phase Genius Detected Moderate Severity

Alert

Process Aberration

Cause

Phase Genius is reporting moderate two-phase flow

Recommended actions

Verify your process.

14.10.48 SD Card Not Present

Alert

Data Loss Possible

Cause

The internal SD card has failed.

Recommended actions

1. Open the transmitter and verify that an SD card is present.
2. If the problem persists, call customer support.

14.10.49 Time Not Set

Alert

Configuration Error

Cause

The system time has not been entered. The system time is required for diagnostic logs.

Recommended actions

Set the system time.

14.10.50 Watchdog Error

Alert

Electronics Failed

Cause

The watchdog timer has expired.

Recommended actions

Contact customer support.

14.10.51 Watercut Limited at 0%

Alert

Configuration Error

Cause

Watercut at Line calculation is less than -5% based on input density. Watercut output is limited to 0%.

Recommended actions

1. Check the base oil density.
2. If the problem persists, contact customer service.

14.10.52 Watercut Limited at 100%

Alert

Output Saturated

Cause

Watercut at Line calculation is greater than 105% based on input density. Watercut output is limited to 100%.

Recommended actions

1. Check the base water density.
2. If the problem persists, contact customer service.

14.11 Perform a core processor resistance test

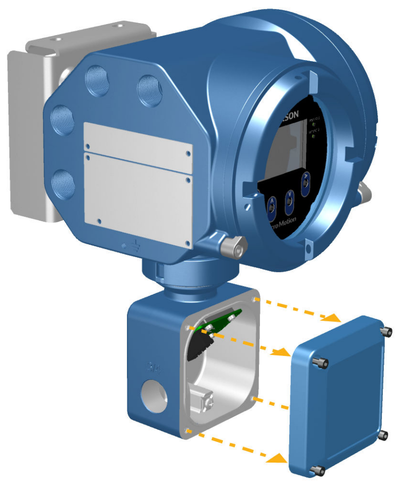
This procedure measures the resistance between the core processor terminals in the transmitter junction box. The procedure applies only to 4-wire remote installations and remote core processor with remote transmitter installations.

Note
Although you can perform the same test on the terminals at the core processor, the transmitter junction box is typically easier to access.

Procedure

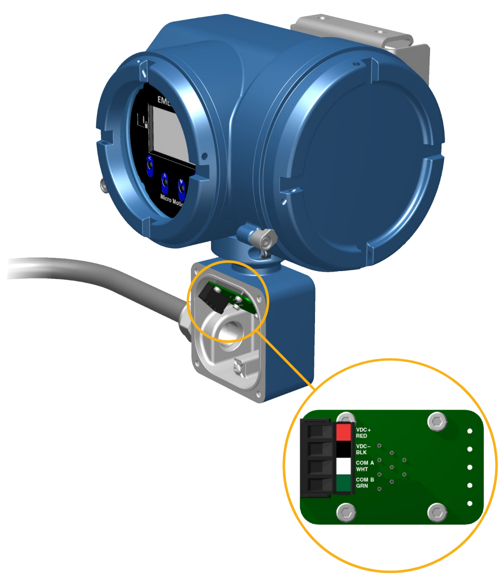
1. Power down the transmitter.
2. Remove the cover of the junction box on the transmitter to access the core processor terminals.

Figure 14-1: Removing the cover of the junction box



3. Disconnect the 4-wire cable between the transmitter and the sensor.
4. Identify the core processor terminals inside the transmitter junction box.

Figure 14-2: Core processor terminals inside the transmitter junction box



5. For the 700 core processor only, measure the resistance between the terminal pairs listed here.

Terminal pair (transmitter)	Terminal pair (core processor)	Function	Expected resistance
White – green	3–4	RS-485/A and RS-485/B	29 kΩ to 33 kΩ

Terminal pair (transmitter)	Terminal pair (core processor)	Function	Expected resistance
Black – white	2–3	VDC– and RS-485/A	29 kΩ to 33 kΩ
Black – green	2–4	VDC– and RS-485/B	16 kΩ to 18 kΩ

6. If any resistance measurements are lower than specified, contact customer service.
7. If the resistance measurements fall within the expected ranges, return the transmitter to normal operation and check the wiring between the transmitter and the core processor. If that does not resolve the problem, contact customer service.

Postrequisites

To return to normal operation:

1. Reconnect the 4-wire cable from the sensor to the core processor terminals.
2. Replace the junction box cover.
3. Restore power to the transmitter.

14.12 Check the cutoffs

If the transmitter cutoffs are configured incorrectly, the transmitter may report zero flow when flow is present, or very small amounts of flow under no-flow conditions.

Procedure

Verify the configuration of all cutoffs.

14.13 Check the direction parameters

If the direction parameters are set incorrectly, flow rate may be reported as reverse when it is actually forward, or vice versa. Totalizers and inventories may increment when they should decrement, or vice versa.

The reported flow rate and flow totals depend on the interaction of four factors: the flow direction arrow on the sensor, actual flow direction, the **Sensor Flow Direction Arrow** parameter, the **Direction** parameter for the mA output or the frequency output, and the **Totalizer Direction** parameter.

Procedure

1. Ensure that **Sensor Flow Direction Arrow** is set correctly for your sensor installation and your process.
2. Verify the configuration of **mA Output Direction**, **Frequency Output Direction**, and **Totalizer Direction**.

14.14 Check the drive gain

Excessive or erratic drive gain may indicate any of a variety of process conditions or sensor problems.

To know whether your drive gain is excessive or erratic, you must collect drive gain data during the problem condition and compare it to drive gain data from a period of normal operation.

Excessive (saturated) drive gain

Table 14-2: Possible causes and recommended actions for excessive (saturated) drive gain

Possible cause	Recommended actions
Bent sensor tube	Check the pickoff voltages (see Check the pickoff voltage). If either of them are close to zero (but neither is zero), the sensor tubes may be bent. The sensor will need to be replaced.
Cracked sensor tube	Replace the sensor.
Core processor or module failure	Contact customer support.
Flow rate out of range	Ensure that the flow rate is within sensor limits.
Open drive or pickoff sensor coil	Contact customer support.
Over-pressurized tubes	Contact customer support.
Plugged sensor tube	A dull, audible hum, and unusually high sensor vibration is usually accompanied by high, even saturated, drive gain. Check the pickoff voltages (see Check the pickoff voltage). If either of them are close to zero (but neither is zero), plugged tubes may be the source of your problem. Purge the tubes. In extreme cases, you may need to replace the sensor.
Sensor case full of process fluid	Replace the sensor.
Sensor imbalance	Contact customer support.
Sensor tubes not completely full	Correct process conditions so that the sensor tubes are full.
Two-phase flow	Check for two-phase flow. See Check for two-phase flow (slug flow).
Vibrating element not free to vibrate	Ensure that the vibrating element is free to vibrate.

Erratic drive gain

Table 14-3: Possible causes and recommended actions for erratic drive gain

Possible cause	Recommended actions
Foreign material caught in sensor tubes	• Purge the sensor tubes. • Replace the sensor.

14.15 Check for internal electrical problems

Shorts between sensor terminals or between the sensor terminals and the sensor case can cause the sensor to stop working.

Possible cause	Recommended action
Moisture inside the sensor junction box	Ensure that the junction box is dry and no corrosion is present.
Liquid or moisture inside the sensor case	Contact customer support.

Possible cause	Recommended action
Internally shorted feedthrough	Contact customer support.
Faulty cable	Replace the cable.
Improper wire termination	Verify wire terminations inside the sensor junction box. See *Micro Motion 9-Wire Flow Meter Cable Preparation and Installation Guide*.
Shorts to the housing created by trapped or damaged wires	Contact customer support.
Loose wires or connectors	Contact customer support.
Liquid or moisture inside the housing	Contact customer support.

14.16 Check Frequency Output Fault Action

The **Frequency Output Fault Action** controls the behavior of the Frequency Output if the transmitter encounters an internal fault condition. If the Frequency Output is reporting a constant value, the transmitter may be in a fault condition.

Procedure

1. Check the status alerts for active fault conditions.
2. If there are active fault conditions, the transmitter is performing correctly. If you want to change its behavior, change the setting of **Frequency Output Fault Action**.
3. If there are no active fault conditions, continue troubleshooting.

14.17 Check the scaling of the Frequency Output

If the process variable assigned to the Frequency Output goes to a value that would set the Frequency Output to a signal below 0 Hz or above 12500 Hz, the meter will post an Output Saturated alert for the affected output, then perform the configured fault action.

Procedure

1. Record your current process conditions.
2. Adjust the scaling of the Frequency Output.

14.18 Check grounding

A sensor and the transmitter must be grounded.

Prerequisites

You will need an:

- Installation manual for your sensor
- Installation manual for your transmitter (remote-mount installations only)

Procedure

Refer to the sensor and transmitter installation manuals for grounding requirements and instructions.

14.19 Perform loop tests

A loop test is a way to verify that the transmitter and the remote device are communicating properly. A loop test also helps you know whether you need to trim mA Outputs.

Prerequisites

- Follow appropriate procedures to ensure that loop testing will not interfere with existing measurement and control loops.

Related information

Perform loop tests using the display
Perform loop tests using ProLink III
Perform loop tests using a field communicator or an enhanced FF host

14.19.1 Perform loop tests using the display

Procedure

1. Test the mA Output(s).
    a) Choose **Menu** → **Service Tools** → **Output Simulation** and select the mA Output to test.
    b) Set **Simulation Value** to `4`.
    c) Start the simulation.
    d) Read the mA current at the receiving device and compare it to the transmitter output.

       The readings do not need to match exactly. If the values are slightly different, you can correct the discrepancy by trimming the output.
    e) Choose **New Value**.
    f) Set **Simulation Value** to `20`.
    g) Start the simulation.
    h) Read the mA current at the receiving device and compare it to the transmitter output.

       The readings do not need to match exactly. If the values are slightly different, you can correct the discrepancy by trimming the output.
    i) Choose **Exit**.
2. Test the Frequency Output(s).
    a) Choose **Menu** → **Service Tools** → **Output Simulation** and select the Frequency Output to test.
    b) Set **Simulation Value** to `1`.
    c) Start the simulation.

d) Read the frequency signal at the receiving device and compare it to the transmitter output.

e) Choose **New Value**.

f) Set **Simulation Value** to `14500`.

g) Start the simulation.

h) Read the frequency signal at the receiving device and compare it to the transmitter output.

i) Choose **Exit**.

3. Test the Discrete Output(s).

   a) Choose **Menu** → **Service Tools** → **Output Simulation** and select the discrete output to test.

   b) Set **Simulation Value** to ON.

   c) Start the simulation.

   d) Verify the signal at the receiving device.

   e) Choose **New Value**.

   f) Set **Simulation Value** to OFF.

   g) Start the simulation.

   h) Verify the signal at the receiving device.

   i) Choose **Exit**.

Postrequisites

- If the mA Output readings are within 20 microamps of the expected values, you can correct this discrepancy by trimming the output.
- If the discrepancy between the mA Output readings is greater than 20 microamps, or if at any step the reading was faulty, verify the wiring between the transmitter and the remote device, and try again.
- If the Discrete Output readings are reversed, check the setting of **Discrete Output Polarity**.

14.19.2 Perform loop tests using ProLink III

Procedure

1. Test the mA Output(s).

   a) Choose **Device Tools** → **Diagnostics** → **Testing** and select the mA output to test.

   b) Enter `4` in **Fix to:**.

   c) Select **Fix mA**.

   d) Read the mA current at the receiving device and compare it to the transmitter output.

      The readings do not need to match exactly. If the values are slightly different, you can correct the discrepancy by trimming the output.

   e) Select **UnFix mA**.

f) Enter `20` in **Fix to:**.

g) Select **Fix mA**.

h) Read the mA current at the receiving device and compare it to the transmitter output.

The readings do not need to match exactly. If the values are slightly different, you can correct the discrepancy by trimming the output.

i) Select **UnFix mA**.

2. Test the Frequency Output(s).

a) Choose **Device Tools** → **Diagnostics** → **Testing** and select the frequency output to test.

b) Enter the Frequency Output value in **Fix to**.

c) Select **Fix FO**.

d) Read the frequency signal at the receiving device and compare it to the transmitter output.

e) Select **UnFix FO**.

3. Test the Discrete Output(s).

a) Choose **Device Tools** → **Diagnostics** → **Testing** → **Discrete Output Test**.

b) Set **Fix to:** to ON.

c) Verify the signal at the receiving device.

d) Set **Fix to:** to OFF.

e) Verify the signal at the receiving device.

f) Select **UnFix**.

Postrequisites

- If the mA Output readings are within 20 microamps of the expected values, you can correct this discrepancy by trimming the output.
- If the discrepancy between the mA Output readings is greater than 20 microamps, or if at any step the reading was faulty, verify the wiring between the transmitter and the remote device, and try again.
- If the Discrete Output readings are reversed, check the setting of **Discrete Output Polarity**.

14.19.3 Perform loop tests using a field communicator or an enhanced FF host

Procedure

1. Test the mA Output(s).

a) Choose **Service Tools** → **Simulate** → **Simulate Outputs** and select the mA output to test.

b) Select **4 mA**.

c) Read the mA current at the receiving device and compare it to the transmitter output.

The readings do not need to match exactly. If the values are slightly different, you can correct the discrepancy by trimming the output.

d) Press **OK**.

e) Select **20 mA**.

f) Read the mA current at the receiving device and compare it to the transmitter output.

The readings do not need to match exactly. If the values are slightly different, you can correct the discrepancy by trimming the output.

g) Press **OK**.

h) Choose **End**.

2. Test the Frequency Output(s).
    a) Choose **Service Tools** → **Simulate** → **Simulate Outputs** and select the Frequency Output to test.
    b) Select the Frequency Output level.
    c) Press **OK**.
    d) Choose **End**.

3. Test the Discrete Output(s).
    a) Choose **Service Tools** → **Simulate** → **Simulate Outputs** and select the Discrete Output to test.
    b) Choose **Off**.
    c) Verify the signal at the receiving device.
    d) Press **OK**.
    e) Choose **On**.
    f) Verify the signal at the receiving device.
    g) Press **OK**.
    h) Choose **End**.

Postrequisites

- If the mA Output readings are within 20 microamps of the expected values, you can correct this discrepancy by trimming the output.
- If the discrepancy between the mA Output readings is greater than 20 microamps, or if at any step the reading was faulty, verify the wiring between the transmitter and the remote device, and try again.
- If the Discrete Output readings are reversed, check the setting of **Discrete Output Polarity**.

14.20 Check Lower Range Value and Upper Range Value

If the process variable assigned to the mA Output falls below the configured **Lower Range Value** (LRV) or rises above the configured **Upper Range Value** (URV), the meter will post an Output Saturated alert for the affected output, then perform the configured fault action.

Procedure

1. Record your current process conditions.
2. Check the configuration of the LRV and URV.

14.21 Check mA Output Fault Action

The **mA Output Fault Action** controls the behavior of the mA Output if the transmitter encounters an internal fault condition. If the mA Output is reporting a constant value below 4 mA or above 20 mA, the transmitter may be in a fault condition.

Procedure

1. Check the status alerts for active fault conditions.
2. If there are active fault conditions, the transmitter is performing correctly. If you want to change its behavior, change the setting of **mA Output Fault Action**.
3. If there are no active fault conditions, continue troubleshooting.

14.22 Trim mA Output

Trimming an mA Output calibrates the transmitter's mA Output to the receiving device. If the current trim value is inaccurate, the transmitter will under-compensate or over-compensate the output.

Related information

Trim an mA Output using the display
Trim mA Output using ProLink III
Trim mA Outputs using a field communicator or an enhanced FF host

14.22.1 Trim an mA Output using the display

Trimming the mA Output establishes a common measurement range between the transmitter and the device that receives the mA Output.

Prerequisites

Ensure that the mA Output is wired to the receiving device that will be used in production.

Procedure

1. Choose **Menu** → **Service Tools** → **mA Output Trim** and select the output to trim.
2. Follow the instructions in the guided method.
3. Check the trim results. If any trim result is less than −20 microamps or greater than +20 microamps, contact customer service.

14.22.2 Trim mA Output using ProLink III

Trimming the mA Output establishes a common measurement range between the transmitter and the device that receives the mA Output.

Prerequisites

Ensure that the mA Output is wired to the receiving device that will be used in production.

Procedure

1. Follow the instructions in the guided method.
2. Check the trim results. If any trim result is less than −20 microamps or greater than +20 microamps, contact customer service.

14.22.3 Trim mA Outputs using a field communicator or an enhanced FF host

Trimming the mA Output establishes a common measurement range between the transmitter and the device that receives the mA Output.

Prerequisites

Ensure that the mA Output is wired to the receiving device that will be used in production.

Procedure

1. Choose **Menu** → **Service Tools** → **Maintenance** → **Routine Maintenance** → **Trim mA Output**.
2. Follow the instructions in the guided method.
3. Check the trim results. If any trim result is less than −20 microamps or greater than +20 microamps, contact customer service.

14.22.4 Trim mA Outputs using a basic FF host

Trimming the mA Output establishes a common measurement range between the transmitter and the device that receives the mA Output.

Prerequisites

Ensure that the mA Output is wired to the receiving device that will be used in production.

Procedure

Check the trim results. If any trim result is less than −20 microamps or greater than +20 microamps, contact customer service.

14.23 Check the pickoff voltage

If the pickoff voltage readings are unusually low, you may have any of a variety of process or equipment problems.

To know whether your pickoff voltage is unusually low, you must collect pickoff voltage data during the problem condition and compare it to pickoff voltage data from a period of normal operation.

Drive gain and pickoff voltage are inversely proportional. As drive gain increases, pickoff voltages decrease and vice versa.

Table 14-4: Possible causes and recommended actions for low pickoff voltage

Possible cause	Recommended actions
Faulty wiring runs between the sensor and transmitter	Verify wiring between sensor and transmitter.
Process flow rate beyond the limits of the sensor	Verify that the process flow rate is not out of range of the sensor.
Sensor tubes are not vibrating	• Check for plugging or deposition. • Ensure that the vibrating element is free to vibrate (no mechanical binding). • Verify wiring.
Moisture in the sensor electronics	Eliminate the moisture in the sensor electronics.
The sensor is damaged, or sensor magnets may have become demagnetized	Replace the sensor.

14.24 Check power supply wiring

If the power supply wiring is damaged or improperly connected, the transmitter may not receive enough power to operate properly.

Prerequisites

- You will need the installation manual for your transmitter.

Procedure

1. Use a voltmeter to test the voltage at the transmitter's power supply terminals.
   - If the voltage is within the specified range, you do not have a power supply problem.
   - If the voltage is low, ensure that the power supply is adequate at the source, the power cable is sized correctly, there is no damage to the power cable, and an appropriate fuse is installed.
   - If there is no power, continue with this procedure.
2. **WARNING**
   If the transmitter is in a hazardous area, wait five minutes after disconnecting the power. Failure to do so could result in an explosion causing death or injury.

   Before inspecting the power supply wiring, disconnect the power source.
3. Ensure that the terminals, wires, and wiring compartment are clean and dry.
4. Ensure that the power supply wires are connected to the correct terminals.

5. Ensure that the power supply wires are making good contact, and are not clamped to the wire insulation.
6. **WARNING**

   If the transmitter is in a hazardous area, do not reapply power to the transmitter with the housing cover removed. Reapplying power to the transmitter while the housing cover is removed could cause an explosion.

   Reapply power to the transmitter.
7. Test the voltage at the terminals.
   If there is no power, contact customer service.

14.25 Check for radio frequency interference (RFI)

The transmitter's Frequency Output or Discrete Output can be affected by radio frequency interference (RFI). Possible sources of RFI include a source of radio emissions, or a large transformer, pump, or motor that can generate a strong electromagnetic field. Several methods to reduce RFI are available. Use one or more of the following suggestions, as appropriate to your installation.

Procedure

- Use shielded cable between the output and the receiving device.
  - Terminate the shielding at the receiving device. If this is impossible, terminate the shielding at the cable gland or conduit fitting.
  - Do not terminate the shielding inside the wiring compartment.
  - 360-degree termination of shielding is unnecessary.
- Eliminate the RFI source.
- Move the transmitter.

14.26 Check sensor-to-transmitter wiring

A number of power-supply and output problems may occur if the wiring between the sensor and the transmitter is improperly connected, or if the wiring becomes damaged.

Be sure to check all wiring segments:

- If you have a 4-wire transmitter, check the wiring between the transmitter and the core processor.
- If you have a 9-wire transmitter, check the wiring between the transmitter and the sensor junction box.
- If you have a remote transmitter with remote core processor, check the wiring between the transmitter and the core processor and the wiring between the core processor and the sensor junction box.

Prerequisites

You will need the installation manual for your transmitter.

Procedure

1. Before opening the wiring compartments, disconnect the power source.

WARNING
If the transmitter is in a hazardous area, wait five minutes after disconnecting the power. Failure to do so could result in an explosion causing death or injury.

2. Verify that the transmitter is connected to the sensor according to the information provided in the installation manual.
3. Verify that the wires are making good contact with the terminals.
4. Check the continuity of all wires from the transmitter to the sensor.

14.27 Check the sensor coils

Checking the sensor coils can identify a cause for a no sensor response alert.

Procedure

1. Disconnect power to the transmitter.

   WARNING
   If the transmitter is in a hazardous area, wait five minutes after disconnecting the power. Failure to do so could result in an explosion causing death or injury.

2. Unplug the terminal blocks from the terminal board on the core processor.
3. Using a digital multimeter (DMM), check the pickoff coils by placing the DMM leads on the unplugged terminal blocks for each terminal pair. See Table 14-5 for a list of the coils. Record the values.

Table 14-5: Coils and test terminal pairs

Coil	Sensor model	Terminal colors
Drive coil	All	Brown to red
Left pickoff coil (LPO)	All	Green to white
Right pickoff coil (RPO)	All	Blue to gray
Resistance temperature detector (RTD)	All	Yellow to violet
Lead length compensator (LLC)	All except T-Series and CMF400 (see note)	Yellow to orange
Composite RTD	CMFS025-150 and T-Series	Yellow to orange
Fixed resistor (see note)	CMFS007, CMFS010, CMFS015, CMF400, and F300	Yellow to orange

Note
The CMF400 fixed resistor applies only to certain specific CMF400 releases. Contact customer support for more information.

There should be no open circuits, that is, no infinite resistance readings. The left pickoff and right pickoff readings should be the same or very close (±5 Ω). If there are any unusual readings, repeat the coil resistance tests at the sensor junction box to eliminate the possibility of faulty cable. The readings for each coil pair should match at both ends.

4. Test the terminals in the sensor junction box for shorts to case.
    a) Leave the terminal blocks disconnected.
    b) Remove the lid of the junction box.
    c) Testing one terminal at a time, place a DMM lead on the terminal and the other lead on the sensor case.

       With the DMM set to its highest range, there should be infinite resistance on each lead. If there is any resistance at all, there is a short to case.

5. Test the resistance of junction box terminal pairs.
    a) Test the brown terminal against all other terminals except the red one.
    b) Test the red terminal against all other terminals except the brown one.
    c) Test the green terminal against all other terminals except the white one.
    d) Test the white terminal against all other terminals except the green one.
    e) Test the blue terminal against all other terminals except the gray one.
    f) Test the gray terminal against all other terminals except the blue one.
    g) Test the orange terminal against all other terminals except the yellow and violet ones.
    h) Test the yellow terminal against all other terminals except the orange and violet ones.
    i) Test the violet terminal against all other terminals except the yellow and orange ones.

   There should be infinite resistance for each pair. If there is any resistance at all, there is a short between terminals.

Postrequisites

To return to normal operation:

1. Plug the terminal blocks into the terminal board.
2. Replace the lid on the sensor junction box.

Important
When reassembling the meter components, be sure to grease all O-rings.

14.28 Using sensor simulation for troubleshooting

When sensor simulation is enabled, the transmitter reports user-specified values for basic process variables. This allows you to reproduce various process conditions or to test the system.

You can use sensor simulation to help distinguish between legitimate process noise and externally caused variation. For example, consider a receiving device that reports an unexpectedly erratic density value. If sensor simulation is enabled and the observed density value does not match the simulated value, the source of the problem is likely to be somewhere between the transmitter and the receiving device.

Sensor simulation requires an enhanced core and a communication device.

Important
When sensor simulation is active, the simulated value is used in all transmitter outputs and calculations, including totals and inventories, volume flow calculations, and concentration calculations. Disable all

automatic functions related to the transmitter outputs and place the loop in manual operation. Do not enable simulation mode unless your application can tolerate these effects, and be sure to disable simulation mode when you have finished testing.

14.29 Check for two-phase flow (slug flow)

Two-phase flow can cause rapid changes in the drive gain. This can cause a variety of measurement issues.

Procedure

1. Check for two-phase flow alerts (e.g., A105).
   If the transmitter is not generating two-phase flow alerts, verify that two-phase flow limits have been set. If limits are set, two-phase flow is not the source of your problem.
2. Check the process for cavitation, flashing, or leaks.
3. Monitor the density of your process fluid output under normal process conditions.
4. Check the settings of **Two-Phase Flow Low Limit**, **Two-Phase Flow High Limit**, and **Two-Phase Flow Timeout**.

   Tip
   You can reduce the occurrence of two-phase flow alerts by setting **Two-Phase Flow Low Limit** to a lower value, **Two-Phase Flow High Limit** to a higher value, or **Two-Phase Flow Timeout** to a higher value.

14.30 Simulation problems

14.30.1 [132] Sensor Simulation On

Alert

Sensor Being Simulated

Cause

- Simulation mode is enabled
- Device simulation is active

Recommended actions

Disable sensor simulation.

14.31 Temperature measurement troubleshooting

Table 14-6: Temperature measurement problems and recommended actions

Problem	Possible causes	Recommended actions
Temperature reading significantly different from process temperature	• RTD failure • Wiring problem • Incorrect calibration factors • Line temperature in bypass does not match temperature in main line	• For sensors with a junction box, check for moisture in the junction box. • Check the sensor coils for electrical shorts. If you find problems, replace the sensor. • Ensure that all of the calibration parameters have been entered correctly. See the sensor tag or the calibration sheet for your meter. • Refer to status alerts (especially RTD failure alerts). • Disable external temperature compensation. • Verify temperature calibration. • Check the wiring between the sensor and the transmitter.
Temperature reading slightly different from process temperature	• Sensor temperature not yet equalized • Sensor leaking heat	• If the error is within the temperature specification for the sensor, there is no problem. If the temperature measurement is outside the specification, contact customer service. • The temperature of the fluid may be changing rapidly. Allow sufficient time for the sensor to equalize with the process fluid. • Install thermal installation, up to but not over, the transmitter housing. • Check the sensor coils for electrical shorts. If you find problems, replace the sensor. • The RTD may not be making good contact with the sensor. The sensor may need to be replaced.
Inaccurate temperature data from external device	• Wiring problem • Problem with input configuration • Problem with external device	• Verify the wiring between the transmitter and the external device. • Verify that the external device is operating correctly. • Verify the configuration of the temperature input. • Ensure that both devices are using the same measurement unit.

14.32 Velocity measurement troubleshooting

Important
If you are measuring gas, minor inaccuracy in velocity readings is expected. If this is an issue for your application, contact customer support.

Table 14-7: Velocity measurement problems and recommended actions

Problem	Possible causes	Recommended actions
Non-zero velocity reading at no-flow conditions or at zero offset	• Misaligned piping (especially in new installations) • Open or leaking valve • Incorrect sensor zero	• Zero the meter. • Check for open or leaking valves or seals. • Check for mounting stress on the sensor (for example, the sensor being used to support piping, misaligned piping). • Contact customer service.
Erratic non-zero flow rate at no-flow conditions	• Leaking valve or seal • Two-phase flow • Plugged or coated sensor tube • Incorrect sensor orientation • Wiring problem • Vibration in pipeline at rate close to sensor tube frequency • Damping value too low • Mounting stress on sensor	• Verify that the sensor orientation is appropriate for your application. See the installation manual for your sensor. • Check the drive gain and the pickoff voltage. • Purge the sensor tubes. • Check for open or leaking valves or seals. • Check for sources of vibration. • Verify damping configuration. • Verify that the measurement units are configured correctly for your application. • Check for two-phase flow. • Check for radio frequency interference. • Contact customer service.

Table 14-7: Velocity measurement problems and recommended actions *(continued)*

Problem	Possible causes	Recommended actions
Erratic non-zero velocity reading when velocity is steady	• Two-phase flow • Damping value too low • Plugged or coated sensor tube • Output wiring problem • Problem with receiving device • Wiring problem	• Verify that the sensor orientation is appropriate for your application. See the installation manual for your sensor. • Check the drive gain and the pickoff voltage. • Check for air entrainment, tube fouling, flashing, or tube damage. • Purge the sensor tubes. • Check for open or leaking valves or seals. • Check for sources of vibration. • Verify damping configuration. • Verify that the measurement units are configured correctly for your application. • Check for two-phase flow. • Check for radio frequency interference. • Contact customer service.
Inaccurate velocity reading	• Wiring problem • Inappropriate measurement unit • Incorrect flow calibration factor • Incorrect density calibration factors • Incorrect grounding • Two-phase flow • Problem with receiving device • Incorrect sensor zero	• Verify that the measurement units are configured correctly for your application. • Zero the meter. • Check the grounding of all components. • Check for two-phase flow. • Verify the receiving device, and the wiring between the transmitter and the receiving device. • Replace the core processor or transmitter.

A FOUNDATION Fieldbus resource block and transducer blocks

A.1 Resource block

The following table lists the parameters contained in the resource block.

Seven views are defined for the resource block. The table also shows the applicable views for each parameter, and the size of the parameter in that view, in bytes.

Many of the parameters are common to all fieldbus devices. Definitions for these parameters are available in the referenced fieldbus specification.

Table A-1: Resource block

Index	Name	View							Description
		1	2	3	3_1	4	4_1	4_2	
1	ST_REV	2	2	2	2	2	2	2	Refer to the FF-891 specification.
2	TAG_DESC								Refer to the FF-891 specification.
3	STRATEGY					2			Refer to the FF-891 specification.
4	ALERT_KEY					1			Refer to the FF-891 specification.
5	MODE_BLK	4		4					Refer to the FF-891 specification.
6	BLOCK_ERR	2		2					Refer to the FF-891 specification.
7	RS_STATE	1		1					Refer to the FF-891 specification.
8	TEST_RW								Refer to the FF-891 specification.
9	DD_RESOURCE								Refer to the FF-891 specification.
10	MANUFAC_ID					4			Refer to the FF-891 specification.
11	DEV_TYPE					2			Refer to the FF-891 specification.
12	DEV_REV					1			Refer to the FF-891 specification.
13	DD_REV					1			Refer to the FF-891 specification.
14	GRANT_DENY		2						Refer to the FF-891 specification.
15	HARD_TYPES					2			Refer to the FF-891 specification.
16	RESTART								Refer to the FF-891 specification.
17	FEATURES					2			Refer to the FF-891 specification.
18	FEATURE_SEL		2						Refer to the FF-891 specification.
19	CYCLE_TYPE					2			Refer to the FF-891 specification.
20	CYCLE_SEL		2						Refer to the FF-891 specification.
21	MIN_CYCLE_T					4			Refer to the FF-891 specification.
22	MEMORY_SIZE					2			Refer to the FF-891 specification.

Table A-1: Resource block *(continued)*

Index	Name	View							Description
		1	2	3	3_1	4	4_1	4_2	
23	NV_CYCLE_T		4						Refer to the FF-891 specification.
24	FREE_SPACE		4						Refer to the FF-891 specification.
25	FREE_TIME	4		4					Refer to the FF-891 specification.
26	SHED_RCAS		4						Refer to the FF-891 specification.
27	SHED_ROUT		4						Refer to the FF-891 specification.
28	FAULT_STATE	1		1					Refer to the FF-891 specification.
29	SET_FSTATE								Refer to the FF-891 specification.
30	CLR_FSTATE								Refer to the FF-891 specification.
31	MAX_NOTIFY					1			Refer to the FF-891 specification.
32	LIM_NOTIFY		1						Refer to the FF-891 specification.
33	CONFIRM_TIME		4						Refer to the FF-891 specification.
34	WRITE_LOCK		1						Refer to the FF-891 specification.
35	UPDATE_EVT								Refer to the FF-891 specification.
36	BLOCK_ALM								Refer to the FF-891 specification.
37	ALARM_SUM	8		8					Refer to the FF-891 specification.
38	ACK_OPTION					2			Refer to the FF-891 specification.
39	WRITE_PRI					1			Refer to the FF-891 specification.
40	WRITE_ALM								Refer to the FF-891 specification.
41	ITK_VER					2			Refer to the FF-891 specification.
42	FD_VER					2			Refer to the FF-912 specification.
43	FD_FAIL_ACTIVE	4		4					Refer to the FF-912 specification.
44	FD_OFFSPEC_ACTIVE	4		4					Refer to the FF-912 specification.
45	FD_MAINT_ACTIVE	4		4					Refer to the FF-912 specification.
46	FD_CHECK_ACTIVE	4		4					Refer to the FF-912 specification.
47	FD_FAIL_MAP					4			Refer to the FF-912 specification.
48	FD_OFFSPEC_MAP					4			Refer to the FF-912 specification.
49	FD_MAINT_MAP					4			Refer to the FF-912 specification.
50	FD_CHECK_MAP					4			Refer to the FF-912 specification.
51	FD_FAIL_MASK					4			Refer to the FF-912 specification.

Table A-1: Resource block *(continued)*

Index	Name	View							Description
		1	2	3	3_1	4	4_1	4_2	
52	FD_OFFSPEC_MASK					4			Refer to the FF-912 specification.
53	FD_MAINT_MASK					4			Refer to the FF-912 specification.
54	FD_CHECK_MASK					4			Refer to the FF-912 specification.
55	FD_FAIL_ALM								Refer to the FF-912 specification.
56	FD_OFFSPEC_ALM								Refer to the FF-912 specification.
57	FD_MAINT_ALM								Refer to the FF-912 specification.
58	FD_CHECK_ALM								Refer to the FF-912 specification.
59	FD_FAIL_PRI					1			Refer to the FF-912 specification.
60	FD_OFFSPEC_PRI					1			Refer to the FF-912 specification.
61	FD_MAINT_PRI					1			Refer to the FF-912 specification.
62	FD_CHECK_PRI					1			Refer to the FF-912 specification.
63	FD_SIMULATE			9					Refer to the FF-912 specification.
64	FD_RECOMMEN_ACT	2		2					Refer to the FF-912 specification.
65	FD_EXTENDED_ACTIVE_1	4		4					Refer to the FF-912 specification.
66	FD_EXTENDED_MAP_1					4			Refer to the FF-912 specification.
67	COMPATIBILITY_REV								This parameter is used when replacing field devices. The correct value of this parameter is the DEV_REV value of the replaced device.
68	HARDWARE_REVISION								Hardware revision of the hardware.
69	SOFTWARE_REV								Software revision of the source code that contains the resource block.
70	PD_TAG						32		PD tag description of device
71	DEV_STRING						32		This is used to load new licensing into the device. The value can be written but will always read back with a value of 0.
72	DEV_OPTIONS						4		Indicates which device licensing options are enabled.
73	OUTPUT_BOARD_SN						4		Output board serial number.
74	FINAL_ASSY_NUM						4		The same final assembly number placed on the neck label.

Table A-1: Resource block *(continued)*

Index	Name	View							Description
		1	2	3	3_1	4	4_1	4_2	
75	DOWNLOAD_MODE								Gives access to the boot block code for over the wire downloads 0=Uninitialized 1=Run mode 2=Download mode
76	HEALTH_INDEX			1					Parameter representing the overall health of the device. 100=Perfect.
77	FAILED_PRI							1	Designates the alerting priority of the FAILED_ALM and also used as switch b/w Field Diagnostics and legacy PlantWeb alerts. If value is greater than or equal to 1, PlantWeb alerts will be active in device; otherwise, device will use Field Diagnostics alerts.
78	RECOMMENDED_ACTION				2				Enumerated list of recommended actions displayed with a device alert.
79	FAILED_ALM								Alert indicating a failure within a device which makes the device non-operational.
80	MAINT _ALM								Alert indicating that the device needs maintenance soon. If the condition is ignored, the device will eventually fail.
81	ADVISE _ALM								Alert indicating advisory alerts. These conditions do not have a direct impact on the process or device integrity.
82	FAILED_ENABLE							4	Enabled FAILED_ALM alert conditions. Corresponds bit for bit to FAILED_ACTIVE. A bit on means that the corresponding alert condition is enabled and will be detected. A bit off means the corresponding alert condition is disabled and will not be detected. This parameter is the Read Only copy of FD_FAIL_MAP.
83	FAILED_MASK							4	Mask of Failure Alert. Corresponds bit for bit to the FAILED_ACTIVE. A bit on means that the failure is masked out from alerting. This parameter is the Read Only copy of FD_FAIL_MASK.
84	FAILED_ACTIVE				4				Enumerated list of advisory conditions within a device. All open bits are free to be used as appropriate for each specific device. This parameter is the Read Only copy of FD_FAIL_ACTIVE.
85	MAINT_PRI							1	Designates the alerting priority of the MAINT_ALM.

Table A-1: Resource block *(continued)*

Index	Name	View							Description
		1	2	3	3_1	4	4_1	4_2	
86	MAINT_ENABLE							4	Enabled MAINT_ALM alert conditions. Corresponds bit for bit to MAINT_ACTIVE. A bit on means that the corresponding alert condition is enabled and will be detected. A bit off means the corresponding alert condition is disabled and will not be detected. This parameter is the Read Only copy of FD_OFFSPEC_MAP
87	MAINT _MASK							4	Mask of Maintenance Alert. Corresponds bit for bit to MAINT_ACTIVE. A bit on means that the failure is masked out from alerting. This parameter is the Read Only copy of FD_OFFSPEC_MASK
88	MAINT _ACTIVE				4				Enumerated list of advisory conditions within a device. All open bits are free to be used as appropriate for each specific device. This parameter is the Read Only copy of FD_OFFSPEC_ACTIVE
89	ADVISE_PRI							1	Designates the alerting priority of the ADVISE_ALM.
90	ADVISE_ENABLE							4	Enabled ADVISE_ALM alert conditions. Corresponds bit for bit to ADVISE_ACTIVE. A bit on means that the corresponding alert condition is enabled and will be detected. A bit off means the corresponding alert condition is disabled and will not be detected. This parameter is the Read Only copy of FD_MAINT_MAP & FD_CHECK_MAP
91	ADVISE _MASK							4	Mask of Advisory Alert. Corresponds bit for bit to ADVISE_ACTIVE. A bit on means that the failure is masked out from alerting. This parameter is the Read Only copy of FD_MAINT_MASK & FD_CHECK_MASK
92	ADVISE _ACTIVE				4				Enumerated list of advisory conditions within a device. This parameter is the Read Only copy of FD_MAINT_ACTIVE & FD_CHECK_ACTIVE
93	FD_MASK_ALL							4	Masks FD conditions in all FD categories.

Table A-1: Resource block *(continued)*

Index	Name	View							Description
		1	2	3	3_1	4	4_1	4_2	
94	FD_MAP_VALUE_1							16	This parameter shall be used to map FD conditions from 0-15 bit positions to any of 4 FD categories. FD_MAP_VALUE_1 & FD_*_MAP parameters shall reflect similar FD mapping configuration for bit 0-15
95	FD_MAP_VALUE_2							16	Maps FD conditions from 16-31 bit position to any of 4 FD categories. FD_MAP_VALUE_2 & FD_*_MAP parameters shall reflect similar FD mapping configuration for bit 16-31.
96	ATTACHEDCORETYPE								Enumerated value indication for attached core processor type.

A.2 Transducer blocks and views

List of transducer blocks

The fieldbus interface is implemented via the following transducer blocks.

Table A-2: Transducer blocks

Transducer block	Tag	Alternate name	Description
Measurement	MEASUREMENT TB	TRANSDUCER 1200	Configuration parameters and data for mass flow rate, volume flow rate, density, and temperature
Device	DEVICE TB	TRANSDUCER 1400	Contains informational static data such as software revisions, serial numbers, calibration data, LDO configuration data and physical IO configuration data
Totalizer & Inventory	TOTAL INVENTORY TB	TRANSDUCER 1600	Contains seven configurable totals and inventories data along with their configuration
Meter Verification	METER VERIFICATION TB	TRANSDUCER 1800	Contains the meter verification configuration and process
Petroleum Measurement (API)	PETRO MEAS TB	TRANSDUCER 2000	Contains PM process variables and configuration data
Concentration Measurement	CONC MEAS TB	TRANSDUCER 2200	Contains concentration measurement process variables and configuration data
Advance Phase Measurement (APM)	APM MEAS TB	TRANSDUCER 2400	Contains advance phase measurement variables and configuration data.

Definitions for transducer block details

Use the following definitions for the transducer block “details” tables:

#	Index of the FF parameter in the object dictionary
Name	Name used in code
Label	Name as it appears in most configuration tools
Msg type	One of the following:

VAR	A value
ENUM (ENUM1, ENUM2)	A value from an enumeration
METHOD	Initiates an action in the device
STR	A set of ASCII characters
ARRAY	A set of values
REC	A data structure defined by the fieldbus FOUNDATION

Data type (size in bytes)	The data type of the parameter, and the size in bytes, when required
Store	Class of memory required, and the update rate in Hz if applicable:

D	Dynamic store (cyclic data, parameter updated periodically)
S	Static store (acyclic data, parameter changed on a deliberate write)
N	Nonvolatile parameter (saved across power cycles)

Access	The type of access allowed for the parameter:

R	Read-only
RW (Any)	Read/write, with the transducer block in any mode
RW (OOS)	Read/write, with the transducer block in Out of Service (OOS) mode
RW (Auto)	Read/write, with the transducer block in Auto mode

Definitions for transducer block views

Four views are defined for each transducer block.

Table A-3: Views of transducer blocks

View	Description
VIEW 1	Access to the dynamic operating parameters of the transducer block
VIEW 2	Access to the static operating parameters of the transducer block
VIEW 3	Access to all the dynamic parameters of the transducer block
VIEW 4	Access to static parameters not included in VIEW 2

The maximum size of a view is 122 bytes.

Use the following definitions for the transducer block "views" tables:

View and size in view The views that contain the parameter, and the size of the parameter in the view, in bytes. The number in the cell indicates that the variable is contained in that particular view. The number is the size of the parameter in bytes.

Release The firmware release number in which the parameter first appears.

A.2.1 Fieldbus standard

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
0	BLOCK_STRUCTURE	VAR	DS_64	S	RW (Any)	N/A
1	ST_REV	VAR	Unsigned16 (2)	S	R	N/A
2	TAG_DESC	STR	OCTET STRING (32)	S	RW (Any)	Any 32 Characters
3	STRATEGY	VAR	Unsigned16 (2)	S	RW (Any)	N/A
4	ALERT_KEY	VAR	Unsigned8 (1)	S	RW (Any)	1 to 255
5	MODE_BLK	REC	DS-69 (4)	mix	RW (Any)	See section 2.6 of FF-891
6	BLOCK_ERR	STR	BIT STRING (2)	D	RO	See section 4.8 of FF-903
7	UPDATE_EVT	REC	DS-73	D	RW (Any)	
8	BLOCK_ALM	REC	DS-72	D	RW (Any)	
9	TRANSDUCER_DIRECTORY	VAR	Unsigned16 (2)		RO	
10	TRANSDUCER_TYPE	VAR	Unsigned16 (2)		RO	
11	TRANSDUCER_TYPE_VER	VAR	Unsigned16 (2)		RO	
12	XD_ERROR	VAR	Unsigned8 (1)	D	RO	0 = No Error 18 = Calibration Error 19 = Configuration Error 20 = Electronics Failure 21 = Sensor Failure 26 = Process Error 27 = Calibration In Progress
13	COLLECTION_DIRECTORY	VAR	Unsigned32	S	RO	

A.2.2 Measurement transducer blocks

Measurement transducer block details

Table A-4: Process variables

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
14	MASS_FLOW (Mass Flow Rate)	VAR	DS-65 (5)	D	RO	MFLOW_LOW_LIMIT ≤ x ≤ MFLOW_HIGH_LIMIT
15	VOLUME_FLOW (Volume Flow Rate)	VAR	DS-65 (5)	D	RO	VFLOW_LOW_LIMIT ≤ x ≤ VFLOW_HIGH_LIMIT
16	TEMPERATURE (Temperature)	VAR	DS-65 (5)	D	RO	TEMP_LOW_LIMIT ≤ x ≤ TEMP_HIGH_LIMIT
17	DENSITY (Density)	VAR	DS-65 (5)	D	RO	DENSITY_LOW_LIMIT ≤ x ≤ DENSITY_HIGH_LIMIT

Table A-5: Mass flow configuration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
18	ACTUAL_FLOW_DIRECTION (Flow Direction)	VAR	DS-66 (2)	D	RO	Value part of DS-66 (2) 0 = Forward/Zero Flow 1=Reverse Flow
19	MFLOW_UNIT (Mass Flow Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Mass flow unit codes.
20	MFLOW_SPL_UNIT_BASE (Mass Flow Base Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1089 = g 1088 = Kg 1092 = t 1094 = lb 1095 = STon 1096 = LTon
21	MFLOW_SPL_UNIT_TIME (Mass Flow Base Time)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1058 = min 1054 = s 1059 = h 1060 = d
22	MFLOW_SPL_UNIT_CON (Mass Flow Conversion Factor)	VAR	FLOAT (4)	S	R/W (OOS)	x > 0.0
23	MFLOW_SPL_UNIT_STR (Mass Flow Special Label)	STR	VISIBLE STRING (8)	S	R/W (OOS)	Any eight characters
24	MFLOW_TOTINV_SPL_UNIT_STR (Mass Flow Total Special Label)	VAR	VISIBLE STRING (8)	S	R/W (OOS)	Any eight characters
25	MFLOW_M_FCATOR (Mass Flow Factor)	VAR	FLOAT (4)	S	R/W (OOS)	0.8 ≤ x ≤ 1.2

Table A-5: Mass flow configuration *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
26	MFLOW_LOW_CUTOFF (Mass Flow Cutoff)	VAR	FLOAT (4)	S	R/W (OOS)	0 ≤ x ≤ MFLOW_HIGH_LIMIT
27	MFLOW_LOW_LIMIT (Mass Flow Low Limit)	VAR	FLOAT (4)	S	RO	N/A
28	MFLOW_HIGH_LIMIT (Mass Flow High Limit)	VAR	FLOAT (4)	S	RO	N/A
29	FLOW_DAMPING (Flow Damping)	VAR	FLOAT (4)	S	R/W (OOS)	0.0 ≤ x ≤ 60.0 (rounded to 60 if x > 60)
30	FLOW_DIRECTION (Flow Direction)	ENUM	Unsigned8 (1)	S	R/W (Any)	0 = Forward 1 = Backward

Mass flow unit codes

1318 = g/s
1319 = g/min
1320 = g/h
1322 = Kg/s
1323 = kg/min
1324 = kg/h
1325 = kg/d
1327 = t/min
1328 = t/h
1329 = t/d
1330 = lb/s
1331 = lb/min
1332 = lb/h
1333 = lb/d
1335 = STon/min
1336 = STon/h
1337 = Ston/d
1340 = LTon/h
1341 = LTon/d
253 = Special

Table A-6: Volume flow configuration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
31	VFLOW_UNIT (Volume Flow Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Volume flow unit codes
32	VFLOW_SPL_UNIT_BASE (Volume Flow Base Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1048 = gallon 1038 = L 1049 = ImpGal 1043 = ft^3 1034 = m^3 1051 = bbl 33002 = beer bbl
33	VFLOW_SPL_UNIT_TIME (Volume Flow Base Time)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1058 = min 1054 = s 1059 = h 1060 = d
34	VFLOW_SPL_UNIT_COVN (Volume Flow Conversion Factor)	VAR	FLOAT (4)	S	R/W (OOS)	> 0.0
35	VFLOW_SPL_UNIT_STR (Volume Flow Label)	STR	VISIBLE STRING (8) S	S	R/W (OOS)	Any eight characters
36	VFLOW_TOTINV_SPL_UNIT_STR (Volume Flow Total Special Label)	STR	VISIBLE STRING (8) S	S	R/W (OOS)	Any eight characters

Table A-6: Volume flow configuration *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
37	VFLOW_M_FACTOR (Volume Flow Factor)	VAR	FLOAT (4)	S	R/W (OOS)	$0.8 \leq x \leq 1.2$
38	VFLOW_LOW_CUTOFF (Volume Flow Cutoff)	VAR	FLOAT (4)	S	R/W (OOS)	$0 \leq x \leq$ VFLOW_HIGH_LIMIT
39	VFLOW_LOW_LIMIT (Volume Low Limit)	VAR	FLOAT (4)	S	RO	N/A
40	VFLOW_HIGH_LIMIT (Volume High Limit)	VAR	FLOAT (4)	S	RO	N/A

Volume flow unit codes

1347 = m3/s
1348 = m3/min
1349 = m3/h
1350 = m3/d
1351 = L/s
1356 = CFS
1357 = CFM
1358 = CFH
1359 = ft^3/d
1362 = gal/s
1366 = Mgal/d
1367 = ImpGal/s
1368 = ImpGal/min
1369 = ImpGal/h
1370 = Impgal/d
1374 = bbl/d
1631 = bbl(US Beer)/d
1632 = bbl(US Beer)/h
1633 = bbl(US Beer)/min
1634 = bbl(US Beer)/s

Table A-7: Temperature configuration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
41	TEMP_UNIT (Temperature Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1000 = K 1001 = deg C 1002 = deg F 1003 = deg R
42	TEMP_LOW_LIMIT (Temperature Low Limit)	VAR	FLOAT (4)	S	RO	N/A
43	TEMP_HIGH_LIMIT (Temperature High Limit)	VAR	FLOAT (4)	S	RO	N/A
44	TEMP_DAMPING (Temperature Damping)	VAR	FLOAT (4)	S	R/W (OOS)	$0.0 \leq x \leq 80.0$ (rounded to 80 if $x > 80$)

Table A-8: Density configuration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
45	DENSITY_UNIT (Density Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Density unit codes
46	DENSITY_LOW_LIMIT (Density Low Limit)	VAR	FLOAT (4)	S	RO	N/A
47	DENSITY_HIGH_LIMIT (Density High Limit)	VAR	FLOAT (4)	S	RO	N/A
48	DENSITY_M_FACTOR (Density Factor)	VAR	FLOAT (4)	S	R/W (OOS)	$0.8 \leq x \leq 1.2$

Table A-8: Density configuration *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
49	DENSITY_DAMPING (Density Damping)	VAR	FLOAT (4)	S	R/W (OOS)	0.0 ≤ x ≤ 60.0 (rounded to 60 if x > 60)
50	DENSITY_LOW_CUTOFF (Density Cutoff)	VAR	FLOAT (4)	S	R/W (OOS)	0.0 ≤ x ≤ 0.5 (g/cm^3)

Density unit codes

1097 = kg/m^3	1104 = g/ml	1107 = lb/ft^3	1113 = degAPI
1100 = g/cm^3	1105 = g/L	1108 = lb/gal	1114 = SGU"
1103 = kg/L	1106 = lb/in^3	1109 = STon/yd^3	

Table A-9: Flow velocity configuration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
51	FLOW_VELOCITY_UNIT (Velocity Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1067 = ft/s 1061 = m/s 1066 = in/s 1069 = in/min 1070 = ft/min 1063 = m/h

Table A-10: Gas process variables

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
52	VOL_FLOW_TYPE (Volume Flow Type)	ENUM	Unsigned8 (1)	S	R/W (OOS)	0 = Liquid 1 = Gas
53	GSV_GAS_DENSITY (Gas Reference Density)	VAR	FLOAT (4)	S	R/W (OOS)	Density Lo Limit ≤ x ≤ Density Hi Limit
54	GSV_VOL_FLOW (Gas Standard Volume Flow)	ENUM2	DS-65 (5)	D	RO	VFLOW_LOW_LIMIT ≤ x ≤ VFLOW_HIGH_LIMIT
55	GSV_FLOW_UNITS (Gas Standard Volume Flow Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Gas Standard Volume Flow Unit codes
56	GSV_FLOW_BASEUNIT (Gas Standard Volume Flow Base Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1521 = Nm^3 1531 = NL 1053 = SCF 1536 = SL 1526 = Sm^3
57	GSV_FLOW_BASETIME (Gas Standard Volume Flow Base Time)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1058 = min 1054 = s 1059 = h 1060 = d
58	GSV_FLOWFACTOR (Gas Standard Volume Flow Conversion Factor)	VAR	FLOAT (4)	S	R/W (OOS)	> 0.0

Table A-10: Gas process variables *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
59	GSV_FLOWTEXT (Gas Standard Volume Flow Label)	STR	VISIBLE STRING (8)	S	R/W (OOS)	Any eight characters
60	GSV_CUTOFF (Gas Standard Volume Cutoff)	VAR	FLOAT (4)	S	R/W (OOS)	≥ 0.0
61	GSV_TOTINV_SPL_UNIT_STR (Gas Standard Volume Flow Total Special Unit Label)	STR	VISIBLE STRING (8)	S	R/W (OOS)	Any eight characters

Gas Standard Volume Flow Unit codes

1360 = SCFM
1361 = SCFH
1522 = Nm^3/s
1523 = Nm^3/min
1524 = Nm^3/h
1525 = Nm^3/d
1527 = Sm^3/s
1528 = Sm^3/min
1529 = Sm^3/h
1530 = Sm^3/d
1532 = NL/s
1534 = NL/h
1535 = NL/d
1537 = SL/s
1538 = SL/min
1539 = SL/h
33000 = SCFS
33001 = SCFD
253 = Special

Table A-11: Pressure compensation

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
62	PRESSURE_COMP (External Pressure)	VAR	DS-65 (5)	D	R/W (Any)	-1.5 BAR ≤ x ≤ 10000.0 BAR
63	PRESSURE_UNITS (Pressure Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Pressure unit codes
64	PRESSURE_COMP_EN (Pressure Compensation)	ENUM	Unsigned8 (1)	S	R/W (OOS)	0 = disabled 1 = enabled
65	PRESSURE_FACTOR_FLOW (Flow Pressure Factor)	VAR	FLOAT (4)	S	R/W (OOS)	-0.1 ≤ x ≤ 0.1
66	PRESSURE_FACTOR_DENS (Density Pressure Factor)	VAR	FLOAT (4)	S	R/W (OOS)	-0.1 ≤ x ≤ 0.1
67	PRESSURE_FLOW_CAL (Flow Calibration Pressure)	VAR	FLOAT (4)	S	R/W (OOS)	≥ 0.0

Pressure unit codes

1148 = inH2O (68 deg F)
1156 = inHg (0 deg C)
1154 = ftH2O (68 deg F)
1151 = mmH2O (68 deg F)
1158 = mmHg (0 deg C)
1141 = psi
1137 = bar
1138 = mbar
1144 =g/cm^2
1145 = Kg/cm^2
1130 = 1133 = KPa
1139 = torr
1140 = atm
1147 = in H2O (4 deg C)
1150 = mm H2O (4 deg C)
33003 = in H2O (60 deg F)

Table A-12: Temperature compensation

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
68	TEMPERATURE_COMP (External Temperature)	VARIABLE	DS-65 (5)	D	R/W (Any)	TEMP_LOW_LIMIT ≤ x ≤ TEMP_HIGH_LIMIT
69	TEMPERATURE_COMP_EN (Temperature Compensation)	Method	Unsigned8 (1)	S	R/W (OOS)	0 = Disabled 1 = Enabled

Table A-13: Device diagnostics

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
70	DRIVE_GAIN (Drive Gain)	VAR	DS-65 (5)	D	RO	0% ≤ x ≤ 100%
71	TUBE_FREQ (Tube Frequency)	VAR	FLOAT (4)	D	RO	—
72	LIVE_ZERO (Live Zero Flow Rate)	VAR	FLOAT (4)	D	RO	—
73	LEFT_PICKUP_VOL (Left Pickoff Amplitude)	VAR	FLOAT (4)	D	RO	0.0 V ≤ x ≤ +5.0 V
74	RIGHT_PICKUP_VOL (Right Pickoff Amplitude)	VAR	FLOAT (4)	D	RO	0.0 V ≤ x ≤ +5.0 V
75	FLOW_VELOCITY (Approximate Velocity)	VAR	DS-65 (5)	D	RO	-700 m/s ≤ x ≤ +700 m/s
76	CORE_BOARD_TEMP (Core Board Temperature)	VAR	FLOAT (4)	D	RO	-200 C ≤ x ≤ +200 C
77	ELECT_TEMP_MAX (Max Electronic Temperature)	VAR	FLOAT (4)	D	RO	N/A
78	ELECT_TEMP_MIN (Min Electronic Temperature)	VAR	FLOAT (4)	D	RO	N/A
79	ELECT_TEMP_AVG (Average Electronic Temperature)	VAR	FLOAT (4)	D	RO	N/A
80	SENSOR_TEMP_MAX (Max Sensor Temperature)	VAR	FLOAT (4)	D	RO	N/A
81	SENSOR_TEMP_MIN (Min Sensor Temperature)	VAR	FLOAT (4)	D	RO	N/A
82	SENSOR_TEMP_AVG (Average Sensor Temperature)	VAR	FLOAT (4)	D	RO	N/A
83	RTD_RESIS_CABLE (RTD Resistance Cable)	VAR	FLOAT (4)	D	RO	N/A

Table A-13: Device diagnostics *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
84	RTD_RESIS_METER (Meter Resistance)	VAR	FLOAT (4)	D	RO	N/A
85	CP_POWER_CYCLE (Core Processor Power Cycles)	VAR	Unsigned16 (2)	D	RO	N/A
86	POWER_ONTIME (Power On Time)	VAR	Unsigned32	D	RO	N/A
87	INPUT_VOL (Core Processor Input Voltage)	VAR	FLOAT (4)	D	RO	0.0 V ≤ x ≤ +20.0 V
88	TARGET_AMP (Target Amplitude)	VAR	FLOAT (4)	D	RO	N/A
89	CASE_RTD_RESIS RTD (Case Resistance)	VAR	FLOAT (4)	D	RO	N/A
90	TRANSMITTER_TEMP (Meter Temperature)	VAR	FLOAT (4)	D	RO	N/A

Table A-14: Two phase flow setup

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
91	SLUG_TIME (Two Phase Time)	VAR	FLOAT (4)	S	R/W (Any)	0.0f ≤ x ≤ 60.0f
92	SLUG_LO_LIMIT (Two Phase Low Limit)	VAR	FLOAT (4)	S	R/W (Any)	DENSITY_LOW_LIMIT ≤ x ≤ DENSITY_HIGH_LIMIT
93	SLUG_HI_LIMIT (Two Phase High Limit)	VAR	FLOAT (4)	S	R/W (Any)	DENSITY_LOW_LIMIT ≤ x ≤ DENSITY_HIGH_LIMIT
94	PHGN_FLOW_SEVERITY (Phase Flow Analysis)	VAR	DS-65 (5)	D	RO	

Table A-15: Device calibration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
95	MASS_FLOW_GAIN (FlowCal)	VAR	FLOAT (4)	S	R/W (OOS)	0.0f ≤ x ≤ 99999.0f
96	MASS_FLOW_T_COMP (Mass Flow Temperature Comp)	VAR	FLOAT (4)	S	R/W (OOS)	0.0f ≤ x ≤ 999.0f
97	K1 (K1)	VAR	FLOAT (4)	S	R/W (OOS)	1000.0f ≤ x ≤ 50000.0f
98	K2 (K2)	VAR	FLOAT (4)	S	R/W (OOS)	1000.0f ≤ x ≤ 50000.0f

Table A-15: Device calibration *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
99	FD (FD)	VAR	FLOAT (4)	S	R/W (OOS)	≥ 0
100	K3 (K3)	VAR	FLOAT (4)	S	R/W (OOS)	1000.0f ≤ x ≤ 50000.0f
101	K4 (K4)	VAR	FLOAT (4)	S	R/W (OOS)	1000.0f ≤ x ≤ 50000.0f
102	D1 (D1)	VAR	FLOAT (4)	S	R/W (OOS)	Density Lo Limit ≤ x ≤ Density Hi Limit
103	D2 (D2)	VAR	FLOAT (4)	S	R/W (OOS)	Density Lo Limit ≤ x ≤ Density Hi Limit
104	FD_VALUE (FD Value)	VAR	FLOAT (4)	S	R/W (Any)	Density Lo Limit ≤ x ≤ Density Hi Limit
105	D3 (D3)	VAR	FLOAT (4)	S	R/W (OOS)	Density Lo Limit ≤ x ≤ Density Hi Limit
106	D4 (D4)	VAR	FLOAT (4)	S	R/W (OOS)	Density Lo Limit ≤ x ≤ Density Hi Limit
107	DENS_T_COEFF (TC/DT)	VAR	FLOAT (4)	S	R/W (OOS)	-20.0f ≤ x ≤ 20.0f
108	T_FLOW_TG_COEFF (FTG)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
109	T_FLOW_FQ_COEFF (FFQ)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
110	T_DENSITY_TG_COEFF (DTG)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
111	T_DENSITY_FQ_COEFF1 (DFQ1)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
112	T_DENSITY_FQ_COEFF2 (DFQ2)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
113	SENSOR_CODE_MEASURE (Sensor Type)	ENUM2	Unsigned16 (2)	S	R/W (Any)	0 = Curve Tube 1 = Straight Tube

Table A-16: Temperature calibration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
114	TEMP_OFFSET (Temperature Offset)	VAR	FLOAT (4)	S	RO/W (OOS)	-9999.0f ≤ x ≤ 99999.0f
115	TEMP_SLOPE Temperature Slope	VAR	FLOAT (4)	S	R/W (OOS)	0.0f ≤ x ≤ 999999.0f

Table A-17: Zero calibration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
116	ZERO_CAL (Zero Calibration)	VAR	DS-66 (2)	S	R/W (OOS)	Value part of DS-66 (2) 0 = Abort Zero Cal 1 = Start Zero Cal
117	ZERO_TIME (Zero Time)	VAR	Unsigned16 (2)	S	R/W (OOS)	$5 \leq x \leq 300$
118	ZERO_STD_DEV (Standard Deviation)	VAR	FLOAT (4)	S	RO	N/A
119	ZERO_OFFSET (Zero Offset)	VAR	FLOAT (4)	S	R/W (OOS)	-5.0f ≤ x ≤ 5.0f
120	ZERO_FAILCM_VALUE (Zero Calibration Failed)	VAR	FLOAT (4)	S	RO	N/A
121	ZERO_IN_PROGRESS (Zero in Progress)	VAR	DS-66 (2)	D	RO	Value part of DS-66 (2) 0 = Not Running 1 = Calibration Running
122	ZERO_RESTORE_FACTORY (Restore Factory Configuration)	METHOD	Unsigned8 (1)	S	R/W (OOS)	0 = no action 1 = Restore
123	ZERO_FACTORY (Factory Zero)	VAR	FLOAT (4)	S	RO	N/A
124	VERIFY_ZERO (Perform Zero Verify)	METHOD	Unsigned8 (1)	S	R/W (Any)	0 = no action 1 = Start verify zero
125	FLOW_VERIFY_ZERO (Flow Verification Zero)	ENUM1	Unsigned8 (1)	S	RO	0 = Existing Zero OK 1 = New Zero Calibration Recommended 2 = Lock-In Ineffective 3 = Fault Active
126	VERIFY_PERCENT (Zero Verify Percent)	VAR	FLOAT (4)	D	RO	N/A
127	ZERO_RESTORE_PREVIOUS (Restore Previous Zero)	METHOD	Unsigned8 (1)	S	R/W (OOS)	0 = no action 1 = Restore

Table A-18: Density calibration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
128	LOW_DENSITY_CAL (First Point Calibration)	METHOD	Unsigned8 (1)	S	R/W (OOS)	0 = None 1 = Start Cal
129	HIGH_DENSITY_CAL (Second Point Calibration)	METHOD	Unsigned8 (1)	S	R/W (OOS)	0 = None 1 = Start Cal
130	FLOWING_DENSITY_CAL (Flow Density Calibration)	METHOD	Unsigned8 (1)	S	R/W (Any)	0 = None 1 = Start Cal

Table A-18: Density calibration *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
131	D3_DENSITY_CAL (Third Point Calibration)	METHOD	Unsigned8 (1)	S	R/W (OOS)	0 = None 1 = Start Cal
132	D4_DENSITY_CAL (Fourth Point Calibration)	METHOD	Unsigned8 (1)	S	R/W (OOS)	0 = None 1 = Start Cal

Table A-19: Miscellaneous controls

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
133	FACTORY_CONFIG_ RESTORE (Restore Factory Configuration)	METHOD	Unsigned8 (1)	S	R/W (OOS)	0 = no action 1 = Restore
134	RESET_POWERON_TIME (Reset Power On Time)	METHOD	Unsigned8 (1)	S	R/W (Any)	0 = no action 1 = Reset
135	EN_LD_OPTIMIZATION LD (Optimization)	ENUM	Unsigned8 (1)	S	R/W (OOS)	0 = Disable LD Optimization 1 = Enable LD Optimization

Table A-20: Process variable simulation

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
136	PROC_VAR_SIMULATION (Process Variable Simulation)	ENUM1	Unsigned8 (1)	S	R/W (Any)	0 = None 1 = Enable
137	SIMU_VAR_SEL (Simulation Variable)	ENUM1	Unsigned8 (1)	S	R/W (Any)	0 = Mass Flow 1 = Density 2 = Temperature
138	SIMU_VAR_WAVEFORM_ SEL (Simulation Waveform Selection)	ENUM1	Unsigned8 (1)	S	R/W (Any)	1 = fixed value 2 = sawtooth 3 = sine wave
139	SIMU_VAR_FIXED_VALUE (Simulation Fixed Value)	VAR	FLOAT (4)	S	R/W (Any)	Any
140	SIMU_VAR_MIN_AMP (Simulation Minimum Value)	VAR	FLOAT (4)	S	R/W (Any)	Any
141	SIMU_VAR_MAX_AMP (Simulation Maximum Value)	VAR	FLOAT (4)	S	R/W (Any)	Any

Table A-20: Process variable simulation *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
142	SIMU_VAR_PERIOD (Simulation Period)	VAR	FLOAT (4)	S	R/W (Any)	Any
143	SIMU_VAR_UNITS (Simulation Variable Units)	ENUM2	Unsigned16 (2)	S	RO	MFLOW_UNIT, TEMP_UNIT, DENSITY_UNIT

Table A-21: Device features

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
144	MEASUREMENT_FEATURES (Device Features)	VAR	BIT STRING (2)	D	RO	See Device features codes

Device features codes

0x0000 = FKEY_NO_FEATURE
0x0001 = APM Cont Flow
0x0002 = TMR
0x0004 = PVR
0x0008 = TBR
0x0010 = SMV
0x0020 = GSV
0x0040 = ED
0x0080 = API
0x0800 = CAL FAIL
0x1000 = APM TMR
0x2000 = APM Var NOC
0x4000 = APM Var Flow
0x8000 = APM Cont NOC

A.2.3 Device information transducer blocks

Device information transducer block details

Table A-22: Transmitter information

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
14	TRANSMITTER_SERIAL_NUMBER (Transmitter Serial Number)	VAR	Unsigned32	S	RO	—
15	OPTION_PRODUCT_CODE (Option Model Number)	STRING	VISIBLE STRING (32)	S	RO	—
16	BASE_PRODUCT_CODE (Base Model Number)	STRING	VISIBLE STRING (32)	S	RO	—
17	TRANSMITTER_SW_REV (Transmitter Software Revision)	VAR	Unsigned16 (2)	S	RO	—
18	TRANSMITTER_SW_CHKSUM (Transmitter Software Checksum)	VAR	Unsigned32	S	RO	—
19	CEQ_NUMBER (Engineer to Order Number)	VAR	Unsigned16 (2)	S	RO	—

Table A-22: Transmitter information *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
20	DESCRIPTION	STRING	VISIBLE STRING (16)	S	R/W (Any)	—
21	TRANSMIITER_DEVICE_TYPE (Model)	VAR	Unsigned16 (2)	S	RO	73 = 5700 FOUNDATION Fieldbus

Table A-23: Core Processor information

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
22	CORE_SERIAL_NUMBER (Core Processor Serial Number)	VAR	Unsigned32	S	RO	—
23	CORE_SW_REV (Core Processor Software Revision)	VAR	Unsigned16 (2)	S	RO	—
24	CORE_SW_CHKSUM (Core Processor Software Checksum)	VAR	Unsigned32	S	RO	—
25	CORE_DEVICE_TYPE (Core Device Type)	ENUM2	Unsigned16 (2)	S	RO	40 = 700 CP 50 = 800 ECP 1000 = No Core

Table A-24: Protocol processor information

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
26	PROTO_SW_REV (Protocol Processor Software Revision)	VAR	Unsigned16 (2)	S	RO	—
27	PROTO_SW_CHKSUM (Protocol Processor Software Checksum)	VAR	Unsigned32	S	RO	—

Table A-25: Sensor information

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
28	SENSOR_SN (Sensor Serial Number)	VAR	Unsigned32	S	R/W (Any)	$0 \leq x \leq 16777215$
29	SENSOR_TYPE (Sensor Model)	STRING	VISIBLE STRING (16)	S	RO	—
30	SENSOR_CODE (Sensor Type)	ENUM2	Unsigned16 (2)	S	R/W (Any)	0 = Curve Tube 1 = Straight Tube

Table A-25: Sensor information *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
31	SENSOR_MATERIAL (Tube Wetted Material)	ENUM2	Unsigned16 (2)	S	R/W (Any)	003 = Hastelloy C-22 004 = Monel 005 = Tantalum 006 = Titanium 019 = 316L stainless steel 023 = Inconel 050 = 304 Stainless Steel 252 = Unknown 253 = Special
32	SENSOR_LINER (Tube Lining)	ENUM2	Unsigned16 (2)	S	R/W (Any)	10 = PTFE (Teflon) 11 = Halar 16 = Tefzel 251 = None 252 = Unknown 253 = Special
33	SENSOR_END (Sensor Flange)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Sensor flange type codes.

Sensor flange type codes

0 = ANSI 150
1 = ANSI 300
2 = ANSI 600
5 = PN 40
7 = JIS 10K
8 = JIS 20K
9 = ANSI 900
10 = Sanitary Clamp Fitting
11 = Union
12 = PN 100
251 = None
252 = Unknown
253 = Special

Table A-26: Alarm status

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
34	ALERT1_CONDITION (Alert Condition1)	ENUM2	BIT STRING (2)	D	RO	See Alert 1 condition codes
35	ALERT2_CONDITION (Alert Condition2)	ENUM2	BIT STRING (2)	D	RO	See Alert 2 condition codes
36	ALERT3_CONDITION (Alert Condition3)	ENUM2	BIT STRING (2)	D	RO	See Alert 3 condition codes
37	ALERT4_CONDITION (Alert Condition4)	ENUM2	BIT STRING (2)	D	RO	See Alert 4 condition codes
38	ALERT5_CONDITION (Alert Condition5)	ENUM2	BIT STRING (2)	D	RO	See Alert 5 condition codes
39	ALERT6_CONDITION (Alert Condition6)	ENUM2	BIT STRING (2)	D	RO	See Alert 6 condition codes
40	ALARM1_IGNOR (Alert Suppress1)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 1 condition codes
41	ALARM2_IGNOR (Alert Suppress2)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 2 condition codes

Table A-26: Alarm status *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
42	ALARM3_IGNOR (Alert Suppress3)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 3 condition codes
43	ALARM4_IGNOR (Alert Suppress4)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 4 condition codes
44	ALARM5_IGNOR (Alert Suppress5)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 5 condition codes
45	ALARM6_IGNOR (Alert Suppress6)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 6 condition codes
46	ALERT_RESTORE_FACTORY (Restore Alert Factory)	ENUM	Unsigned8 (1)	S	R/W (OOS)	0 = No 1 = Restore
47	FAULT_LIMIT (Fault Limit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	0 = Upscale 1 = Downscale 2 = Zero 3 = NAN 4 = Flow goes to zero 5 = None
48	LMV_FLT_TIMEOUT (Fault Timeout)	VAR	Unsigned16 (2)	S	R/W (Any)	0 ≤ x ≤ 60 sec
49	ALERT_TIMEOUT (FOUNDATION Fieldbus Alert Timeout)	VAR	Unsigned16 (2)	S	R/W (Any)	0 ≤ x ≤ 300 sec
50	ANALOG_OUTPUT_FAULT (Analog Output Fault)	VAR	DS-66 (2)	D	RO	Value part of DS-66 (2) 0 = No Critical Fault 1 = Critical Fault Present

Alert 1 condition codes

Used for OD index 34, 40, and 52.

0x0001 = RAM Error-Transmitter (019)
0x0002 = EEPROM Error (018)
0x0004 = Sensor Case Temperature Failure (017)
0x0008 = Sensor Temperature Failure (016)
0x0010 = Calibration Failure (010)
0x0020 = Density Out of Range (008)
0x0040 = Mass Flow Overrange (005)
0x0080 = RAM Error - Core (002)
0x0100 = Incorrect Board Type (030)
0x0200 = Core Write Failure (028)
0x0400 = Undefined
0x0800 = Sensor Communication Failure (026)
0x1000 = Program Corrupt Core (024)
0x2000 = Configuration Data Corrupt (022)
0x4000 = Incorrect Sensor Type (021)
0x8000 = Cal Factors Missing (020)

Alert 2 condition codes

Used for OD index 35, 41, and 53.

0x0001 = Drive Overrange (102)
0x0002 = Undefined
0x0004 = Undefined
0x0008 = Meter Verification Aborted (035)
0x0010 = Meter Verification Failed (034)
0x0020 =Tube Not Full (033)
0x0040 = Undefined
0x0080 = Low Power- Core (031)

0x0100 = Frequency Output Saturated (110)
0x0200 = Undefined
0x0400 = Undefined
0x0800 = Power Reset (107)
0x1000 = Undefined
0x2000 = Two Phase Flow (105)
0x4000 = Calibration in progress (104)
0x8000 = Data Loss Possible (103)

Alert 3 condition codes

Used for OD index 36, 42, and 54.

0x0001 = Discrete Output Fixed (119)
0x0002 = Undefined
0x0004 = API - Density Out of Range (117)
0x0008 = Temperature Out of range (116)
0x0010 = No Input (115)
0x0020 = mA Output Fixed (114)
0x0040 = mA Output Saturated (113)
0x0080 = Frequency Output Fixed (111)

0x0100 = Discrete Output Present Value
0x0200 = Undefined
0x0400 = Undefined
0x0800 = Sensor Simulation On (132)
0x1000 = Smart Meter Verification in progress (131)
0x2000 = Undefined
0x4000 = Extrapolation Alert (121)
0x8000 = Curve Fit Failure (120)

Alert 4 condition codes

Used for OD index 37, 43, and 55.

0x0001 = Enhanced Event 3 Active
0x0002 = Enhanced Event 2 Active
0x0004 = Enhanced Event 1 Active
0x0008 = Transmitter Initializing (009)
0x0010 = Sensor Failed (003)
0x0020 = Flow Direction (on = forward/zero, off = reverse)
0x0040 = Undefined
0x0080 = Undefined

0x0100 = Watchdog Error
0x0200 = Configuration Changed
0x0400 = Undefined
0x0800 = Core Processor Communicating with Transmitter
0x1000 = Core Software update Failed
0x2000 = Programming Core Processor
0x4000 = Enhanced Event 5 Active
0x8000 = Enhanced Event 4 Active

Alert 5 condition codes

Used for OD index 38, 44, and 56.

0x0001 = Pressure Out of Range (123)
0x0002 = SD Card not Present
0x0004 = Undefined
0x0008 = Undefined
0x00010 = Undefined
0x0020 = Undefined
0x0040 = Undefined
0x0080 = System is in fault

0x0100 = Undefined
0x0200 = Undefined
0x0400 = Clock is Constant
0x0800 = Severe Two-Phase
0x1000 = Phase Genius detected Moderate Severity
0x2000 = Firmware Update failed
0x4000 = No Permanent License
0x8000 = Time Not Set

Alert 6 condition codes

Used for OD index 39, 45, and 57.

0x0001 = Undefined
0x0002 = Undefined
0x0004 = Undefined
0x0008 = Undefined
0x0010 = New Core Processor detected
0x0020 = Core Processor has incompatible ETO
0x0040 = Internal Memory Full
0x0080 = No Password
0x0100 = Undefined
0x0200 = Undefined
0x0400 = Fieldbus Bridge Comm Error
0x0800 = Undefined
0x1000 = Undefined
0x2000 = Watercut Unavailable
0x4000 = Watercut Limited to 0%
0x8000 = Watercut Limited to 100%

Table A-27: Alert condition simulation

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
51	SIMULATE_ALERT_CONDITION (Alert Condition Simulation)	VAR	Unsigned8 (1)	S	R/W (Any)	0 = Disable 1 = Enable
52	ALERT1_SIMULATE (Alert Simulation 1)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 1 condition codes
53	ALERT2_SIMULATE (Alert Simulation 2)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 2 condition codes
54	ALERT3_SIMULATE (Alert Simulation 3)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 3 condition codes
55	ALERT4_SIMULATE (Alert Simulation 4)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 4 condition codes
56	ALERT5_SIMULATE (Alert Simulation 5)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 5 condition codes
57	ALERT6_SIMULATE (Alert Simulation 6)	ENUM2	BIT STRING (2)	S	R/W (Any)	See Alert 6 condition codes

Table A-28: FF simulation

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
58	FF_SIMULATION (Alert Simulation Lock)	ENUM	Unsigned8 (1)	S	R/W (Any)	0 = Disable 1 = Enable

Table A-29: Local display

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
59	LDO_BACKLIGHT_INTEN (Intensity (0-100))	VAR	Unsigned16 (2)	S	R/W (Any)	$0 \leq x \leq 100$
60	LDO_CONTRAST (Contrast (0-100))	VAR	Unsigned16 (2)	S	R/W (Any)	$0 \leq x \leq 100$

Table A-29: Local display *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
61	LDO_LANG (Language)	ENUM1	Unsigned16 (2)	S	R/W (Any)	0 = English 1 = German 2 = French 3 = Katakana (Japanese) 4 = Spanish 5 = Chinese 6 = Russian 7 = Portuguese
62	LDO_BACKLIGHT_EN (Backlight Control)	ENUM	Unsigned8 (1)	S	R/W (Any)	0 = Off 1 = On
63	LDO_TOT_RESET_EN (Totalizer Reset)	ENUM	Unsigned8 (1)		R/W (Any)	0 = Disable 1 = Enable
64	LDO_TOT_START_STOP_EN (Start/Stop) Totalizers	ENUM	Unsigned8 (1)		R/W (Any)	0 = Disable 1 = Enable
65	LDO_AUTO_SCROLL_EN (Auto Scroll)	ENUM	Unsigned8 (1)		R/W (Any)	0 = Disable 1 = Enable
66	LDO_AUTO_SCROLL_RATE (Scroll Time) (1-30)	VAR	Unsigned16 (2)		R/W (Any)	$1 \leq x \leq 30$
67	LDO_OFFLINE_PWD_EN (Offline Menu Passcode Required)	ENUM	Unsigned8 (1)		R/W (Any)	0 = Disable 1 = Enable
68	LDO_OFFLINE_PWD (Passcode (4 Digits alphanumeric))	VAR	VISIBLE STRING (4)		R/W (Any)	—
69	LDO_VAR1_CODE (Variable 1)	ENUM	Unsigned16 (2)		R/W (Any)	See Display variable codes
70	LDO_VAR2_CODE (Variable 2)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
71	LDO_VAR3_CODE (Variable 3)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
72	LDO_VAR4_CODE (Variable 4)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
73	LDO_VAR5_CODE (Variable 5)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
74	LDO_VAR6_CODE (Variable 6)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
75	LDO_VAR7_CODE (Variable 7)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
76	LDO_VAR8_CODE (Variable 8)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
77	LDO_VAR9_CODE (Variable 9)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes

Table A-29: Local display *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
78	LDO_VAR10_CODE (Variable 10)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
79	LDO_VAR11_CODE (Variable 11)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
80	LDO_VAR12_CODE (Variable 12)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
81	LDO_VAR13_CODE (Variable 13)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
82	LDO_VAR14_CODE (Variable 14)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
83	LDO_VAR15_CODE (Variable 15)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
84	LDO_2PV_VAR1_CODE (Two PV Variable 1)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
85	LDO_2PV_VAR2_CODE (Two PV Variable 2)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
86	LDO_PROC_VAR_INDEX (Process Variable)	ENUM2	Unsigned16 (2)	S	R/W (Any)	See Display variable codes
87	LDO_NUM_DECIMALS (Decimal Places)	VAR	Unsigned16 (2)	S	R/W (Any)	$0 \leq x \leq 5$
88	LDO_UPDATE_PERIOD (Variable Update Rate)	VAR	Unsigned16 (2)	S	R/W (Any)	$100 \leq x \leq 10000$
89	LDO_PASSWORD_EN (Alert Passcode)	ENUM	Unsigned8 (1)	S	R/W (Any)	0 = Disable 1 = Enable
90	LDO_FF_SIMULATE (Simulation Switch)	ENUM1	Unsigned8 (1)	S	RO	0 = Disable 1 = Enable
91	LDO_WL_STATUS (Write Lock Switch)	ENUM1	Unsigned8 (1)	S	RO	0 = Disable 1 = Enable

Display variable codes

Not available for Variable 1 (OD Index 69) or Process Variable (OD Index 86)

0 = Mass Flow Rate
1 = Temperature
2 = Cfg Total 1
3 = Density
4 = Cfg Inv 1
5 = Volume Flow Rate
6 = Cfg Total 2
7 = Cfg Inv 2
15 = API: Corr Density
16 = API: Corr Vol Flow
17 = Cfg Total 3
18 = Cfg Inv 3
19 = API: Avg Density
20 = API: Avg Temp
21 = ED: Density At Ref
22 = ED: Density (SGU)
23 = ED: Std Vol Flow Rate
24 = Cfg Total 5
25 = Cfg Inv 5
26 = ED: Net Mass Flow
27 = Cfg Total 6
28 = Cfg Inv 6
29 = ED: Net Vol Flow Rate
30 = Cfg Total 7
31 = Cfg Inv 7
32 = ED: Concentration
33 = API: CTL
46 = Raw Tube Frequency
47 = Drive Gain
48 = Case Temperature
49 = LPO Amplitude
50 = RPO Amplitude
51 = Board Temperature
52 = Input Voltage,
53 = Ext. Input Pressure
55 = Ext. Input Temp
56 = ED: Density (Baume)
62 = Gas Std Vol Flow
63 = Cfg Total 4
64 = Cfg Inv 4
68 = Field Verification Zero
69 = Live Zero73 = APM: Net Flow Oil At Line
74 = APM: Water Cut At Line
75 = APM: Net Flow Water At Line
78 = APM: Net Flow Oil At Ref
79 = APM: Water Cut At Ref
81 = APM: Net Flow Water At Ref
101 = Flow Switch Indicator
187 = APM: Net Oil Density at Line(Fixed API Units)
205 = APM: Gas Void Fraction
208 = Mass Flow Velocity
228 = Phage Genius Flow Severity
251 = None.

Table A-30: Channel assignments

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
92	CH_SEL_B (Channel B Assignment)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	3 = mAO Output 6 = None
93	CH_SEL_C (Channel C Assignment)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1 = Frequency Output 11 = Discrete Output 6 = None
94	MAO_SRC_VAR (mAO Source Variable)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See mAO source variable codes
95	MAO_SRC_UNITS (mAOutput Units)	ENUM2	Unsigned16 (2)	S	RO	MFLOW_UNIT VFLOW_UNIT TEMP_UNIT DENSITY_UNIT PRESSURE_UNITS GSV_FLOW_UNITS FLOW_VELOCITY_UNIT Hz % Volts BAUM NO_UNIT
96	MAO_DAMPING (mAO Added Damping)	VAR	FLOAT (4)	S	R/W (OOS)	0.0f ≤ x ≤ 440.0f
97	MAO_VAR_LO (mAO Lower Range Value)	VAR	FLOAT (4)	S	R/W (OOS)	—

Table A-30: Channel assignments *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
98	MAO_VAR_HI (mAO Upper Range Value)	VAR	FLOAT (4)	S	R/W (OOS)	—
99	MAO_FLT_ACT (mAO Fault Action)	VAR	Unsigned16 (2)	S	R/W (OOS)	0 = Upscale 1 = Downscale 3 = Internal Zero 4 = None
100	MAO_FLT_LEV (mAO Fault Level)	VAR	FLOAT (4)	S	R/W (OOS)	1.0 ≤ x ≤ 3.6 (if MAO_FAULT_ACTION is Downscale) 21.0 ≤ x ≤ 23.00 (if MAO_FAULT_ACTION is Upscale)
101	MAO_START_LO_TRM (mAO Low Trim)	METHOD	Unsigned8 (1)	S	R/W (OOS)	0 = None 1 = Start Lo Trim
102	MAO_START_HO_TRM (mAO High Trim)	METHOD	Unsigned8 (1)	S	R/W (OOS)	0 = None 1 = Start Hi Trim
103	MAO_DIR (mAO Direction)	ENUM	Unsigned8 (1)	S	R/W (OOS)	0 = Normal 1 = Absolute Value
104	MAO_FLOW_CUTOFF (mA Output Flow Rate Cutoff)	VAR	FLOAT (4)	S	R/W (OOS)	x ≥ 0.0
105	MAO_MIN_SPAN (mAO Minimum Span)	VAR	FLOAT (4)	S	RO	—
106	MAO_SENSOR_LO_LIMIT (mAO Lower Sensor Limit)	VAR	FLOAT (4)	S	RO	—
107	MAO_SENSOR_HI_LIMIT (mAO Upper Sensor Limit)	VAR	FLOAT (4)	S	RO	—
108	MAO_SIMULATE (mAO Simulation)	ENUM	Unsigned8 (1)	S	R/W (Any)	0 = Disable 1 = Enable
109	MAO_FIXED_CURRENT (mAO Fixed Current)	VAR	FLOAT (4)	S	R/W (Any)	1 ≤ x ≤ 23 or 0
110	MAO_ACTUAL_CURRENT (mAO Actual Current)	VAR	FLOAT (4)	D	RO	—

mAO source variable codes

0 = Mass Flow Rate
1 = Temperature
3 = Density
5 = Volume Flow Rate
15 = API Corr Density
16 = API Corr Volume Flow
19 = API Average Density
20 = API Average Temperature
21 = CM Ref Density
22 = CM: Density
23 = CM: Std Vol Flow Rate
26 = CM: Net Mass Flow Rate
29 = CM: Net Vol Flow Rate
32 = CM: Concentration
47 = Drive Gain
53 = Ext Press
55 = Ext Temp
56 = CM: Density (Baume)
62 = Gas Std Vol Flow
73 = APM: Net Flow Oil At Line
74 = APM: Water Cut At Line
75 = APM: Net Flow Water At Line
78 = APM: Net Flow Oil At Ref
79 = APM: Water Cut At Ref
81 = APM: Net Flow Water At Ref
208 = Flow Velocity
228 = Phage Genius Flow Severity

Table A-31: Frequency Output configuration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
111	FO_SRC_VAR (Frequency Output)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Frequency Output source variable codes
112	FO_SRC_UNITS (Frequency Output Units)	ENUM2	Unsigned16 (2)	S	RO	MFLOW_UNIT VFLOW_UNIT GSV_FLOW_UNITS
113	FO_FLOW_FAC FO (Rate Factor)	VAR	FLOAT (4)	S	R/W (OOS)	x ≥ 0.0
114	FO_FRQ_FAC (Frequency Factor)	VAR	FLOAT (4)	S	R/W (OOS)	0.001 ≤ x ≤ 10000.0
115	FO_PULSES_PER_UNIT (Pulses/Unit)	VAR	FLOAT (4)	S	R/W (OOS)	x > 0.0
116	FO_UNITS_PER_PULSE (Units/Pulse)	VAR	FLOAT (4)	S	R/W (OOS)	x > 0.0
117	FO_FLT_ACT (FO Fault Action)	VAR	Unsigned16 (2)	S	R/W (OOS)	0 = Upscale 1 = Downscale 3 = Internal Zero 4 = None
118	FO_FLT_LEV (FO Fault Level)	VAR	FLOAT (4)	S	R/W (OOS)	10 ≤ x ≤ 15000
119	FO_DIR (Frequency Output Direction)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	0 = Pulse on Positive Flow Only 1 = Pulse on Negative Flow Only 2 = Pulse on both Positive and Negative Flow
120	FO_SCALING_METHOD (Frequency Output Scaling Method)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	0 = Frequency = Flow 1 = Pulses/Unit 2 = Units/Pulse
121	FO_SIMULATE (FO Simulation)	ENUM1	Unsigned8 (1)	S	R/W (Any)	0 = Disable 1 = Enable

Table A-31: Frequency Output configuration *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
122	FO_FIXED_VALUE (FO Fixed Frequency)	VAR	FLOAT (4)	S	R/W (Any)	$0.0 \leq x \leq 14500.0$
123	FO_OUT (FO Actual Frequency)	VAR	FLOAT (4)	D	RO	$0.0 \leq x \leq 14500.0$

Frequency Output source variable codes

0 = Mass Flow Rate
5 = Volume Flow Rate
16 = API Corr Volume Flow
23 = CM: Std Vol Flow Rate
26 = CM: Net Mass Flow Rate
29 = CM: Net Vol Flow Rate
62 = Gas Std Vol Flow
73 = APM: Net Flow Oil At Line
75 = APM: Net Flow Water At Line
78 = APM: Net Flow Oil At Ref
81 = APM: Net Flow Water At Re

Table A-32: Discrete Output configuration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
124	DO_VAR (DO Source)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Discrete Output source variable codes
125	DO_POLARITY (DO Polarity)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	0 = Active Low 1 = Active High
126	DO_FLT_ACT (DO Fault Action)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	0 = Upscale 1 = Downscale 4 = None
127	DO_FIX_STATE (DO Fix)	ENUM1	Unsigned8 (1)	S	R/W (Any)	0 = Off 1 = On 255 = Unfix
128	DO_SIMULATE (DO Simulation)	ENUM1	Unsigned8 (1)	S	R/W (Any)	0 = Disable 1 = Enable

Discrete Output source variable codes

57 = Discrete Event 1
58 = Discrete Event 2
59 = Discrete Event 3
60 = Discrete Event 4
61 = Discrete Event 5
101 = Flow Switch Indicator
102 = Forward/Reverse Indication
103 = Zero Calibration in Progress
104 = Fault Condition Indication
216 = Meter Verification Failure

Table A-33: Flow rate switch

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
129	FLW_RATE_SW_SOURCE (Flow Source)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Frequency Output source variable codes
130	FLW_RATE_SW_SETPOINT (Flow Setpoint)	VAR	FLOAT (4)	S	R/W (OOS)	x ≥ 0.0
131	FLW_RATE_SW_HYS (Flow Rate Hysteresis (0.1-10.0))	VAR	FLOAT (4)	S	R/W (OOS)	0.1 ≤ x ≤ 10.0
132	FLW_RATE_SOURCE_ UNITS (Flow Rate Source)	ENUM2	Unsigned16 (2)	S	RO	MFLOW_UNIT VFLOW_UNIT GSV_FLOW_UNITS

Table A-34: System time

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
133	RTC_TIME_ZONE (Time Zone)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Time zone codes
134	RTC_TIME_ZONE_OFFSET (Time Zone Offset from UTC)	VAR	FLOAT (4)	S	R/W (OOS)	-24.0f ≤ x ≤ 24.0f
135	RTC_DAY_LIGHT_SAVING (Day Light Savings)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	0 = Disable 1 = Enable
136	RTC_DATE_TIME (Set Clock Date-Time)	VAR	DATE (7)	D	R/W (OOS)	—

Time zone codes

0 = Dateline (-12.0)
1 = Soma (-11.0)
2 = Hawaii (-10.0)
3 = Alaska (-9.0)
4 = Pacific (-8.0)
5 = Mountain (-7.0)
6 = Central (-6.0)
7 = Eastern (-5.0)
8 = Atlantic (-4.0)
9 = New Foundland (-3.5)
10 = saEastern (-3.0)
11 = MidAtlantic (-2.0)
13 = Greenwich (0.0)
14 = Central EU (+1.0)
15 = Europe (+2.0)
16 = Russian (+3.0)
17 = Iran (+3.5)
18 = Arabian (+4.0)
19 = Afghan (+4.5)
20 = West Asia (+5.0)
21 = India (+5.5)
22 = Nepal (+5.75)
23 = Central Asia (+6.0)
24 = Myanmar (+6.5)
25 = South East Asia (+7.0)
26 = China (+8.0)
27 = Korea (+9.0)
28 = Central Australia (+9.5)
29 = East Australia (+10.0)
30 = Central Pacific (+11.0)
31 = Fiji (+12.0)
32 = Tonga (+13.0)
33 = special

Table A-35: Device feature control

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
137	DEVICE_UNIQUE_ID (Device Unique ID)	VAR	Unsigned32	S	RO	—
138	PERM_LICENSE_KEY (Permanent License Key)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	16 ASCII characters that represent hexadecimal values (0-9, A-F)
139	TEMP_LICENSE_KEY (Temporary License Key)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	16 ASCII characters that represent hexadecimal values (0-9, A-F)
140	DEVICE_TEMP_LICENSE (Temporary Feature)	VAR	BIT STRING (4)	S	RO	See Temporary and permanent feature license codes
141	DEV_TEMP_LICS_EXPIRY (Days Until Expiration)	VAR	Unsigned16 (2)	S	RO	—
142	DEVICE_PERM_LICENSE (Permanent Feature)	VAR	BIT STRING (4)	S	RO	See Temporary and permanent feature license codes
143	DEV_PERM_LICS_EXPIRY (Device Permanent License Expiry)	VAR	Unsigned16 (2)	S	RO	—
144	CM_EN (Concentration Measurement)	ENUM	Unsigned8 (1)	S	R/W (OOS)	0 = Disable 1 = Enable
145	PM_EN (API Referral)	ENUM	Unsigned8 (1)	S	R/W (OOS)	0 = Disable 1 = Enable
146	USB_PORT_EN (Enable Service Port)	ENUM	Unsigned8 (1)	S	R/W (Any)	0 = Disable 1 = Enable

Temporary and permanent feature license codes

Used with OD Index 140 and 142.

0x00008000 = APM for Single Liquid and Gas
0x00000010 = API Referral
0x00000008 = Concentration Measurement
0x00000800 = APM for Wet Gas
0x00002000 = APM for 3 Phase Flow and NOC
0x00004000 = Historian download
0x00001000 = Meter Verification

Table A-36: Configuration file operations

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
147	CONF_FILE_TYPE (Configuration File Type)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1 = Spare File 3 = Transfer File 5 = ED Matrix File 255 = None
148	CONF_FILE_SAVE (Save Configuration File)	ENUM	Unsigned8 (1)	S	R/W (OOS)	0 = None 1 = Save Config File

Table A-36: Configuration file operations *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
149	CONF_FILE_RESTORE (Restore Configuration File)	ENUM	Unsigned8 (1)	S	R/W (OOS)	0 = None 1 = Restore Config File
150	CONF_FILE_NAME (File Name)	VAR	VISIBLE STRING (20)	S	R/W (OOS)	—
151	CONF_FILE_STATUS (Config File)	ENUM2	Unsigned16 (2)	S	RO	0 = Done 1 = Error/Aborted 2 = In progress
152	CONF_FILE_CURVE_NUM (Select the Matrix)	VAR	Unsigned16 (2)	S	R/W (OOS)	0 ≤ x ≤ 5

Table A-37: Discrete events

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
153	DIS_EVENT_INDEX (Discrete Event)	ENUM1	Unsigned8 (1)	S	R/W (Any)	0 ≤ x ≤ 4
154	DIS_EVENT_ACTION (Discrete Event Action)	ENUM2	Unsigned8 (1)	S	R/W (OOS)	0 = > set-point A (process value > A) 1 = < set-point A (process value < A) 2 = In Range (A < process value < B) 3 = Out of Range (process value < A or process value > B)
155	DIS_EVENT_SETPOINTA (SetpointA)	VAR	FLOAT (4)	S	R/W (OOS)	—
156	DIS_EVENT_SETPOINTB (SetpointB)	VAR	FLOAT (4)	S	R/W (OOS)	—
157	DIS_EVENT_PV (Enhanced Event PV)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Enhanced event process variable codes
158	DIS_ENENT_TRIGGER (Enhanced Event Trigger)	ENUM2	BIT STRING (2)	S	R/W (OOS)	See Enhanced event trigger codes

Table A-37: Discrete events *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
159	DIS_ENENT_UNITS (Enhanced Event Units)	ENUM2	Unsigned16 (2)	S	RO	MFLOW_UNIT VFLOW_UNIT TEMP_UNIT DENSITY_UNIT PRESSURE_UNITS GSV_FLOW_UNITS FLOW_VELOCITY_UNIT Hz % Volts BAUM NO_UNIT TI_MASS_STD_UNITS TI_VOL_STD_UNITS TI_GSV_STD_UNITS

Enhanced event process variable codes

0 = Mass Flow Rate
1 = Temperature
2 = Cfg Total 1
3 = Density
4 = Cfg Inv 1
5 = Volume Flow Rate
6 = Cfg Total 2
7 = Cfg Inv 2
15 = API: Corr Density
16 = API: Corr Vol Flow
17 = Cfg Total 3
18 = Cfg Inv 3
19 = API: Avg Density
20 = API: Avg Temp
21 = ED: Density At Ref
22 = ED: Density (SGU)
23 = ED: Std Vol Flow Rate
24 = Cfg Total 5
25 = Cfg Inv 5
26 = ED: Net Mass Flow
27 = Cfg Total 6
29 = ED: Net Vol Flow Rate
30 = Cfg Total 7
31 = Cfg Inv 7
32 = ED: Concentration
33 = API: CTL
46 = Raw Tube Frequency
47 = Drive Gain
48 = Case Temperature
49 = LPO Amplitude
50 = RPO Amplitude
51 = Board Temperature
53 = Ext. Input Pressure
55 = Ext. Input Temp
56 = ED: Density (Baume)
62 = Gas Std Vol Flow
63 = Cfg Total 4
64 = Cfg Inv 4
68 = Field Verification Zero
69 = Live Zero
73 = APM: Net Flow Oil At Line
74 = APM: Water Cut At Line
75 = APM: Net Flow Water At Line
78 = APM: Net Flow Oil At Ref
79 = APM: Water Cut At Ref
81 = APM: Net Flow Water At Ref
187 = APM: Dens Oil at Line
205 = APM: Gas Void Fraction
208 = Mass Flow Velocity
228 = Phage Genius Flow Severity
251 = None

Enhanced event trigger codes

0x0001 = Reset All Totals
0x0002 = Start/Stop Totals
0x0004 = Reset Total 1
0x0008 = Reset Total 2
0x0010 = Reset Total 3
0x0020 = Reset Total 4
0x0040 = Reset Total 5
0x0080 = Reset Total 6
0x0100 = Reset Total 7
0x0200 = Start Sensor Zero
0x0400 = Increment ED Curve
0x0800 = Start Smart Meter Verification

Table A-38: Features

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
160	DEV_FEATURES (Device Features)	VAR	BIT STRING (2)	D	RO	See Device feature codes

Device feature codes

0x0000 = FKEY_NO_FEATURE
0x0001 = APM Cont Flow
0x0002 = TMR
0x0004 = PVR
0x0008 = TBR
0x0010 = SMV
0x0020 = GSV
0x0040 = ED
0x0080 = API
0x0800 = CAL FAIL
0x1000 = APM TMR
0x2000 = APM Var NOC
0x4000 = APM Var Flow
0x8000 = APM Cont NOC

Device information transducer block views

Table A-39: Standard FF parameters

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
0	BLOCK_STRUCTURE										1.0
1	ST_REV	2	2	2	2	2	2	2	2	2	1.0
2	TAG_DESC										1.0
3	STRATEGY										1.0
4	ALERT_KEY				1						1.0
5	MODE_BLK	4		4	4						1.0
6	BLOCK_ERR	2		2							1.0
7	UPDATE_EVT										1.0
8	BLOCK_ALM										1.0
9	TRANSDUCER_DIRECTORY										1.0
10	TRANSDUCER_TYPE	2	2	2					2		1.0
11	TRANSDUCER_TYPE_VER	2	2	2					2		1.0
12	XD_ERROR	1		1							1.0
13	COLLECTION_DIRECTORY										1.0

Table A-40: Transmitter information

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
14	TRANSMITTER_SERIAL_NUMBER (Transmitter Serial Number)										1.0
15	OPTION_PRODUCT_CODE (Option Model Number)										1.0
16	BASE_PRODUCT_CODE (Base Model Number)										1.0
17	TRANSMITTER_SW_REV (Transmitter Software Revision)										1.0

Table A-40: Transmitter information *(continued)*

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
18	TRANSMITTER_SW_CHKSUM (Transmitter Software Checksum)										1.0
19	CEQ_NUMBER (Engineer to Order Number)										1.0
20	DESCRIPTION (Description)				16						1.0
21	TRANSMIITER_DEVICE_TYPE (Model)										1.0

Table A-41: Core Processor information

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
22	CORE_SERIAL_NUMBER (Core Processor Serial Number)										1.0
23	CORE_SW_REV (Core Processor Software Revision)										1.0
24	CORE_SW_CHKSUM (Core Processor Software Checksum)										1.0
25	CORE_DEVICE_TYPE (Core Device Type)										1.0

Table A-42: Protocol processor information

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
26	PROTO_SW_REV (Protocol Processor Software Revision)										1.0
27	PROTO_SW_CHKSUM (Protocol Processor Software Checksum)										1.0

Table A-43: Sensor information

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
28	SENSOR_SN (Sensor Serial Number)				4						1.0
29	SENSOR_TYPE (Sensor Model)				16						1.0
30	SENSOR_CODE (Sensor Type)				2						1.0
31	SENSOR_MATERIAL (Tube Wetted Material)				2						1.0
32	SENSOR_LINER (Tube Lining)				2						1.0
33	SENSOR_END (Sensor Flange)				2						1.0

Table A-44: Alarm status

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
34	ALERT1_CONDITION (Alert Condition1)	2		2							1.0
35	ALERT2_CONDITION (Alert Condition2)	2		2							1.0
36	ALERT3_CONDITION (Alert Condition3)	2		2							1.0
37	ALERT4_CONDITION (Alert Condition4)	2		2							1.0
38	ALERT5_CONDITION (Alert Condition5)	2		2							1.0
39	ALERT6_CONDITION (Alert Condition6)	2		2							1.0
40	ALARM1_IGNOR (Alert Suppress 1)								2		1.0
41	ALARM2_IGNOR (Alert Suppress 2)								2		1.0
42	ALARM3_IGNOR (Alert Suppress 3)								2		1.0
43	ALARM4_IGNOR (Alert Suppress 4)								2		1.0
44	ALARM5_IGNOR (Alert Suppress 5)								2		1.0
45	ALARM6_IGNOR (Alert Suppress 6)								2		1.0

Table A-44: Alarm status *(continued)*

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
46	ALERT_RESTORE_FACTORY (Restore Alert Factory)								1		1.0
47	FAULT_LIMIT (Fault Limit)		2								1.0
48	LMV_FLT_TIMEOUT (Fault Timeout)		2								1.0
49	ALERT_TIMEOUT FOUNDATION Fieldbus Alert Timeout					2					1.0
50	ANALOG_OUTPUT_FAULT (Analog Output Fault)	2		2							1.0

Table A-45: Alert condition simulation

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
51	SIMULATE_ALERT_CONDITION (Alert Condition Simulation)									1	1.0
52	ALERT1_SIMULATE (Alert Simulation 1)									2	1.0
53	ALERT2_SIMULATE (Alert Simulation 2)									2	1.0
54	ALERT3_SIMULATE (Alert Simulation 3)									2	1.0
55	ALERT4_SIMULATE (Alert Simulation 4)									2	1.0
56	ALERT5_SIMULATE (Alert Simulation 5)									2	1.0
57	ALERT6_SIMULATE (Alert Simulation 6)									2	1.0

Table A-46: FF simulation

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
58	FF_SIMULATION (Alert Simulation Lock)									1	1.0

Table A-47: Local display

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
59	LDO_BACKLIGHT_INTEN (Intensity (0-100))							2			1.0
60	LDO_CONTRAST (Contrast (0-100))							2			1.0
61	LDO_LANG (Language)							2			1.0
62	LDO_BACKLIGHT_EN (Backlight Control)							1			1.0
63	LDO_TOT_RESET_EN (Totalizer Reset)							1			1.0
64	LDO_TOT_START_STOP_EN (Start/Stop) Totalizers							1			1.0
65	LDO_AUTO_SCROLL_EN (Auto Scroll)							1			1.0
66	LDO_AUTO_SCROLL_RATE (Scroll Time) (1-30)							2			1.0
67	LDO_OFFLINE_PWD_EN (Offline Menu Passcode Required)							1			1.0
68	LDO_OFFLINE_PWD (Passcode (4 Digits alphanumeric))							4			1.0
69	LDO_VAR1_CODE (Variable 1)					2					1.0
70	LDO_VAR2_CODE (Variable 2)					2					1.0
71	LDO_VAR3_CODE (Variable 3)					2					1.0
72	LDO_VAR4_CODE (Variable 4)					2					1.0
73	LDO_VAR5_CODE (Variable 5)					2					1.0
74	LDO_VAR6_CODE (Variable 6)					2					1.0
75	LDO_VAR7_CODE (Variable 7)					2					1.0
76	LDO_VAR8_CODE (Variable 8)					2					1.0
77	LDO_VAR9_CODE (Variable 9)					2					1.0

Table A-47: Local display *(continued)*

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
78	LDO_VAR10_CODE (Variable 10)					2					1.0
79	LDO_VAR11_CODE (Variable 11)					2					1.0
80	LDO_VAR12_CODE (Variable 12)					2					1.0
81	LDO_VAR13_CODE (Variable 13)					2					1.0
82	LDO_VAR14_CODE (Variable 14)					2					1.0
83	LDO_VAR15_CODE (Variable 15)					2					1.0
84	LDO_2PV_VAR1_CODE Two PV Variable 1					2					1.0
85	LDO_2PV_VAR2_CODE (Two PV Variable 2)					2					1.0
86	LDO_PROC_VAR_INDEX (Process Variable)					2					1.0
87	LDO_NUM_DECIMALS (Decimal Places)					2					1.0
88	LDO_UPDATE_PERIOD (Variable Update Rate)					2					1.0
89	LDO_PASSWORD_EN (Alert Passcode)							1			1.0
90	LDO_FF_SIMULATE (Simulation Switch)							1			1.0
91	LDO_WL_STATUS (Write Lock Switch)							1			1.0

Table A-48: Channel assignments

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
92	CH_SEL_B (Channel B Assignment)				2						1.0
93	CH_SEL_C (Channel C Assignment)				2						1.0

Table A-49: Analog output (mAO) configuration

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
94	MAO_SRC_VAR (mAO Source Variable)						2				1.0
95	MAO_SRC_UNITS (mA Output Units)						2				1.0
96	MAO_DAMPING (mAO Added Damping)						4				1.0
97	MAO_VAR_LO (mAO Lower Range Value)						4				1.0
98	MAO_VAR_HI (mAO Upper Range Value)						4				1.0
99	MAO_FLT_ACT (mAO Fault Action)						2				1.0
100	MAO_FLT_LEV (mAO Fault Level)						4				1.0
101	MAO_START_LO_TRM (mAO Low Trim)		1								1.0
102	MAO_START_HO_TRM (mAO High Trim)		1								1.0
103	MAO_DIR (mAO Direction)						1				1.0
104	MAO_FLOW_CUTOFF (mA Output Flow) Rate Cutoff						4				1.0
105	MAO_MIN_SPAN (mAO Minimum Span)						4				1.0
106	MAO_SENSOR_LO_LIMIT (mAO Lower Sensor Limit)						4				1.0
107	MAO_SENSOR_HI_LIMIT (mAO Upper Sensor Limit)						4				1.0
108	MAO_SIMULATE (mAO Simulation)						1				1.0
109	MAO_FIXED_CURRENT (mAO Fixed Current)						4				1.0
110	MAO_ACTUAL_CURRENT (mAO Actual Current)			4							1.0

Table A-50: Frequency Output configuration

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
111	FO_SRC_VAR (Frequency Output)									2	1.0
112	FO_SRC_UNITS (Frequency Output Units)									2	1.0
113	FO_FLOW_FAC FO (Rate Factor)									4	1.0
114	FO_FRQ_FAC (Frequency Factor)									4	1.0
115	FO_PULSES_PER_UNIT (Pulses/Unit)									4	1.0
116	FO_UNITS_PER_PULSE (Units/Pulse)									4	1.0
117	FO_FLT_ACT (FO Fault Action)									1	1.0
118	FO_FLT_LEV (FO Fault Level)									4	1.0
119	FO_DIR (Frequency Output Direction)									2	1.0
120	FO_SCALING_METHOD (Frequency Output Scaling Method)									2	1.0
121	FO_SIMULATE (FO Simulation)									1	1.0
122	FO_FIXED_VALUE (FO Fixed Frequency)									4	1.0
123	FO_OUT (FO Actual Frequency)			4							1.0

Table A-51: Discrete Output configuration

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
124	DO_VAR (DO Source)								2		1.0
125	DO_POLARITY (DO Polarity)								2		1.0
126	DO_FLT_ACT (DO Fault Action)								2		1.0
127	DO_FIX_STATE (DO Fix)								1		1.0
128	DO_SIMULATE (DO Simulation)								1		1.0

Table A-52: Flow rate switch

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
129	FLW_RATE_SW_SOURCE (Flow Source)								2		1.0
130	FLW_RATE_SW_SETPOINT (Flow Setpoint)								4		1.0
131	FLW_RATE_SW_HYS (Flow Rate Hysteresis (0.1-10.0))								4		1.0
132	FLW_RATE_SOURCE_UNITS (Flow Rate Source)								2		1.0

Table A-53: System time

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
133	RTC_TIME_ZONE (Time Zone)								2		1.0
134	RTC_TIME_ZONE_OFFSET (Time Zone Offset from UTC)								4		1.0
135	RTC_DAY_LIGHT_SAVING (Day Light Savings)								1		1.0
136	RTC_DATE_TIME (Set Clock Date-Time)			7							1.0

Table A-54: Device feature control

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
137	DEVICE_UNIQUE_ID (Device Unique ID)										1.0
138	PERM_LICENSE_KEY (Permanent License Key)				16						1.0
139	TEMP_LICENSE_KEY (Temporary License Key)				16						1.0
140	DEVICE_TEMP_LICENSE (Temporary Feature)				4						1.0
141	DEV_TEMP_LICS_EXPIRY (Days Until Expiration)				2						1.0
142	DEVICE_PERM_LICENSE (Permanent Feature)				4						1.0

Table A-54: Device feature control *(continued)*

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
143	DEV_PERM_LICS_EXPIRY (Device Permanent License Expiry)				2						1.0
144	CM_EN (Concentration Measurement)				1						1.0
145	PM_EN (API Referral)				1						1.0
146	USB_PORT_EN (Enable Service Port)				1						1.0

Table A-55: Configuration file operations

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
147	CONF_FILE_TYPE (Configuration File Type)							2			1.0
148	CONF_FILE_SAVE (Save Configuration File)							1			1.0
149	CONF_FILE_RESTORE (Restore Configuration File)							1			1.0
150	CONF_FILE_NAME (File Name)							20			1.0
151	CONF_FILE_STATUS (Config File)							2			1.0
152	CONF_FILE_CURVE_NUM (Select the Matrix)							2			1.0

Table A-56: Discrete events

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
153	DIS_EVENT_INDEX (Discrete Event)						1				1.0
154	DIS_EVENT_ACTION (Discrete Event Action)						2				1.0
155	DIS_EVENT_SETPOINTA (Setpoint A)						4				1.0
156	DIS_EVENT_SETPOINTB (Setpoint B)						4				1.0
157	DIS_EVENT_PV (Enhanced Event PV)						2				1.0

Table A-56: Discrete events *(continued)*

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
158	DIS_ENENT_TRIGGER (Enhanced Event Trigger)						2				1.0
159	DIS_ENENT_UNITS (Enhanced Event Units)						2				1.0

Table A-57: Features

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
160	DEV_FEATURES (Device Features)			2							1.0

A.2.4 Totalizers and inventories transducer block

Totalizers and inventories transducer block details

Table A-58: Configurable totalizer

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
14	INTEGRATOR1_FB_CONFIG (Integrator1 Configuration)	ENUM1	Unsigned8 (1)	S	R/W (Any)	See Integrator1 and Integrator2 configuration codes
15	INTEGRATOR2_FB_CONFIG (Integrator2 Configuration)	ENUM1	Unsigned8 (1)	S	R/W (Any)	See Integrator1 and Integrator2 configuration codes
16	TOT_INV_CON (Totalizer and Inventory Control Codes)	ENUM1	Unsigned8 (1)	S	R/W (Any)	See Totalizer and inventory control codes
17	CFG_TOT1 (Total 1)	VAR	DS-65 (5)	D	RO	N/A
18	CFG_TOT1_SRC (Total 1 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
19	CFG_TOT1_UNIT_SRC (Total 1 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
20	CFG_TOT1_UNIT (Total 1 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
21	CFG_TOT1_DIRECTION (Total1 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
22	CFG_TOT1_NAME (Total 1 Name)	VAR	VISIBLE STRING (16)	S	RO	—
23	CFG_TOT1_USER_NAME (Total1 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—

Table A-58: Configurable totalizer *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
24	CFG_TOT1_RESET (Total 1 Reset)	VAR	DS-66 (2)	S	R/W (Any)	—
25	CFG_TOT2 (Total 2)	VAR	DS-65 (5)	D	RO	—
26	CFG_TOT2_SRC (Total 2) Source Variable	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
27	CFG_TOT2_UNIT_SRC (Total 2Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
28	CFG_TOT2_UNIT (Total 2 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
29	CFG_TOT2_DIRECTION (Total 2 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
30	CFG_TOT2_NAME (Total 2 Name)	VAR	VISIBLE STRING (16)	S	RO	—
31	CFG_TOT2_USER_NAME (Total 2 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
32	CFG_TOT2_RESET (Total 2 Reset)	VAR	DS-66 (2)	S	R/W (Any)	—
33	CFG_TOT3 (Total 3)	VAR	DS-65 (5)	D	RO	—
34	CFG_TOT3_SRC (Total 3 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
35	CFG_TOT3_UNIT_SRC (Total 3 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
36	CFG_TOT3_UNIT (Total 3 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
37	CFG_TOT3_DIRECTION (Total 3 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
38	CFG_TOT3_NAME (Total 3 Name)	VAR	VISIBLE STRING (16)	S	RO	—
39	CFG_TOT3_USER_NAME (Total 3 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
40	CFG_TOT3_RESET (Total 3 Reset)	VAR	DS-66 (2)	S	R/W (Any)	—
41	CFG_TOT4 (Total 4)	VAR	DS-65 (5)	D	RO	—
42	CFG_TOT4_SRC (Total 4 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
43	CFG_TOT4_UNIT_SRC (Total 4 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
44	CFG_TOT4_UNIT (Total 4 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes

Table A-58: Configurable totalizer *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
45	CFG_TOT4_DIRECTION (Total 4 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
46	CFG_TOT4_NAME (Total 4 Name)	VAR	VISIBLE STRING (16)	S	RO	—
47	CFG_TOT4_USER_NAME (Total 4 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
48	CFG_TOT4_RESET (Total 4 Reset)	VAR	DS-66 (2)	S	R/W (Any)	—
49	CFG_TOT5 (Total 5)	VAR	DS-65 (5)	D	RO	N/A
50	CFG_TOT5_SRC (Total 5 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
51	CFG_TOT5_UNIT_SRC (Total 5 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
52	CFG_TOT5_UNIT (Total 5 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
53	CFG_TOT5_DIRECTION (Total 5 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
54	CFG_TOT5_NAME (Total 5 Name)	VAR	VISIBLE STRING (16)	S	RO	—
55	CFG_TOT5_USER_NAME (Total 5 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
56	CFG_TOT5_RESET (Total 5 Reset)	VAR	DS-66 (2)	S	R/W (Any)	—
57	CFG_TOT6 (Total 6)	VAR	DS-65 (5)	D	RO	N/A
58	CFG_TOT6_SRC (Total 6 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
59	CFG_TOT6_UNIT_SRC (Total 6 Unit)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
60	CFG_TOT6_UNIT (Total 6 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
61	CFG_TOT6_DIRECTION (Total 6 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
62	CFG_TOT6_NAME (Total 6 Name)	VAR	VISIBLE STRING (16)	S	RO	—
63	CFG_TOT6_USER_NAME (Total 6 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
64	CFG_TOT6_RESET (Total 6 Reset)	VAR	DS-66 (2)	S	R/W (Any)	—
65	CFG_TOT7 (Total 7)	VARIABL E	DS-65 (5)	D	RO	N/A

Table A-58: Configurable totalizer *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
66	CFG_TOT7_SRC (Total 7 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
67	CFG_TOT7_UNIT_SRC (Total 7 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
68	CFG_TOT7_UNIT (Total 7 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
69	CFG_TOT7_DIRECTION (Total 7 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
70	CFG_TOT7_NAME (Total 7 Name)	VAR	VISIBLE STRING (16)	S	RO	—
71	CFG_TOT7_USER_NAME (Total 7 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
72	CFG_TOT7_RESET (Total 7 Reset)	VAR	DS-66 (2)	S	R/W (Any)	—
73	ALL_TOT_RESET (Reset All Totalizers)	VAR	DS-66 (2)	S	R/W (Any)	Value part of DS-66 (2) \ 1 = Reset All Totals 0= None
74	START_STOP_ALL_TOTALS (Start/Stop all Totalizers)	VAR	DS-66 (2)	S	R/W (Any)	Value part of DS-66 (2) 0 = Stop Totalizers 1 = Start Totalizers

Integrator1 and Integrator2 configuration codes

0 = Standard
1 = Total 1
2 = Total 2
3 = Inventory 1
4 = Inventory 2
5 = Total 4
6 = Inventory 3
7 = Total 3
8 = Inventory 4
9 = Total 5
10 = Inventory 5
11 = Total 6
12 = Inventory 6
13 = Total 7
14 = Inventory 7

Totalizer and inventory control codes

00 = None
01 = Start All Totalizers
02 = Stop All Totalizers
03 = Reset All Totalizers
04 = Reset All Inventories
05 = Totalizer1 Start
06 = Totalizer2 Start
07 = Totalizer3 Start
08 = Totalizer4 Start
09 = Totalizer5 Start
10 = Totalizer6 Start
11 = Totalizer7 Start
12 = Inventory1 Start
13 = Inventory2 Start
14 = Inventory3 Start
15 = Inventory4 Start
16 = Inventory5 Start
17 = Inventory6 Start
18 = Inventory7 Start
19 = Totalizer1 Stop
20 = Totalizer2 Stop
21 = Totalizer3 Stop
22 = Totalizer4 Stop
23 = Totalizer5 Stop
24 = Totalizer6 Stop
25 = Totalizer7 Stop
26 = Inventory1 Stop
27 = Inventory2 Stop
28 = Inventory3 Stop
29 = Inventory4 Stop
30 = Inventory5 Stop
31 = Inventory6 Stop
32 = Inventory7 Stop
33 = Totalizer1 Reset
34 = Totalizer2 Reset
35 = Totalizer3 Reset
36 = Totalizer4 Reset
37 = Totalizer5 Reset
38 = Totalizer6 Reset
39 = Totalizer7 Reset
40 = Inventory1 Reset
41 = Inventory2 Reset
42 = Inventory3 Reset
43 = Inventory4 Reset
44 = Inventory5 Reset
45 = Inventory6 Reset
46 = Inventory7 Reset

Totalizer and inventory source variable codes

00 = Mass Flow Rate
05 = Line (Gross) Volume Flow Rate
16 = PM: Temp Corrected (Standard) Volume Flow
23 = CM: Standard Volume Flow Rate
26 = CM:Net Mass Flow Rate
29 = CM:Net Volume Flow Rate
62 = Gas Standard Volume Flow Rate
73 = APM: Net Flow Oil At Line
75 = APM: Net Flow Water At Line
78 = APM: Net Flow Oil At Ref
81 = APM: Net Flow Water At Ref
210 = APM: Unremediated Mass Flow
212 = APM: Unremediated Vol Flow

Totalizer and inventory unit source codes

224 = Mass Total Units
225 = Volume Total Units
226 = Alt Volume Total Units
227 = Alt Mass Total Units

Totalizer and inventory unit codes

1089 = Grams
1088 = Kilograms
1092 = Metric Tons
1094 = Pounds
1095 = Short tons
1096 = long tons
1048 = Gallons
1038 = Liters
1049 = Imperial Gallons
1043 = Cubic Feet
1034 = Cubic Meters
1051 = Barrels
1053 = SCF
1521 = Nm3
1526 = Sm3
1531 = NL
1536 = SL
253 = Special units

Totalizer and inventory direction codes

0 = Forward Only (Totalizers Increment for Positive Flow)
1 = Reverse Only (Totalizers Increment for Negative Flow)
2 = Bi-Directional (Totalizers Increment for Positive Flow Decrement for Negative Flow)
3 = Absolute (Totalizers Increment for Positive and Negative Flow)

Table A-59: Configurable inventory

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
75	CFG_INV1 (Inventory 1)	VAR	DS-65 (5)	D	RO	N/A
76	CFG_INV1_DIRECTION (Inventory1 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
77	CFG_INV1_SRC (Inventory 1 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
78	CFG_INV1_UNIT_SRC (Inventory1 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
79	CFG_INV1_UNIT (Inventory 1 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
80	CFG_INV1_NAME (Inventory 1 Name)	VAR	VISIBLE STRING (16)	S	RO	—
81	CFG_INV1_USER_NAME (Inventory 1 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
82	CFG_INV2 (Inventory 2)	VAR	DS-65 (5)	D	RO	N/A
83	CFG_INV2_DIRECTION (Inventory 2 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes

Table A-59: Configurable inventory *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
84	CFG_INV2_SRC (Inventory 2 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
85	CFG_INV2_UNIT_SRC (Inventory2 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
86	CFG_INV2_UNIT (Inventory 2 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
87	CFG_INV2_NAME (Inventory 2 Name)	VAR	VISIBLE STRING (16)	S	RO	—
88	CFG_INV2_USER_NAME (Inventory 2 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
89	CFG_INV3 (Inventory 3)	VAR	DS-65 (5)	D	RO	N/A
90	CFG_INV3_DIRECTION (Inventory 3 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
91	CFG_INV3_SRC (Inventory 3 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
92	CFG_INV3_UNIT_SRC (Inventory 3 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
93	CFG_INV3_UNIT (Inventory 3 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
94	CFG_INV3_NAME (Inventory 3 Name)	VAR	VISIBLE STRING (16)	S	RO	—
95	CFG_INV3_USER_NAME (Inventory 3 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
96	CFG_INV4 (Inventory 4)	VAR	DS-65 (5)	D	RO	N/A
97	CFG_INV4_DIRECTION (Inventory 4 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
98	CFG_INV4_SRC (Inventory 4 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
99	CFG_INV4_UNIT_SRC (Inventory 4 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
100	CFG_INV4_UNIT (Inventory 4 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
101	CFG_INV4_NAME (Inventory 4 Name)	VAR	VISIBLE STRING (16)	S	RO	—
102	CFG_INV4_USER_NAME (Inventory 4 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
103	CFG_INV5 (Inventory 5)	VAR	DS-65 (5)	D	RO	N/A

Table A-59: Configurable inventory *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
104	CFG_INV5_DIRECTION (Inventory 5 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
105	CFG_INV5_SRC (Inventory 5 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
106	CFG_INV5_UNIT_SRC (Inventory 5 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
107	CFG_INV5_UNIT (Inventory 5 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
108	CFG_INV5_NAME (Inventory 5 Name)	VAR	VISIBLE STRING (16)	S	RO	—
109	CFG_INV5_USER_NAME (Inventory 5 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
110	CFG_INV6 (Inventory 6)	VAR	DS-65 (5)	D	RO	N/A
111	CFG_INV6_DIRECTION (Inventory 6 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
112	CFG_INV6_SRC(Inventory 6 Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
113	CFG_INV6_UNIT_SRC (Inventory 6 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
114	CFG_INV6_UNIT (Inventory 6 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
115	CFG_INV6_NAME (Inventory 6 Name)	VAR	VISIBLE STRING (16)	S	RO	—
116	CFG_INV6_USER_NAME (Inventory 6 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—
117	CFG_INV7 (Inventory 7)	VAR	DS-65 (5)	D	RO	N/A
118	CFG_INV7_DIRECTION (Inventory 7 Direction)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory direction codes
119	CFG_INV7_SRC (Inventory 7 Source Variable)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory source variable codes
120	CFG_INV7_UNIT_SRC (Inventory 7 Unit Source)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	See Totalizer and inventory unit source codes
121	CFG_INV7_UNIT (Inventory 7 Unit)	ENUM2	Unsigned16 (2)	S	RO	See Totalizer and inventory unit codes
122	CFG_INV7_NAME (Inventory 7 Name)	VAR	VISIBLE STRING (16)	S	RO	—
123	CFG_INV7_USER_NAME (Inventory 7 User-Defined Label)	VAR	VISIBLE STRING (16)	S	R/W (OOS)	—

Table A-60: Totalizer\Inventory units

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
124	TI_MASS_STD_UNITS (Tot/Inv Mass Standard Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1089 = g 1088 = kg 1092= t 1094= lb 1095= STon 1096 = Lton
125	TI_MASS_ALT_UNITS (Tot/Inv Mass Alternate Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	
126	TI_VOL_STD_UNITS (Tot/Inv Volume Standard Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Tot/Inv volume standard and alternate unit codes
127	TI_VOL_ALT_UNITS (Tot/Inv Volume Alternate Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Tot/Inv volume standard and alternate unit codes

Tot/Inv volume standard and alternate unit codes

1048 = gallon
1038 = L
1049 = ImpGal
1043 = ft^3
1034 = m^3
1051 = bbl
1053 = SCF
1521 = Nm^3
1526 = Sm^3
1531 = NL
1536 = SL
253 = Special units

Table A-61: Totalizer/Inventory features

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
128	TI_FEATURES (Device Features)	VAR	BIT STRING (2)	D	RO	See Device feature codes

Device feature codes

0x0000 = FKEY_NO_FEATURE
0x0001 = APM Cont Flow
0x0002 = TMR
0x0004 = PVR
0x0008 = TBR
0x0010 = SMV
0x0020 = GSV
0x0040 = ED
0x0080 = API
0x0800 = CAL FAIL
0x1000 = APM TMR
0x2000 = APM Var NOC
0x4000 = APM Var Flow
0x8000 = APM Cont NOC

Totalizers and inventories transducer block views

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
Standard FF Parameters											
0	BLOCK_STRUCTURE										1.0
1	ST_REV	2	2	2	2	2	2	2	2	2	1.0
2	TAG_DESC										1.0
3	STRATEGY										
4	ALERT_KEY				1						1.0
5	MODE_BLK	4		4	4						1.0

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
6	BLOCK_ERR	2		2							1.0
7	UPDATE_EVT										1.0
8	BLOCK_ALM										1.0
9	TRANSDUCER_DIRECTORY										1.0
10	TRANSDUCER_TYPE	2	2	2	2						1.0
11	TRANSDUCER_TYPE_VER	2	2	2	2						1.0
12	XD_ERROR	1		1							1.0
13	COLLECTION_DIRECTORY										1.0
Configurable Totalizer											
14	INTEGRATOR1_FB_CONFIG (Integrator1 Configuration)									1	1.0
15	INTEGRATOR2_FB_CONFIG (Integrator2 Configuration)									1	1.0
16	TOT_INV_CON (Totalizer and Inventory Control Codes)				1	1	1	1	1		1.0
17	CFG_TOT1 (Total 1)	5		5							1.0
18	CFG_TOT1_SRC (Total 1 Source Variable)									1	1.0
19	CFG_TOT1_UNIT_SRC (Total 1 Unit Source)									1	1.0
20	CFG_TOT1_UNIT (Total 1 Unit)									2	1.0
21	CFG_TOT1_DIRECTION (Total 1 Direction)									1	1.0
22	CFG_TOT1_NAME (Total 1 Name)									16	1.0
23	CFG_TOT1_USER_NAME (Total 1 User-Defined Label)									16	1.0
24	CFG_TOT1_RESET (Total 1 Reset)		2								1.0
25	CFG_TOT2 (Total 2)	5		5							1.0
26	CFG_TOT2_SRC (Total 2)Source Variable				1						1.0
27	CFG_TOT2_UNIT_SRC (Total 2 Unit Source)				1						1.0

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
28	CFG_TOT2_UNIT (Total 2 Unit)				2						1.0
29	CFG_TOT2_DIRECTION (Total 2 Direction)				1						1.0
30	CFG_TOT2_NAME (Total 2 Name)				16						1.0
31	CFG_TOT2_USER_NAME (Total 2 User-Defined Label)				16						1.0
32	CFG_TOT2_RESET (Total 2 Reset)		2								1.0
33	CFG_TOT3 (Total 3)	5		5							1.0
34	CFG_TOT3_SRC (Total 3 Source Variable)									1	1.0
35	CFG_TOT3_UNIT_SRC (Total 3 Unit Source)									1	1.0
36	CFG_TOT3_UNIT (Total 3 Unit)									2	1.0
37	CFG_TOT3_DIRECTION (Total 3 Direction)									1	1.0
38	CFG_TOT3_NAME (Total 3 Name)									16	1.0
39	CFG_TOT3_USER_NAME (Total 3 User-Defined Label)									16	1.0
40	CFG_TOT3_RESET (Total 3 Reset)		2								1.0
41	CFG_TOT4 (Total 4)	5		5							1.0
42	CFG_TOT4_SRC (Total 4 Source Variable)				1						1.0
43	CFG_TOT4_UNIT_SRC (Total 4 Unit Source)				1						1.0
44	CFG_TOT4_UNIT (Total 4 Unit)				2						1.0
45	CFG_TOT4_DIRECTION (Total 4 Direction)				1						1.0
46	CFG_TOT4_NAME (Total 4 Name)				16						1.0
47	CFG_TOT4_USER_NAME (Total 4 User-Defined Label)				16						1.0

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
48	CFG_TOT4_RESET (Total 4 Reset)		2								1.0
49	CFG_TOT5 (Total 5)	5		5							1.0
50	CFG_TOT5_SRC (Total 5 Source Variable)					1					1.0
51	CFG_TOT5_UNIT_SRC (Total 5 Unit Source)					1					1.0
52	CFG_TOT5_UNIT (Total 5 Unit)					2					1.0
53	CFG_TOT5_DIRECTION (Total 5 Direction)					1					1.0
54	CFG_TOT5_NAME (Total 5 Name)					16					1.0
55	CFG_TOT5_USER_NAME (Total 5 User-Defined Label)					16					1.0
56	CFG_TOT5_RESET (Total 5 Reset)		2								1.0
57	CFG_TOT6 (Total 6)	5		5							1.0
58	CFG_TOT6_SRC (Total 6 Source Variable)		1			1					1.0
59	CFG_TOT6_UNIT_SRC (Total 6 Unit)		1			1					1.0
60	CFG_TOT6_UNIT (Total 6 Unit)					2					1.0
61	CFG_TOT6_DIRECTION (Total 6 Direction)					1					1.0
62	CFG_TOT6_NAME (Total 6 Name)						16				1.0
63	CFG_TOT6_USER_NAME (Total 6 User-Defined Label)						16				1.0
64	CFG_TOT6_RESET (Total 6 Reset)		2								1.0
65	CFG_TOT7 (Total 7)	5		5							1.0
66	CFG_TOT7_SRC (Total 7 Source variable)						1				1.0
67	CFG_TOT7_UNIT_SRC (Total 7 Unit Source)						1				1.0
68	CFG_TOT7_UNIT (Total 7 Unit)						2				1.0

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
69	CFG_TOT7_DIRECTION (Total 7 Direction)						1				1.0
70	CFG_TOT7_NAME (Total 7 Name)						16				1.0
71	CFG_TOT7_USER_NAME (Total 7 User-Defined Label)						16				1.0
72	CFG_TOT7_RESET (Total 7 Reset)		2								1.0
73	ALL_TOT_RESET (Reset All Totalizers)		2								1.0
74	START_STOP_ALL_TOTALS (Start/Stop all Totalizers)		2								1.0
Configurable Inventory											
75	CFG_INV1 (Inventory 1)	5		5							1.0
76	CFG_INV1_DIRECTION (Inventory 1 Direction)						1				1.0
77	CFG_INV1_SRC (Inventory 1 Source Variable)						1				1.0
78	CFG_INV1_UNIT_SRC (Inventory 1 Unit Source)						1				1.0
79	CFG_INV1_UNIT (Inventory 1 Unit)						2				1.0
80	CFG_INV1_NAME (Inventory 1 Name)						16				1.0
81	CFG_INV1_USER_NAME Inventory 1 User-Defined Label						16				1.0
82	CFG_INV2 (Inventory 2)	5		5							1.0
83	CFG_INV2_DIRECTION (Inventory 2 Direction)						1				1.0
84	CFG_INV2_SRC (Inventory 2 Source Variable)							1			1.0
85	CFG_INV2_UNIT_SRC (Inventory 2 Unit Source)							1			1.0
86	CFG_INV2_UNIT (Inventory 2 Unit)							2			1.0
87	CFG_INV2_NAME (Inventory 2 Name)							16			1.0

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
88	CFG_INV2_USER_NAME (Inventory 2 User-Defined Label)							16			1.0
89	CFG_INV3 (Inventory 3)	5		5							1.0
90	CFG_INV3_DIRECTION (Inventory 3 Direction)					1					1.0
91	CFG_INV3_SRC (Inventory 3 Source Variable)							1			1.0
92	CFG_INV3_UNIT_SRC (Inventory 3 Unit Source)							1			1.0
93	CFG_INV3_UNIT (Inventory 3 Unit)							2			1.0
94	CFG_INV3_NAME (Inventory 3 Name)							16			1.0
95	CFG_INV3_USER_NAME (Inventory 3 User-Defined Label)							16			1.0
96	CFG_INV4 (Inventory 4)	5		5							1.0
97	CFG_INV4_DIRECTION (Inventory 4 Direction)					1					1.0
98	CFG_INV4_SRC (Inventory 4 Source Variable)							1			1.0
99	CFG_INV4_UNIT_SRC (Inventory 4 Unit Source)							1			1.0
100	CFG_INV4_UNIT (Inventory 4 Unit)							2			1.0
101	CFG_INV4_NAME (Inventory 4 Name)							16			1.0
102	CFG_INV4_USER_NAME (Inventory 4 User-Defined Label)							16			1.0
103	CFG_INV5 (Inventory 5)	5		5							1.0
104	CFG_INV5_DIRECTION (Inventory 5 Direction)					1					1.0
105	CFG_INV5_SRC (Inventory 5 Source Variable)								1		1.0
106	CFG_INV5_UNIT_SRC (Inventory 5 Unit Source)								1		1.0
107	CFG_INV5_UNIT (Inventory 5 Unit)								2		1.0

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
108	CFG_INV5_NAME (Inventory 5 Name)								16		1.0
109	CFG_INV5_USER_NAME (Inventory 5 User-Defined Label)								16		1.0
110	CFG_INV6 (Inventory 6)	5		5							1.0
111	CFG_INV6_DIRECTION (Inventory 6 Direction)					1					1.0
112	CFG_INV6_SRC (Inventory 6 Source)								1		1.0
113	CFG_INV6_UNIT_SRC (Inventory 6 Unit Source)								1		1.0
114	CFG_INV6_UNIT (Inventory 6 Unit)								2		1.0
115	CFG_INV6_NAME (Inventory 6 Name)								16		1.0
116	CFG_INV6_USER_NAME (Inventory 6 User-Defined Label)								16		1.0
117	CFG_INV7 (Inventory 7)	5		5							1.0
118	CFG_INV7_DIRECTION (Inventory 7 Direction)					1					1.0
119	CFG_INV7_SRC (Inventory 7 Source Variable)								1		1.0
120	CFG_INV7_UNIT_SRC (Inventory 7 Unit Source)								1		1.0
121	CFG_INV7_UNIT (Inventory 7 Unit)								2		1.0
122	CFG_INV7_NAME (Inventory 7 Name)								16		1.0
123	CFG_INV7_USER_NAME (Inventory 7 User-Defined Label)								16		1.0
Total \ Inventory Units											
124	TI_MASS_STD_UNITS (Tot/Inv Mass Standard Unit)		2								1.0
125	TI_MASS_ALT_UNITS (Tot/Inv Mass Alternate Unit)		2								1.0

#	Name (Label)	View list									Release
		1	2	3	4_1	4_2	4_3	4_4	4_5	4_6	
126	TI_VOL_STD_UINTS (Tot/Inv Volume Standard Unit)		2								1.0
127	TI_VOL_ALT_UINTS (Tot/Inv Volume Alternate Unit)		2								1.0
Total | Inventory Features											
128	TI_FEATURES (Device Features)			2							1.0

A.2.5 Meter verification transducer block

Meter verification transducer block details

Table A-62: Meter verification

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
14	FRF_EN (SMV Enable)	METHOD	Unsigned16 (2)	S	R/W (OOS)	0 = Disabled 1 = Fixed Output Mode 2 = Factory Air Verification 3 = Factory Water Verification 4 = Special debug mode 5 = Abort 6 = Continue Measurement Mode 7 = Single Point Baseline (takes the place of factory air and factory water)
15	FRF_ONLINE_MV_START (Online Meter Verification)	VAR	DS-66 (2)	D	R/W (Any)	Value part of DS-66 (2) 0 = No action 1 = Start Meter Verification in continue measurement mode
16	FRF_MV_FAULT_ALARM (Meter Verification Fault Alarm)	ENUM2	Unsigned16 (2)	S	R/W (Any)	0= Last Value 1 = Fault
17	FRF_RUN_COUNT (Run Counter)	VAR	Unsigned16 (2)	S	RO	N/A
18	FRF_MV_INPROGRESS (FCF status)	ENUM	Unsigned8(1)	D	RO	0 = None 1 = MV In Progress
19	FRF_MV_ALGOSTATE (Meter Verification Status)	VAR	Unsigned16 (2)	D	RO	1 - 18
20	FRF_MV_PROGRESS (Meter Verification Progress)	VAR	Unsigned16 (2)	D	RO	0 - 100

Table A-62: Meter verification *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
21	FRF_MV_ABORTCODE (Meter Verification Abort Code)	ENUM	Unsigned16 (2)	D	RO	See Meter verification abort codes
22	FRF_MV_ABORTSTATE (Meter Verification Abort State)	VAR	Unsigned16 (2)	D	RO	1 - 18
23	FRF_MV_FAILED (Meter Verification Failed)	VAR	DS-66 (2)	D	RO	Value part of DS-66 (2) 0 = Meter Verification did not Fail 1 = Meter Verification Failed
24	FRF_STIFFNESS_LIMIT (Uncertainty Limit)	VAR	FLOAT (4)	S	R/W (Any)	0.0f ≤ x ≤ 1.0f
25	FRF_STFLMT_LPO (Left Pickoff Stiffness Limit)	VAR	Unsigned16 (2)	D	RO	N/A
26	FRF_STFLMT_RPO (Right Pickoff Stiffness Limit)	VAR	Unsigned16 (2)	D	RO	N/A
27	FRF_STF_LPO_AIR (Left Pickoff Air Stiffness)	VAR	FLOAT (4)	S	RO	N/A
28	FRF_STF_RPO_AIR (Right Pickoff Air Stiffness)	VAR	FLOAT (4)	S	RO	N/A
29	FRF_STF_LPO_WATER (Left Pickoff Water Stiffness)	VAR	FLOAT (4)	S	RO	N/A
30	FRF_STF_RPO_WATER (Right Pickoff Water Stiffness)	VAR	FLOAT (4)	S	RO	N/A
31	FRF_MASS_LPO_AIR (Left Pickoff Mass Air)	VAR	FLOAT (4)	S	RO	N/A
32	FRF_MASS_RPO_AIR (Left Pickoff Mass Air)	VAR	FLOAT (4)	S	RO	N/A
33	FRF_MASS_LPO_WATER (Left Pickoff Mass Water)	VAR	FLOAT (4)	S	RO	N/A
34	FRF_MASS_RPO_WATER (Right Pickoff Mass Water)	VAR	FLOAT (4)	S	RO	N/A
35	FRF_DAMPING_AIR (Air Damping)	VAR	FLOAT (4)	S	RO	N/A
36	FRF_DAMPING_WATER (Water Damping)	VAR	FLOAT (4)	S	RO	N/A
37	MV_CORE_DEVICE_TYPE (Core Device Type)	ENUM2	Unsigned16 (2)	S	RO	40 = 700 CP 50= 800 ECP 1000= No CP
38	FRF_MV_PASSCOUNTER (MV Pass counter)	VAR	Unsigned16 (2)	S	RO	N/A

Table A-62: Meter verification *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
39	FRF_DRIVE_CURRENT (Drive Current)	VAR	FLOAT (4)	S	RO	N/A
40	FRF_DL_T (Delta T)	VAR	FLOAT (4)	S	RO	N/A
41	FRF_TEMP (Temperature)	VAR	FLOAT (4)	S	RO	N/A
42	FRF_DENSITY (Density)	VAR	FLOAT (4)	S	RO	N/A
43	FRF_DRIVE_FREQ (Drive Frequency)	VAR	FLOAT (4)	S	RO	N/A
44	FRF_LPO_FILTER (Left Pickoff Filter)	VAR	FLOAT (4)	S	RO	N/A
45	FRF_RPO_FILTER (Right Pickoff Filter)	VAR	FLOAT (4)	S	RO	N/A
46	FRF_MV_FIRSTRUN_TIME (Hours Until Next Run)	VAR	FLOAT (4)	S	R/W (Any)	N/A
47	FRF_MV_ELAPSE_TIME (Hours Between Recurring Runs)	VAR	FLOAT (4)	S	R/W (Any)	N/A
48	FRF_MV_TIME_LEFT (Hours Remaining Until Next Run)	VAR	FLOAT (4)	D	RO	N/A
49	FRF_TONE_LEVELMV (Tone Level)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
50	FRF_TONE_RAMP_TIME (MV Tone Ramp Time)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
51	FRF_BL_COE (BL Coefficient)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
52	FRF_DRIVE_TARGET (Drive Target)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
53	FRF_DRIVE_PCOE (Drive P Coefficient)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
54	FRF_TONE_SPACING_MUL (Tone Space Multiplier)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
55	FRF_FREQ_DRIFT_LMT (Frequency Drift Limit)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
56	FRF_MAX_CURRENT_MA (Max Sensor Current)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
57	FRF_KFQ2 (KFQ2)	VAR	FLOAT (4)	S	R/W (OOS)	N/A
58	FRF_COEFF_INDEX (Coefficient Index)	ENUM	Unsigned16 (2)	S	R/W (Any)	0 = T1 1 = T2 2 = T3 3 = T4 4 = DR

Table A-62: Meter verification *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
59	FRF_LPO_COEFF_REAL (Left Pickoff Coefficient Real)	VAR	FLOAT (4)	S	RO	N/A
60	FRF_LPO_CEOFF_IMAG (Left Pickoff Coefficient Imaginary)	VAR	FLOAT (4)	S	RO	N/A
61	FRF_RPO_COEFF_REAL (Right Pickoff Coefficient Real)	VAR	FLOAT (4)	S	RO	N/A
62	FRF_RPO_CEOFF_IMAG (Right Pickoff Coefficient Imaginary)	VAR	FLOAT (4)	S	RO	N/A
63	FRF_CAL_AMPL_REAL (Cal Amplitude Real)	VAR	FLOAT (4)	S	RO	N/A
64	FRF_CAL_AMPL_IMAG (Cal Amplitude Imaginary)	VAR	FLOAT (4)	S	RO	N/A
65	FRF_TONE_FREQUENCY (Tone Frequency)	VAR	FLOAT (4)	S	RO	N/A
66	FRF_POLE_REAL (Pole Real)	VAR	FLOAT (4)	S	RO	N/A
67	FRF_POLE_IMAG (Pole Imaginary)	VAR	FLOAT (4)	S	RO	N/A
68	FRF_RESIDUAL_LPO_REAL (Residual Left Pickoff Real)	VAR	FLOAT (4)	S	RO	N/A
69	FRF_RESIDUAL_LPO_IMAG (Residual Left Pickoff Imaginary)	VAR	FLOAT (4)	S	RO	N/A
70	FRF_RESIDUAL_RPO_REAL (Residual Right Pickoff Real)	VAR	FLOAT (4)	S	RO	N/A
71	FRF_RESIDUAL_RPO_IMAG (Residual Right Pickoff Imaginary)	VAR	FLOAT (4)	S	RO	N/A
72	FRF_LPO_IMPORT_BIAS (Left Pickoff Import Bias)	VAR	FLOAT (4)	S	RO	N/A
73	FRF_LPO_EXPORT_BIAS (Left Pickoff Export Bias)	VAR	FLOAT (4)	S	RO	N/A
74	FRF_RPO_IMPORT_BIAS (Right Pickoff Import Bias)	VAR	FLOAT (4)	S	RO	N/A
75	FRF_RPO_EXPORT_BIAS (Right Pickoff Export Bias)	VAR	FLOAT (4)	S	RO	N/A
76	FRF_LPO_FILTER_AVG (Left Pickoff Filter Average)	VAR	FLOAT (4)	S	RO	N/A

Table A-62: Meter verification *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
77	FRF_RPO_FILTER_AVG (Right Pickoff Filter Average)	VAR	FLOAT (4)	S	RO	N/A
78	FRF_SENSOR_ID (Sensor ID)	VAR	Unsigned16 (2)	S	RO	N/A
79	FRF_DATA_SEL (MV Data Selection)	VAR	Unsigned16 (2)	S	R/W (Any)	N/A
80	FRF_LPO_STIFFNESS (Left Pickoff Stiffness)	VAR	FLOAT (4)	S	RO	N/A
81	FRF_RPO_STIFFNESS (Right Pickoff Stiffness	VAR	FLOAT (4)	S	RO	N/A
82	FRF_DAMPING (Damping)	VAR	FLOAT (4)	S	RO	N/A
83	FRF_DATA_MASS_LPO (Left Pickoff Mass)	VAR	FLOAT (4)	S	RO	N/A
84	FRF_DATA_MASS_RPO (Right Pickoff Mass)	VAR	FLOAT (4)	S	RO	N/A
85	FRF_DATA_RESO_FREQ_ ESTIMATED (Estimated Resonant Frequency)	VAR	FLOAT (4)	S	RO	N/A
86	FRF_DATA_DRIVE_ CURRENT (Drive Current)	VAR	FLOAT (4)	S	RO	N/A
87	FRF_DATA_DELTA_T (Delta T)	VAR	FLOAT (4)	S	RO	N/A
88	FRF_DATA_TEMPERATURE (Temperature)	VAR	FLOAT (4)	S	RO	N/A
89	FRF_DATA_DENSITY (Density)	VAR	FLOAT (4)	S	RO	N/A
90	FRF_DATA_FREQUENCY (Frequency)	VAR	FLOAT (4)	S	RO	N/A
91	FRF_DATA_LPO_FILTER (Left Pickoff Filter)	VAR	FLOAT (4)	S	RO	N/A
92	FRF_DATA_RPO_FILTER (Right Pickoff Filter)	VAR	FLOAT (4)	S	RO	N/A

Meter verification abort codes

0 = No error
1 = Manual abort
2 = Drive settle time error
3 = Frequency drift error
4 = Drive voltage too high
5 = Drive current too high
6 = Drive current erratic
7 = General drive error
8 = Delta T erratic
9 = Delta To too high
10 = State Running
11 = State complete
12 = MV data error
13 = No Air Calibration
14 = No Water Calibration
15 = In correct Configuration

Table A-63: Meter verification history

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
93	FRF_DS-INDEX (MV data storage Index)	VAR	Unsigned16 (2)	S	R/W (Any)	0 ≤ x < 20
94	FRF_DS-TIME (Transmitter Running Seconds at Test)	VAR	Unsigned32	S	RO	N/A
95	FRF_DS-LPO_STIFF (Left Pickoff Normal Stiffness)	VAR	FLOAT (4)	S	RO	N/A
96	FRF_DS-RPO_STIFF (Right Pickoff Stiffness)	VAR	FLOAT (4)	S	RO	N/A
97	FRF_DS-LPO_MASS (Left Pickoff Mass Data)	VAR	FLOAT (4)	S	RO	N/A
98	FRF_DS-RPO_MASS (Right Pickoff Mass Data)	VAR	FLOAT (4)	S	RO	N/A
99	FRF_DS-DAMPING (Damping)	VAR	FLOAT (4)	S	RO	N/A
100	FRF_DS-DRIVE_MA (Drive Current in mA)	VAR	FLOAT (4)	S	RO	N/A
101	FRF_DS-DELTA_T (Delta T)	VAR	FLOAT (4)	S	RO	N/A
102	FRF_DS-TEMPERATURE (Temperature)	VAR	FLOAT (4)	S	RO	N/A
103	FRF_DS-DENSITY (Density)	VAR	FLOAT (4)	S	RO	N/A
104	FRF_DS-LPO_AMP (Left Pickoff Amplitude)	VAR	FLOAT (4)	S	RO	N/A
105	FRF_DS-RPO_AMP (Right Pickoff Amplitude)	VAR	FLOAT (4)	S	RO	N/A
106	FRF_DS-DRV_FREQ (Drive Frequency)	VAR	FLOAT (4)	S	RO	N/A
107	FRF_DS-LPO_EXP (Left Pickoff Export)	VAR	FLOAT (4)	S	RO	N/A
108	FRF_DS-RPO_EXP (Right Pickoff Export)	VAR	FLOAT (4)	S	RO	N/A
109	FRF_DS-LPO_CONF (Left Pickoff Configure)	VAR	FLOAT (4)	S	RO	N/A
110	FRF_DS-RPO_CONF (Right Pickoff Configure)	VAR	FLOAT (4)	S	RO	N/A
111	FRF_DS-LPO_FLEX (Left Pickoff Flex)	VAR	FLOAT (4)	S	RO	N/A
112	FRF_DS-RPO_FLEX (Right Pickoff Flex)	VAR	FLOAT (4)	S	RO	N/A
113	FRF_DS-ABORT_CODE (Abort Code)	VAR	Unsigned16 (2)	S	RO	N/A

Table A-63: Meter verification history *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
114	FRF_DS-ABORT_STATE (Abort State)	VAR	Unsigned16 (2)	S	RO	N/A
115	FRF_DS-LPO_P_F (Left Pickoff P/F)	VAR	Unsigned16 (2)	S	RO	N/A
116	FRF_DS-RPO_P_F (Right Pickoff P/F)	VAR	Unsigned16 (2)	S	RO	N/A
117	FRF_DS-SENSOR_CD (Sensor Type Code)	VAR	Unsigned16 (2)	S	RO	N/A
118	FRF_DS-SENSOR_SN (Sensor Serial Number)	VAR	Unsigned32	S	RO	N/A
119	FRF_LAST_RUN_INDEX (Last Run Index)	VAR	Unsigned16 (2)	D	RO	N/A
120	MV_FEATURE_KEY (Device Features)	STR	BIT STRING	D	RO	See Device feature codes

Device feature codes

0x0000 = FKEY_NO_FEATURE
0x0001 = APM Cont Flow
0x0002 = TMR
0x0004 = PVR
0x0008 = TBR
0x0010 = SMV
0x0020 = GSV
0x0040 = ED
0x0080 = API
0x0800 = CAL FAIL
0x1000 = APM TMR
0x2000 = APM Var NOC
0x4000 = APM Var Flow
0x8000 = APM Cont NOC

Meter verification transducer block views

#	Name (Label)	View list								Release
		1	2	3	4__1	4_2	4_3	4_4	4_5	
Standard FF Parameters										
0	BLOCK_STRUCTURE									1.0
1	ST_REV	2	2	2	2	2	2	2	2	1.0
2	TAG_DESC									1.0
3	STRATEGY				2	2				1.0
4	ALERT_KEY				1	1				1.0
5	MODE_BLK	4		4	4					1.0
6	BLOCK_ERR	2		2						1.0
7	UPDATE_EVT									1.0
8	BLOCK_ALM									1.0
9	TRANSDUCER_DIRECTORY									1.0
10	TRANSDUCER_TYPE	2	2	2	2					1.0

#	Name (Label)	View list								Release
		1	2	3	4__1	4_2	4_3	4_4	4_5	
11	TRANSDUCER_TYPE_VER	2	2	2	2					1.0
12	XD_ERROR	1		1						1.0
13	COLLECTION_DIRECTORY									1.0
Meter Verification										
14	FRF_EN (SMV Enable)		2		2		2			1.0
15	FRF_ONLINE_MV_START (Online Meter Verification)	2		2						1.0
16	FRF_MV_FAULT_ALARM (Meter Verification Fault Alarm)		2							1.0
17	FRF_RUN_COUNT (Run Counter)				2					1.0
18	FRF_MV_INPROGRESS (FCF status)	1		1						1.0
19	FRF_MV_ALGOSTATE (Meter Verification Status)			2						1.0
20	FRF_MV_PROGRESS (Meter Verification Progress)			2						1.0
21	FRF_MV_ABORTCODE (Meter Verification Abort Code)			2						1.0
22	FRF_MV_ABORTSTATE (Meter Verification Abort State)			2						1.0
23	FRF_MV_FAILED (Meter Verification Failed)	2		2						1.0
24	FRF_STIFFNESS_LIMIT (Uncertainty Limit)		4		4					1.0
25	FRF_STFLMT_LPO (Left Pickoff Stiffness Limit)			2						1.0
26	FRF_STFLMT_RPO (Right Pickoff Stiffness Limit)			2						1.0
27	FRF_STF_LPO_AIR (Left Pickoff Air Stiffness)				4					1.0
28	FRF_STF_RPO_AIR (Right Pickoff Air Stiffness)				4					1.0
29	FRF_STF_LPO_WATER (Left Pickoff Water Stiffness)				4					1.0
30	FRF_STF_RPO_WATER (Right Pickoff Water Stiffness)				4					1.0
31	FRF_MASS_LPO_AIR (Left Pickoff Mass Air)				4					1.0
32	FRF_MASS_RPO_AIR (Left Pickoff Mass Air)				4					1.0

#	Name (Label)	View list								Release
		1	2	3	4__1	4_2	4_3	4_4	4_5	
33	FRF_MASS_LPO_WATER (Left Pickoff Mass Water)				4					1.0
34	FRF_MASS_RPO_WATER (Right Pickoff Mass Water)				4					1.0
35	FRF_DAMPING_AIR (Air Damping)				4					1.0
36	FRF_DAMPING_WATER (Water Damping)				4					1.0
37	MV_CORE_DEVICE_TYPE (Core Device Type)					2				1.0
38	FRF_MV_PASSCOUNTER (MV Pass counter)					2				1.0
39	FRF_DRIVE_CURRENT (Drive Current)					4				1.0
40	FRF_DL_T (Delta T)					4				1.0
41	FRF_TEMP (Temperature)					4				1.0
42	FRF_DENSITY (Density)					4				1.0
43	FRF_DRIVE_FREQ (Drive Frequency)					4				1.0
44	FRF_LPO_FILTER (Left Pickoff Filter)					4				1.0
45	FRF_RPO_FILTER (Right Pickoff Filter)					4				1.0
46	FRF_MV_FIRSTRUN_TIME (Hours Until Next Run)					4				1.0
47	FRF_MV_ELAPSE_TIME (Hours Between Recurring Runs)					4				1.0
48	FRF_MV_TIME_LEFT (Hours Remaining Until Next Run)			4						1.0
49	FRF_TONE_LEVEL MV (Tone Level)					4				1.0
50	FRF_TONE_RAMP_TIME (MV Tone Ramp Time)					4				1.0
51	FRF_BL_COE (BL. Coefficient)					4				1.0
52	FRF_DRIVE_TARGET (Drive Target)					4				1.0
53	FRF_DRIVE_PCOE (Drive P Coefficient)					4				1.0
54	FRF_TONE_SPACING_MUL (Tone Space Multiplier)					4				1.0
55	FRF_FREQ_DRIFT_LMT (Frequency Drift Limit)					4				1.0

#	Name (Label)	View list								Release
		1	2	3	4__1	4_2	4_3	4_4	4_5	
56	FRF_MAX_CURRENT_MA (Max. Sensor Current)					4				1.0
57	FRF_KFQ2 (KFQ2)					4				1.0
58	FRF_COEFF_INDEX (Coefficient Index)							2		1.0
59	FRF_LPO_COEFF_REAL (Left Pickoff Coefficient Real)							4		1.0
60	FRF_LPO_CEOFF_IMAG (Left Pickoff Coefficient Imaginary)							4		1.0
61	FRF_RPO_COEFF_REAL (Right Pickoff Coefficient Real)							4		1.0
62	FRF_RPO_CEOFF_IMAG (Right Pickoff Coefficient Imaginary)							4		1.0
63	FRF_CAL_AMPL_REAL (Cal Amplitude Real)							4		1.0
64	FRF_CAL_AMPL_IMAG (Cal Amplitude Imaginary)							4		1.0
65	FRF_TONE_FREQUENCY (Tone Frequency)							4		1.0
66	FRF_POLE_REAL (Pole Real)							4		1.0
67	FRF_POLE_IMAG (Pole Imaginary)							4		1.0
68	FRF_RESIDUAL_LPO_REAL (Residual Left Pickoff Real)							4		1.0
69	FRF_RESIDUAL_LPO_IMAG (Residual Left Pickoff Imaginary)							4		1.0
70	FRF_RESIDUAL_RPO_REAL (Residual Right Pickoff Real)							4		1.0
71	FRF_RESIDUAL_RPO_IMAG (Residual Right Pickoff Imaginary)							4		1.0
72	FRF_LPO_IMPORT_BIAS Left (Pickoff Import Bias)							4		1.0
73	FRF_LPO_EXPORT_BIAS (Left Pickoff Export Bias)							4		1.0
74	FRF_RPO_IMPORT_BIAS (Right Pickoff Import Bias)							4		1.0
75	FRF_RPO_EXPORT_BIAS (Right Pickoff Export Bias)							4		1.0
76	FRF_LPO_FILTER_AVG (Left Pickoff Filter Average)							4		1.0

#	Name (Label)	View list								Release
		1	2	3	4__1	4_2	4_3	4_4	4_5	
77	FRF_RPO_FILTER_AVG (Right Pickoff Filter Average)							4		1.0
78	FRF_SENSOR_ID (Sensor ID)				2					1.0
79	FRF_DATA_SEL (MV Data Selection)								2	1.0
80	FRF_LPO_STIFFNESS (Left Pickoff Stiffness)								4	1.0
81	FRF_RPO_STIFFNESS (Right Pickoff Stiffnes(Left Pickoff Stiffness)								4	1.0
82	FRF_DAMPING (Damping)								4	1.0
83	FRF_DATA_MASS_LPO (Left Pickoff Mass)								4	1.0
84	FRF_DATA_MASS_RPO (Right Pickoff Mass)								4	1.0
85	FRF_DATA_RESO_FREQ_ESTIMATED (Estimated Resonant Frequency)								4	1.0
86	FRF_DATA_DRIVE_CURRENT (Drive Current)								4	1.0
87	FRF_DATA_DELTA_T (Delta T)								4	1.0
88	FRF_DATA_TEMPERATURE (Temperature)								4	1.0
89	FRF_DATA_DENSITY (Density)								4	1.0
90	FRF_DATA_FREQUENCY (Frequency)								4	1.0
91	FRF_DATA_LPO_FILTER (Left Pickoff Filter)								4	1.0
92	FRF_DATA_RPO_FILTER (Right Pickoff Filter)								4	1.0
Meter Verification History										
93	FRF_DS-INDEX (MV data storage Index)						2			1.0
94	FRF_DS-TIME (Transmitter Running Seconds at Test)						4			1.0
95	FRF_DS-LPO_STIFF (Left Pickoff Normal Stiffness)						4			1.0
96	FRF_DS-RPO_STIFF (Right Pickoff Stiffness)						4			1.0
97	FRF_DS-LPO_MASS (Left Pickoff Mass Data)						4			1.0

#	Name (Label)	View list								Release
		1	2	3	4__1	4_2	4_3	4_4	4_5	
98	FRF_DS-RPO_MASS (Right Pickoff Mass Data)						4			1.0
99	FRF_DS-DAMPING (Damping)						4			1.0
100	FRF_DS-DRIVE_MA (Drive Current in mA)						4			1.0
101	FRF_DS-DELTA_T (Delta T)						4			1.0
102	FRF_DS-TEMPERATURE (Temperature)						4			1.0
103	FRF_DS-DENSITY (Density)						4			1.0
104	FRF_DS-LPO_AMP (Left Pickoff Amplitude)						4			1.0
105	FRF_DS-RPO_AMP (Right Pickoff Amplitude)						4			1.0
106	FRF_DS-DRV_FREQ (Drive Frequency)						4			1.0
107	FRF_DS-LPO_EXP (Left Pickoff Export)						4			1.0
108	FRF_DS-RPO_EXP (Right Pickoff Export)						4			1.0
109	FRF_DS-LPO_CONF (Left Pickoff Configure)						4			1.0
110	FRF_DS-RPO_CONF (Right Pickoff Configure)						4			1.0
111	FRF_DS-LPO_FLEX (Left Pickoff Flex)						4			1.0
112	FRF_DS-RPO_FLEX (Right Pickoff Flex)						4			1.0
113	FRF_DS-ABORT_CODE (Abort Code)								4	1.0
114	FRF_DS-ABORT_STATE (Abort State)								2	1.0
115	FRF_DS-LPO_P_F (Left Pickoff P/F)								2	1.0
116	FRF_DS-RPO_P_F (Right Pickoff P/F)								2	1.0
117	FRF_DS-SENSOR_CD (Sensor Type Code)								2	1.0
118	FRF_DS-SENSOR_SN (Sensor Serial Number)								4	1.0

#	Name (Label)	View list								Release
		1	2	3	4__1	4_2	4_3	4_4	4_5	
119	FRF_LAST_RUN_INDEX (Last Run Index)			2						1.0
120	MV_FEATURE_KEY (Device Features)			2						1.0

A.2.6 API Referral transducer block

API transducer block details

Table A-64: PM process variables

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
14	PM_CORR_DENSITY (Density at Reference Temperature)	VAR	DS-65 (5)	D	RO	DENSITY_LOW_LIMIT ≤ x ≤ DENSITY_HIGH_LIMIT
15	PM_CORR_VOL_FLOW (Referred Volume Flow Rate)	VAR	DS-65 (5)	D	RO	VFLOW_LOW_LIMIT ≤ x ≤ VFLOW_HIGH_LIMIT
16	PM_AVG_CORR_DENSITY (Average Observed Density)	VAR	DS-65 (5)	D	RO	DENSITY_LOW_LIMIT ≤ x ≤ DENSITY_HIGH_LIMIT
17	PM_AVG_CORR_TEMP (Average Temperature)	VAR	DS-65 (5)	D	RO	TEMP_LOW_LIMIT ≤ x ≤ TEMP_HIGH_LIMIT
18	PM_CTPL (CTPL)	VAR	DS-65 (5)	D	RO	0.0f ≤ x ≤ 2.0f

Table A-65: PM setup data

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
19	PM_REF_TEMP (Reference Temperature)	VAR	FLOAT (4)	S	R/W (OOS)	-50.0f ≤ x ≤ 150.0f deg C.
20	PM_TEC (Thermal Expansion Coefficient)	VAR	FLOAT (4)	S	R/W (OOS)	0.000485ff ≤ x ≤ 0.001675f
21	PM_TABLE_TYPE (2540 CTL Table Type)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See 2540 CTL table type codes
22	PM_REF_PRESSURE (Reference Pressure)	VAR	FLOAT (4)	S	R/W (OOS)	0.0f ≤ x ≤ 1500.0f PSI
23	PM_TEMP_UNITS (Temperature Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1000 = K 1001 = deg C 1002 = deg F 1003 = deg R
24	PM_DENSITY_UNITS (Density Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Density unit codes

Table A-65: PM setup data *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
25	PM_VOL_FLOW_UNITS (Volume Flow Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Volume flow unit codes
26	PM_PRESSURE_UNITS (Pressure Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Pressure unit codes
27	PM_FEATURE (API Referral)	ENUM	Unsigned8 (1)	D	RO	0 = API Disabled 1 = API Enabled

2540 CTL table type codes

17 = Table 5A
18 = Table 5B
19 = Table 5D
36 = Table 6C
49 = Table 23A
50 = Table 23B
51 = Table 23D
53 = Table 23E
68 = Table 24C
69 = Table 24E
81 = Table 53A
82 = Table 53B
83 = Table 53D
85 = Table 53E
100 = Table 54C
101 = Table 54E
117 = Table 59E
133 = Table 60E

Density unit codes

1097 = kg/m³
1100 = g/cm³
1103 = kg/L
1104 = g/ml
1105 = g/L
1106 = lb/in³
1107 = lb/ft³
1108 = lb/gal
1109 = STon/yd³
1113 = degAPI
1114 = SGU"

Volume flow unit codes

1347 = m3/s
1348 = m3/min
1349 = m3/h
1350 = m3/d
1351 = L/s
1356 = CFS
1357 = CFM
1358 = CFH
1359 = ft³/d
1362 = gal/s
1366 = Mgal/d
1367 = ImpGal/s
1368 = ImpGal/min
1369 = ImpGal/h
1370 = Impgal/d
1374 = bbl/d
1631 = bbl(US Beer)/d
1632 = bbl(US Beer)/h
1633 = bbl(US Beer)/min
1634 = bbl(US Beer)/s

Pressure unit codes

1148 = inH2O (68 deg F)
1156 = inHg (0 deg C)
1154 = ftH2O (68 deg F)
1151 = mmH2O (68 deg F)
1158 = mmHg (0 deg C)
1141 = psi
1137 = bar
1138 = mbar
1144 =g/cm²
1145 = Kg/cm²
1130 = 1133 = KPa
1139 = torr
1140 = atm
1147 = in H2O (4 deg C)
1150 = mm H2O (4 deg C)
33003 = in H2O (60 deg F)

API transducer block views

#	Name (Label)	View list 1	2	3	4	Release
Standard FF Parameters						
0	BLOCK_STRUCTURE					
1	ST_REV	2	2	2	2	2
2	TAG_DESC					

#	Name (Label)	View list				Release
		1	2	3	4	
3	STRATEGY				2	2
4	ALERT_KEY				1	1
5	MODE_BLK	4		4	4	
6	BLOCK_ERR	2		2		
7	UPDATE_EVT					
8	BLOCK_ALM					
9	TRANSDUCER_DIRECTORY					
10	TRANSDUCER_TYPE	2	2	2	2	
11	TRANSDUCER_TYPE_VER	2	2	2	2	
12	XD_ERROR	1		1		
13	COLLECTION_DIRECTORY					
PM Process Variables						
14	PM_CORR_DENSITY (Density at Reference Temperature)	5		5		1.0
15	PM_CORR_VOL_FLOW (Referred Volume Flow Rate)	5		5		1.0
16	PM_AVG_CORR_DENSITY (Average Observed Density)	5		5		1.0
17	PM_AVG_CORR_TEMP (Average Temperature)	5		5		1.0
18	PM_CTPL (CTPL)	5		5		1.0
PM Setup Data						
19	PM_REF_TEMP (Reference Temperature)				4	1.0
20	PM_TEC (Thermal Expansion Coefficient)				4	1.0
21	PM_TABLE_TYPE (2540 CTL Table Type)				2	1.0
22	PM_REF_PRESSURE (Reference Pressure)					1.0
23	PM_TEMP_UNITS (Temperature Unit)		2			1.0
24	PM_DENSITY_UNITS (Density Unit)		2			1.0
25	PM_VOL_FLOW_UNITS (Volume Flow Unit)		2			1.0
26	PM_PRESSURE_UNITS (Pressure) Unit		2			1.0
27	PM_FEATURE (API Referral)	1		1		1.0

A.2.7 Concentration measurement transducer blocks

Concentration measurement transducer block details

Table A-66: Concentration measurement process variables

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
14	CM_REF_DENS (Density at Reference/Referred Density)	VAR	DS-65 (5)	D	RO	DENSITY_LOW_LIMIT ≤ x ≤ DENSITY_HIGH_LIMIT
15	CM_SPEC_GRAV (Density (Fixed SG Units))	VAR	DS-65 (5)	D	RO	N/A
16	CM_STD_VOL_FLOW (Standard Volume Flow Rate)	VAR	DS-65 (5)	D	RO	VFLOW_LOW_LIMIT ≤ x ≤ VFLOW_HIGH_LIMIT
17	CM_NET_MASS_FLOW (Net Mass Flow Rate)	VAR	DS-65 (5)	D	RO	MFLOW_LOW_LIMIT ≤ x ≤ MFLOW_HIGH_LIMIT
18	CM_NET_VOL_FLOW (Standard Net Volume Flow Rate)	VAR	DS-65 (5)	D	RO	VFLOW_LOW_LIMIT ≤ x ≤ VFLOW_HIGH_LIMIT
19	CM_CONC (Concentration)	VAR	DS-65 (5)	D	RO	N/A
20	CM_BAUME (CM Baume)	VAR	DS-65 (5)	D	RO	N/A

Table A-67: Concentration measurement setup data

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
21	CM_CURVE_LOCK (Concentration Matrix Lock)	ENUM	Unsigned8 (1)	S	R/W (OOS)	0 = not locked 1 = locked
22	CM_MODE (Derived Variable)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1 = Dens at Ref Temp 2 = Specific Gravity 3 = Mass Conc (Dens) 4 = Mass Conc (SG) 5 = Vol Conc (Dens) 6 = Vol Conc (SG) 7 = Conc (Dens) 8 = Conc (SG)
23	CM_ACTIVE_CURVE (Active Matrix)	VAR	Unsigned16 (2)	S	R/W (Any)	0 - 5
24	CM_CURVE_INDEX (Matrix Being Configured)	VAR	Unsigned16 (2)	S	R/W (Any)	0 - 5
25	CM_TEMP_INDEX (Temperature Index)	VAR	Unsigned16 (2)	S	R/W (Any)	0 - 5
26	CM_CONC_INDEX (Concentration Index)	VAR	Unsigned16 (2)	S	R/W (Any)	0 - 5

Table A-67: Concentration measurement setup data *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
27	CM_TEMP_ISO (Temperature Isothermal Value)	VAR	FLOAT (4)	S	R/W (OOS)	FLOAT (4)
28	CM_DENS_AT_TEMP_ISO (Density At Isothermal Temperature)	VAR	FLOAT (4)	S	R/W (OOS)	FLOAT (4)
29	CM_DENS_AT_TEMP_COE (Density At Temperature Coefficient)	VAR	FLOAT (4)	S	R/W (OOS)	FLOAT (4)
30	CM_CONC_LABEL_55 (Concentration Label 55)	VAR	FLOAT (4)	S	R/W (OOS)	FLOAT (4)
31	CM_DENS_AT_CONC (Density At Concentration)	VAR	FLOAT (4)	S	R/W (OOS)	FLOAT (4)
32	CM_DENS_AT_CONC_COE (Density At Concentration Coefficient)	VAR	FLOAT (4)	S	R/W (OOS)	FLOAT (4)
33	CM_CONC_LABLE_51 (Concentration Label 51)	VAR	FLOAT (4)	S	R/W (OOS)	FLOAT (4)
34	CM_REF_TEMP (Reference Temperature)	VAR	FLOAT (4)	S	R/W (OOS)	FLOAT (4)
35	CM_SG_WATER_REF_TEMP (Water Reference Temperature)	VAR	FLOAT (4)	S	R/W (OOS)	TEMP_LOW_LIMIT ≤ x ≤ TEMP_HIGH_LIMIT
36	CM_SG_WATER_REF_DENS (Water Reference Density)	VAR	FLOAT (4)	S	R/W (OOS)	Density Lo Limit ≤ x ≤ Density Hi Limit
37	CM_SLOPE_TRIME (Slope Trim)	VAR	FLOAT (4)	S	R/W (OOS)	0.8f ≤ x ≤ 1.2f
38	CM_SLOPE_OFFSET (Offset Trim)	VAR	FLOAT (4)	S	R/W (OOS)	FLOAT (4)
39	CM_EXTRAP_ALARM_LIMIT (Extrapolation Limit)	VAR	FLOAT (4)	S	R/W (Any)	0.0f ≤ x ≤ 270.0f
40	CM_CURVE_NAME (Matrix Name)	VAR	VISIBLESTRING (12)	S	R/W (Any)	—
41	CM_MAX_FIT_ORDER (Max Fit Order)	VAR	Unsigned16 (2)	S	R/W (OOS)	2, 3, 4, 5 (accepts only enum values)
42	CM_FIT_RESULT (Curve Fit Result)	ENUM2	Unsigned16 (2)	S	RO	0= Good 1= Poor 2= Failed 3= Empty
43	CM_EXPECTED_ACC (Expected Accuracy)	VAR	FLOAT (4)	S	RO	—

Table A-67: Concentration measurement setup data *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
44	CM_CONC_UNITS (Concentration Units)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Concentration unit codes
45	CM_CONC_SPEC_TEXT (Concentration Label)	STRING	VisibleString (8)	S	R/W (OOS)	—
46	CM_CURVE_RESET (Reset Matrix Data)	METHOD	Unsigned8 (1)	S	R/W (OOS)	1 = Reset 0 = None
47	CM_DENS_LO_EXTRAP_EN (Density Low)	ENUM	Unsigned8 (1)	S	R/W (Any)	1 = Reset 0 = None
48	CM_DENS_HI_EXTRAP_EN (Density High)	ENUM	Unsigned8 (1)	S	R/W (Any)	1 = Reset 0 = None
49	CM_TEMP_LO_EXTRAP_EN (Temperature Low)	ENUM	Unsigned8 (1)	S	R/W (Any)	1 = Reset 0 = None
50	CM_TEMP_HI_EXTRAP_EN (Temperature High)	ENUM	Unsigned8 (1)	S	R/W (Any)	1 = Reset 0 = None
51	CM_INC_CURVE(Curve Increment)	VAR	DS-66(2)	S	R/W (Any)	Value part of DS-66 (2) 0 = None 1 = Increment
52	CM_TEMP_UNITS (Temperature Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1000 = K 1001= deg C 1002= deg F 1003= deg R
53	CM_DENS_UNITS (Density Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Density unit codes
54	CM_VFLOW_UNITS (Volume Flow Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Volume flow unit codes
55	CM_MFLOW_UNITS (Mass Flow Unit)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Mass flow unit codes
56	CM_ACT_CUR_CONC_ UNITS (Active Curve Concentration Units)	ENUM2	Unsigned16 (2)	S	RO	See Concentration unit codes
57	CM_FEATURE (Concentration Measurement)	ENUM	Unsigned8 (1)	D	RO	0 = Disabled 1 = Enabled

Concentration unit codes

1110 = degTwad
1426 = degBrix
1111 = degBaum hv
1112 = degBaum lt
1343 = % sol/wt
1344 = % sol/vol
1427 = degBall
1428 = proof/vol
1429 = proof/mass
33004 = deg plato
253 = Special Unit

Density unit codes

1097 = kg/m³	1104 = g/ml	1107 = lb/ft³	1113 = degAPI
1100 = g/cm³	1105 = g/L	1108 = lb/gal	1114 = SGU"
1103 = kg/L	1106 = lb/in³	1109 = STon/yd³	

Volume flow unit codes

1347 = m3/s	1356 = CFS	1366 = Mgal/d	1374 = bbl/d
1348 = m3/min	1357 = CFM	1367 = ImpGal/s	1631 = bbl(US Beer)/d
1349 = m3/h	1358 = CFH	1368 = ImpGal/min	1632 = bbl(US Beer)/h
1350 = m3/d	1359 = ft³/d	1369 = ImpGal/h	1633 = bbl(US Beer)/min
1351 = L/s	1362 = gal/s	1370 = Impgal/d	1634 = bbl(US Beer)/s

Mass flow unit codes

1318 = g/s	1324 = kg/h	1330 = lb/s	1336 = STon/h
1319 = g/min	1325 = kg/d	1331 = lb/min	1337 = Ston/d
1320 = g/h	1327 = t/min	1332 = lb/h	1340 = LTon/h
1322 = Kg/s	1328 = t/h	1333 = lb/d	1341 = LTon/d
1323 = kg/min	1329 = t/d	1335 = STon/min	253 = Special

Concentration measurement transducer block views

#	Name (Label)	View list					Release
		1	2	3	4_1	4_2	
Standard FF Parameters							
0	BLOCK_STRUCTURE						1.0
1	ST_REV	2	2	2	2	2	1.0
2	TAG_DESC						1.0
3	STRATEGY				2		1.0
4	ALERT_KEY				1		1.0
5	MODE_BLK	4		4			1.0
6	BLOCK_ERR	2		2			1.0
7	UPDATE_EVT						1.0
8	BLOCK_ALM						1.0
9	TRANSDUCER_DIRECTORY						1.0
10	TRANSDUCER_TYPE	2	2	2	2		1.0
11	TRANSDUCER_TYPE_VER	2	2	2	2		1.0
12	XD_ERROR	1		1			1.0
13	COLLECTION_DIRECTORY						1.0
CM Process Variables							
14	CM_REF_DENS (Density at Reference/ Referred Density)	5		5			1.0

#	Name (Label)	View list					Release
		1	2	3	4_1	4_2	
15	CM_SPEC_GRAV (Density (Fixed SG Units))	5		5			1.0
16	CM_STD_VOL_FLOW (Standard Volume Flow Rate)	5		5			1.0
17	CM_NET_MASS_FLOW (Net Mass Flow Rate)	5		5			1.0
18	CM_NET_VOL_FLOW (Standard Net Volume Flow Rate)	5		5			1.0
19	CM_CONC (Concentration)	5		5			1.0
20	CM_BAUME (CM Baume)	5		5			1.0
CM Setup Data							
21	CM_CURVE_LOCK (Concentration Matrix Lock)					1	1.0
22	CM_MODE (Derived Variable)					2	1.0
23	CM_ACTIVE_CURVE (Active Matrix)				2		1.0
24	CM_CURVE_INDEX (Matrix Being Configured)				2		1.0
25	CM_TEMP_INDEX (Temperature Index)				2		1.0
26	CM_CONC_INDEX (Concentration Index)				2		1.0
27	CM_TEMP_ISO (Temperature Isothermal Value)				4		1.0
28	CM_DENS_AT_TEMP_ISO (Density At Isothermal Temperature)				4		1.0
29	CM_DENS_AT_TEMP_COE (Density At Temperature Coefficient)				4		1.0
30	CM_CONC_LABEL_55 (Concentration Label 55)				4		1.0
31	CM_DENS_AT_CONC (Density At Concentration)				4		1.0
32	CM_DENS_AT_CONC_COE (Density At Concentration Coefficient)				4		1.0
33	CM_CONC_LABLE_51 (Concentration Label 51)				4		1.0
34	CM_REF_TEMP (Reference Temperature)					4	1.0
35	CM_SG_WATER_REF_TEMP (Water Reference Temperature)					4	1.0
36	CM_SG_WATER_REF_DENS (Water Reference Density)					4	1.0
37	CM_SLOPE_TRIME (Slope Trim)					4	1.0
38	CM_SLOPE_OFFSET (Offset Trim)					4	1.0

#	Name (Label)	View list					Release
		1	2	3	4_1	4_2	
39	CM_EXTRAP_ALARM_LIMIT (Extrapolation Limit)					4	1.0
40	CM_CURVE_NAME (Matrix Name)					12	1.0
41	CM_MAX_FIT_ORDER (Max Fit Order)					2	1.0
42	CM_FIT_RESULT (Curve Fit Result)					2	1.0
43	CM_EXPECTED_ACC (Expected Accuracy)					4	1.0
44	CM_CONC_UNITS (Concentration Units)		2				1.0
45	CM_CONC_SPEC_TEXT (Concentration Label)					8	1.0
46	CM_CURVE_RESET (Reset Matrix Data)	1					1.0
47	CM_DENS_LO_EXTRAP_EN (Density Low)	1					1.0
48	CM_DENS_HI_EXTRAP_EN (Density High)	1					1.0
49	CM_TEMP_LO_EXTRAP_EN (Temperature Low)	1					1.0
50	CM_TEMP_HI_EXTRAP_EN (Temperature High)	1					1.0
51	CM_INC_CURVE (Curve Increment)	2					1.0
52	CM_TEMP_UNITS (Temperature Unit)	2					1.0
53	CM_DENS_UNITS (Density Unit)	2					1.0
54	CM_VFLOW_UNITS (Volume Flow Unit)	2					1.0
55	CM_MFLOW_UNITS (Mass Flow Unit)	2					1.0
56	CM_ACT_CUR_CONC_UNITS (Active Curve Concentration Units)					2	1.0
57	CM_FEATURE (Concentration Measurement)	1		1			1.0

A.2.8 Advanced Phase Measurement transducer blocks

Advanced Phase Measurement transducer block details

Table A-68: Net oil variables

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
14	NET_OIL_FLOW_REF (Net Oil Flow at Reference)	VAR	DS-65 (5)	D	RO	—
15	NET_WATER_FLOW_REF (Net Water Flow at Reference)	VAR	DS-65 (5)	D	RO	—

Table A-68: Net oil variables *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
16	NET_OIL_FLOW_LINE (Net Oil Flow at Line)	VAR	DS-65 (5)	D	RO	—
17	WATERCUT_LINE (Watercut at Line)	VAR	DS-65 (5)	D	RO	—
18	WATERCUT_REF (Watercut at Reference)	VAR	DS-65 (5)	D	RO	—
19	WATER_FLOW_LINE (Net Water Flow at Line)	VAR	DS-65 (5)	D	RO	—
20	GAS_VOID_FRACTION (Gas Void Fraction)	VAR	DS-65 (5)	D	RO	—
21	OIL_DENSITY_LINE_SGU (Density Oil at Line (Fixed SG Units))	VAR	DS-65 (5)	D	RO	—
22	OIL_DENSITY_LINE_API (Density Oil at Line (Fixed API Units))	VAR	DS-65 (5)	D	RO	—

Table A-69: Net oil configuration

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
23	PAO_ACTION (Net Oil Action)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	0 = Liquid Density 1 = Oil Density@Line
24	PAO_FLUID_TYPE (Fluid Type)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	0 = Disable 1 = Liquid with Gas 2 = Net Oil 3 = Gas with Liquid
25	PAO_PRODUCTION_TYPE (Production Type)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	0 = Continuous Flow 1 = Variable Flow
26	PAO_PERIOD (Interval)	VAR	Unsigned16 (2)	S	R/W (OOS)	$1 \le x \le 1440$
27	DRY_OIL_DENSITY_REF (Dry Oil Density at Reference)	VAR	FLOAT (4)	S	R/W (Any)	$0.2 \le x \le 1.5$
28	WATER_DENSITY_REF (Water Density at Reference)	VAR	FLOAT (4)	S	R/W (Any)	$0.5 \le x \le 1.5$
29	REF_TEMPERATURE (Reference Temperature)	VAR	FLOAT (4)	S	R/W (Any)	$-50 \le x \le 150$ degC
30	PAO_GAS_DENSITY (Gas Density at Line)	VAR	FLOAT (4)	S	R/W (Any)	—
31	PAO_MASS_FLOW (PAO Mass Flow)	VAR	FLOAT (4)	D	RO	—

Table A-69: Net oil configuration *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
32	PAO_DENSITY (PAO Density)	VAR	FLOAT (4)	D	RO	—
33	PAO_VOL_FLOW (PAO Volume Flow)	VAR	FLOAT (4)	D	RO	—
34	PAO_LINE_NET_OIL_FLOW (PAO Net Oil Flow at Line)	VAR	FLOAT (4)	D	RO	—
35	PAO_REF_NET_OIL_FLOW (PAO Net Oil Flow at Reference)	VAR	FLOAT (4)	D	RO	—
36	PAO_LINE_WATER_CUT (PAO Watercut at Line)	VAR	FLOAT (4)	D	RO	—
37	PAO_GAS_VOID_FRACTION (PAO Gas Void Fraction)	VAR	FLOAT (4)	D	RO	—
38	PAO_LINE_TEMPERATURE (PAO Temperature)	VAR	FLOAT (4)	D	RO	—

Table A-70: Contract period

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
39	CONTRACT_PERIOD_STR (Contract Period Start)	VAR	Unsigned16 (2)	S	R/W (OOS)	$0 \leq x \leq 23$
40	CONTRACT_PERIOD1_SRC (Contract Total 1)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Sensor flange type codes
41	CONTRACT_PERIOD2_SRC (Contract Total 2)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Sensor flange type codes
42	CONTRACT_PERIOD3_SRC (Contract Total 3)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Sensor flange type codes
43	CONTRACT_PERIOD4_SRC (Contract Total 4)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Sensor flange type codes
44	CONTRACT_TODAY_TOT1 (Today's Total 1)	VAR	FLOAT (4)	D	RO	—
45	CONTRACT_TODAY_TOT2 (Today's Total 2)	VAR	FLOAT (4)	D	RO	—
46	CONTRACT_TODAY_TOT3 (Today's Total 3)	VAR	FLOAT (4)	D	RO	—
47	CONTRACT_TODAY_TOT4 (Today's Total 4)	VAR	FLOAT (4)	D	RO	—
48	CONTRACT_YESTERDAY_TOT1 (Yesterday's Total 1)	VAR	FLOAT (4)	S	RO	—
49	CONTRACT_YESTERDAY_TOT2 (Yesterday's Total 2)	VAR	FLOAT (4)	S	RO	—

Table A-70: Contract period *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
50	CONTRACT_YESTERDAY_TOT3 (Yesterday's Total 3)	VAR	FLOAT (4)	S	RO	—
51	CONTRACT_YESTERDAY_TOT4 (Yesterday's Total 4)	VAR	FLOAT (4)	S	RO	—
52	CONTRACT_TOT1_UNITS (Total1 Unit)	ENUM2	Unsigned16 (2)	S	RO	—
53	CONTRACT_TOT2_UNITS (Total 2 Unit)	ENUM2	Unsigned16 (2)	S	RO	—
54	CONTRACT_TOT3_UNITS (Total 3 Unit)	ENUM2	Unsigned16 (2)	S	RO	—
55	CONTRACT_TOT4_UNITS (Total 4 Unit)	ENUM2	Unsigned16 (2)	S	RO	—

Sensor flange type codes

2 = Cfg Total 1
4 = Cfg Inv 1
6 = Cfg Total 2
7 = Cfg Inv 2
17 = Cfg Total 3
18 = Cfg Inv 3
24 = Cfg Total 5
25 = Cfg Inv 5
27 = Cfg Total 6
28 = Cfg Inv 6
30 = Cfg Total 7
31 = Cfg Inv 7
63 = Cfg Total 4
64 = Cfg Inv 4

Table A-71: TMR

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
56	PRE_EVENT_PERIOD (Pre-Mist Average Period)	VAR	Unsigned16 (2)	S	R/W (OOS)	($2 \leq x \leq 128$)
57	POST_EVENT_PERIOD (Post-Mist Average Period)	VAR	Unsigned16 (2)	S	R/W (OOS)	($2 \leq x \leq 128$)
58	TMR_ACTIVE_TIME (Mist Duration)	VAR	Unsigned32	D	RO	—

Table A-72: Units

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
59	APM_MASS_FLOW_UNITS (Mass Flow Units)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Mass flow unit codes
60	APM_VOL_FLOW_UNITS (Volume Flow Units)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Volume flow unit codes
61	APM_DENSITY_UNITS (Density Units)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Density unit codes

Table A-72: Units *(continued)*

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
62	APM_TEMP_UNITS (Temperature Units)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	1000 = K 1001 = deg C 1002 = deg F 1003 = deg R

Mass flow unit codes

1318 = g/s	1324 = kg/h	1330 = lb/s	1336 = STon/h
1319 = g/min	1325 = kg/d	1331 = lb/min	1337 = Ston/d
1320 = g/h	1327 = t/min	1332 = lb/h	1340 = LTon/h
1322 = Kg/s	1328 = t/h	1333 = lb/d	1341 = LTon/d
1323 = kg/min	1329 = t/d	1335 = STon/min	253 = Special

Volume flow unit codes

1347 = m3/s	1356 = CFS	1366 = Mgal/d	1374 = bbl/d
1348 = m3/min	1357 = CFM	1367 = ImpGal/s	1631 = bbl(US Beer)/d
1349 = m3/h	1358 = CFH	1368 = ImpGal/min	1632 = bbl(US Beer)/h
1350 = m3/d	1359 = ft^3/d	1369 = ImpGal/h	1633 = bbl(US Beer)/min
1351 = L/s	1362 = gal/s	1370 = Impgal/d	1634 = bbl(US Beer)/s

Density unit codes

1097 = kg/m^3	1104 = g/ml	1107 = lb/ft^3	1113 = degAPI
1100 = g/cm^3	1105 = g/L	1108 = lb/gal	1114 = SGU"
1103 = kg/L	1106 = lb/in^3	1109 = $STon/yd^3$	

Table A-73: System time

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
63	APM_TIME_ZONE (Time Zone)	ENUM2	Unsigned16 (2)	S	R/W (OOS)	See Time zone codes
64	APM_TIME_ZONE_OFFSET (Time Zone Offset from UTC)	VAR	FLOAT (4)	S	R/W (OOS)	-24.0f ≤ x ≤ 24.0f
65	RTC_DATE_TIME (Set Clock Date-Time)	VAR	DATE	D	R/W (OOS)	—
66	RTC_DAY_LIGHT_SAVING (Day Light Savings)	ENUM1	Unsigned8 (1)	S	R/W (OOS)	0 = Disable 1 = Enable

Time zone codes

0 = Dateline (-12.0)
1 = Soma (-11.0)
2 = Hawaii (-10.0)
3 = Alaska (-9.0)
4 = Pacific (-8.0)
5 = Mountain (-7.0)
6 = Central (-6.0)
7 = Eastern (-5.0)
8 = Atlantic (-4.0)
9 = New Foundland (-3.5)
10 = saEastern (-3.0)
11 = MidAtlantic (-2.0)
13 = Greenwich (0.0)
14 = Central EU (+1.0)
15 = Europe (+2.0)
16 = Russian (+3.0)
17 = Iran (+3.5)
18 = Arabian (+4.0)
19 = Afghan (+4.5)
20 = West Asia (+5.0)
21 = India (+5.5)
22 = Nepal (+5.75)
23 = Central Asia (+6.0)
24 = Myanmar (+6.5)
25 = South East Asia (+7.0)
26 = China (+8.0)
27 = Korea (+9.0)
28 = Central Australia (+9.5)
29 = East Australia (+10.0)
30 = Central Pacific (+11.0)
31 = Fiji (+12.0)
32 = Tonga (+13.0)
33 = special

Table A-74: Parameter limits

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
67	APM_MFLOW_LOW_LIM (Mass Flow Low Limit)	VAR	FLOAT (4)	S	RO	—
68	APM_MFLOW_HI_LIM (Mass Flow High Limit)	VAR	FLOAT (4)	S	RO	—
69	APM_VFLOW_LOW_LIM (Volume Flow Low Limit)	VAR	FLOAT (4)	S	RO	—
70	APM_VFLOW_HI_LIM (Volume Flow High Limit)	VAR	FLOAT (4)	S	RO	—
71	APM_TEMP_LOW_LIM (Temperature Low Limit)	VAR	FLOAT (4)	S	RO	—
72	APM_TEMP_HI_LIM (Temperature High Limit)	VAR	FLOAT (4)	S	RO	—
73	APM_DENS_LOW_LIM (Density Low Limit)	VAR	FLOAT (4)	S	RO	—
74	APM_DENS_HI_LIM (Density High Limit)	VAR	FLOAT (4)	S	RO	—

Table A-75: External watercut

#	Name (Label)	Msg type	Data type (size in bytes)	Store	Access	Enumerated list of values
75	EXTR_WATERCUT (External Watercut)	VAR	DS-65 (5)	D	R/W (Any)	0.0f ≤ x ≤ 100.0f
76	EN_EXTR_WATERCUT (External Watercut control)	ENUM	Unsigned8 (1)	S	R/W (OOS)	0 = Disable 1 = Enable
77	APM_FEATURE (Device Features)	ENUM	Unsigned16 (2)	D	RO	See Device feature codes

Device feature codes

0x0000 = FKEY_NO_FEATURE
0x0001 = APM Cont Flow
0x0002 = TMR
0x0004 = PVR
0x0008 = TBR
0x0010 = SMV
0x0020 = GSV
0x0040 = ED
0x0080 = API
0x0800 = CAL FAIL
0x1000 = APM TMR
0x2000 = APM Var NOC
0x4000 = APM Var Flow
0x8000 = APM Cont NOC

Advanced Phase Measurement transducer block views

#	Name (Label)	View list					Release
		1	2	3_1	3_2	4	
Standard FF Parameters							
0	BLOCK_STRUCTURE						1.0
1	ST_REV	2	2	2	2	2	1.0
2	TAG_DESC						1.0
3	STRATEGY					2	1.0
4	ALERT_KEY					1	1.0
5	MODE_BLK	4		4	4		1.0
6	BLOCK_ERR	2		2	2		1.0
7	UPDATE_EVT						1.0
8	BLOCK_ALM						1.0
9	TRANSDUCER_DIRECTORY						1.0
10	TRANSDUCER_TYPE	2	2	2		2	1.0
11	TRANSDUCER_TYPE_VER	2	2	2		2	1.0
12	XD_ERROR	1		1			1.0
13	COLLECTION_DIRECTORY						1.0
Net Oil Variables							
14	NET_OIL_FLOW_REF (Net Oil Flow at Reference)	5		5			1.0
15	NET_WATER_FLOW_REF (Net Water Flow at Reference)	5		5			1.0
16	NET_OIL_FLOW_LINE (Net Oil Flow at Line)	5		5			1.0
17	WATERCUT_LINE (Watercut at Line)	5		5			1.0
18	WATERCUT_REF (Watercut at Reference)	5		5			1.0
19	WATER_FLOW_LINE (Net Water Flow at Line)	5		5			1.0
20	GAS_VOID_FRACTION (Gas Void Fraction)	5			5		1.0
21	OIL_DENSITY_LINE_SGU (Density Oil at Line (Fixed SG Units))	5			5		1.0

#	Name (Label)	View list					Release
		1	2	3_1	3_2	4	
22	OIL_DENSITY_LINE_API (Density Oil at Line (Fixed API Units))	5			5		1.0
Net Oil Configuration							
23	PAO_ACTION (Net Oil Action)		2				1.0
24	PAO_FLUID_TYPE (Fluid Type)		2				1.0
25	PAO_PRODUCTION_TYPE (Production Type)		2				1.0
26	PAO_PERIOD (Interval)		2				1.0
27	DRY_OIL_DENSITY_REF (Dry Oil Density at Reference)		4				1.0
28	WATER_DENSITY_REF (Water Density at Reference)		4				1.0
29	REF_TEMPERATURE (Reference Temperature)		4				1.0
30	PAO_GAS_DENSITY (Gas Density at Line)		4				1.0
31	PAO_MASS_FLOW (PAO Mass Flow)				4		1.0
32	PAO_DENSITY (PAO Density)				4		1.0
33	PAO_VOL_FLOW (PAO Volume Flow)				4		1.0
34	PAO_LINE_NET_OIL_FLOW (PAO Net Oil Flow at Line)				4		1.0
35	PAO_REF_NET_OIL_FLOW (PAO Net Oil Flow at Reference)				4		1.0
36	PAO_LINE_WATER_CUT (PAO Watercut at Line)				4		1.0
37	PAO_GAS_VOID_FRACTION (PAO Gas Void Fraction)				4		1.0
38	PAO_LINE_TEMPERATURE (PAO Temperature)				4		1.0
Contarct Period							
39	CONTRACT_PERIOD_STR (Contract Period Start)		2				1.0
40	CONTRACT_PERIOD1_SRC (Contract Total 1)		2				1.0
41	CONTRACT_PERIOD2_SRC (Contract Total 2)		2				1.0
42	CONTRACT_PERIOD3_SRC (Contract Total 3)		2				1.0
43	CONTRACT_PERIOD4_SRC (Contract Total 4)		2				1.0

#	Name (Label)	View list					Release
		1	2	3_1	3_2	4	
44	CONTRACT_TODAY_TOT1 (Today's Total 1)			4			1.0
45	CONTRACT_TODAY_TOT2 (Today's Total 2)			4			1.0
46	CONTRACT_TODAY_TOT3 (Today's Total 3)			4			1.0
47	CONTRACT_TODAY_TOT4 (Today's Total 4)			4			1.0
48	CONTRACT_YESTERDAY_TOT1 (Yesterday's Total 1)		4				1.0
49	CONTRACT_YESTERDAY_TOT2 (Yesterday's Total 2)		4				1.0
50	CONTRACT_YESTERDAY_TOT3 (Yesterday's Total 3)		4				1.0
51	CONTRACT_YESTERDAY_TOT4 (Yesterday's Total 4)		4				1.0
52	CONTRACT_TOT1_UNITS (Total1 Unit)		2				1.0
53	CONTRACT_TOT2_UNITS (Total2 Unit)		2				1.0
54	CONTRACT_TOT3_UNITS (Total3 Unit)		2				1.0
55	CONTRACT_TOT4_UNITS (Total4 Unit)		2				1.0
TMR							
56	PRE_EVENT_PERIOD (Pre-Mist Average Period)					2	1.0
57	POST_EVENT_PERIOD (Post-Mist Average Period)					2	1.0
58	TMR_ACTIVE_TIME (Mist Duration)			4			1.0
Units							
59	APM_MASS_FLOW_UNITS (Mass Flow Units)					2	1.0
60	APM_VOL_FLOW_UNITS (Volume Flow Units)					2	1.0
61	APM_DENSITY_UNITS (Density Units)					2	1.0
62	APM_TEMP_UNITS (Temperature Units)					2	1.0
System Time							
63	APM_TIME_ZONE (Time Zone)					2	1.0
64	APM_TIME_ZONE_OFFSET (Time Zone Offset from UTC)					4	1.0
65	RTC_DATE_TIME (Set Clock Date-Time)			7			1.0
66	RTC_DAY_LIGHT_SAVING (Day Light Savings)					1	1.0

#	Name (Label)	View list					Release
		1	2	3_1	3_2	4	
Parameter Limits							
67	APM_MFLOW_LOW_LIM (Mass Flow Low Limit)					4	1.0
68	APM_MFLOW_HI_LIM (Mass Flow High Limit)					4	1.0
69	APM_VFLOW_LOW_LIM (Volume Flow Low Limit)					4	1.0
70	APM_VFLOW_HI_LIM (Volume Flow High Limit)					4	1.0
71	APM_TEMP_LOW_LIM (Temperature Low Limit)					4	1.0
72	APM_TEMP_HI_LIM (Temperature High Limit)					4	1.0
73	APM_DENS_LOW_LIM (Density Low Limit)					4	1.0
74	APM_DENS_HI_LIM (Density High Limit)					4	1.0
External Watercut							
75	EXTR_WATERCUT (External Watercut)			5			1.0
76	EN_EXTR_WATERCUT (External Watercut control)					1	1.0
77	APM_FEATURE (Device Features)	2		2			1.0

A.3 Fieldbus channel references

Fieldbus channels with Analog Input function block

Channel number	Channel description	Transducer block value reference	Valid unit codes or transducer block units reference	Release
1	Mass Flow	MEASUREMENT TB --> MASS_FLOW	MEASUREMENT TB --> MFLOW_UNIT	1.0
2	Temperature	MEASUREMENT TB --> TEMPERATURE	MEASUREMENT TB --> TEMP_UNIT	1.0
3	Density	MEASUREMENT TB --> DENSITY	MEASUREMENT TB --> DENSITY_UNIT	1.0
4	Volume Flow	MEASUREMENT TB --> VOLUME_FLOW	MEASUREMENT TB --> VFLOW_UNIT	1.0
5	Drive Gain	MEASUREMENT TB --> DRIVE_GAIN	1342 = %	1.0
6	Flow Velocity	MEASUREMENT TB --> FLOW_VELOCITY	MEASUREMENT TB --> FLOW_VELOCITY_UNIT	1.0
7	PM Corr Density	PM --> PM_CORR_DENSITY	PM --> PM_DENSITY_UNITS	1.0
8	PM Corr Vol Flow	PM --> PM_CORR_VOL_FLOW	PM --> PM_VFLOW_UNITS	1.0
9	PM Avg Corr Density	PM --> PM_AVG_CORR_DENSITY	PM --> PM_DENSITY_UNITS	1.0

Channel number	Channel description	Transducer block value reference	Valid unit codes or transducer block units reference	Release
10	PM Avg Corr Temp	PM --> PM_AVG_CORR_TEMP	PM --> PM_TEMP_UNITS	1.0
11	PM CTL	PM --> PM_CTL	1588 = No Units	1.0
12	CM Ref Density	CM --> CM_REF_DENS	CM --> CM_DENS_UNITS	1.0
13	CM Specific Gravity	CM --> CM_SPEC_GRAV	1588 = No Units	1.0
14	CM Std Vol Flow	CM --> CM_STD_VOL_FLOW	CM --> CM_VFLOW_UNITS	1.0
15	CM Net Mass Flow	CM --> CM_NET_MASS_FLOW	CM --> CM_MFLOW_UNIT	1.0
16	CM Net Vol Flow	CM --> CM_NET_VOL_FLOW	CM --> CM_VFLOW_UNITS	1.0
17	CM Conc	CM --> CM_CONC	CM --> CM_CONC_UNITS	1.0
18	CM Baume	CM --> CM_BAUME	1111 = Deg Baume (heavy) 1112 = Deg Baume (light)	1.0
19	Std Gas Volume Flow	MEASUREMENT TB --> GSV_VOL_FLOW	MEASUREMENT TB --> GSV_FLOW_UNITS	1.0
20	Phase Flow Severity	MEASUREMENT TB -->PHGN_FLOW_SEVERITY	No Unit	1.0
21	APM Net Flow Oil At Line	APM TB ->NET_OIL_FLOW_LINE	APM->APM_VOL_FLOW_UNITS	1.0
22	APM Watercut At Line	APM TB ->WATERCUT_LINE	1342 = %	1.0
23	APM Net Water Flow At Line	APM TB ->WATER_FLOW_LINE	APM->APM_VOL_FLOW_UNITS	1.0
24	APM Net Oil Flow At Ref	APM TB ->NET_OIL_FLOW	APM->APM_VOL_FLOW_UNITS	1.0
25	APM Watercut At Ref	APM TB ->NET_WATER_CUT	1342 = %	1.0
26	APM Net Flow Water At Ref	APM TB ->NET_WATER_FLOW	APM->APM_VOL_FLOW_UNITS	1.0
27	APM Gas Void Fraction	APM_TB->GAS_VOID_FRACTION	1342 = %	1.0

Fieldbus channels with Analog Output function block

Channel number	Channel description	Transducer block value reference	Valid unit codes or transducer block units reference	Release
28	Pressure	MEASUREMENT TB --> PRESSURE_COMP	MEASUREMENT TB --> PRESSURE_UNITS	1.0
29	Temperature	MEASUREMENT TB --> TEMPERATURE_COMP	MEASUREMENT TB --> TEMP_UNIT	1.0
30	Watercut	APM TB -> EXTR_WATERCUT	1342 = %	1.0

Fieldbus channels with Discrete Input function block

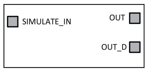
Channel number	Channel description	Transducer block value reference	Valid unit codes or transducer block units reference	Release
31	Actual Flow Direction	MEASUREMENT TB --> ACTUAL_FLOW_DIRECTION	N / A	1.0
32	Zero In Progress	MEASUREMENT TB --> ZERO_IN_PROGRESS	N / A	1.0
33	Analog Output Fault	DEVICE --> ANALOG_OUTPUT_FAULT	N / A	1.0
34	Meter Verification Failed	MV --> FRF_MV_FAILED	N / A	1.0

Fieldbus channels with Discrete Output function block

Channel number	Channel description	Transducer block value reference	Valid unit codes or transducer block units reference	Release
35	Start Sensor Zero	MEASURMENT TB --> ZERO_CAL	N / A	1.0
36	Increment CM Curve	CM --> CM_INC_CURVE	N / A	1.0
37	Start Meter Verification in Continuous Measurement Mode	MV --> FRF_ONLINE_MV_START	N / A	1.0
38	Reset All Process Totals	TOTAL_INV --> ALL_TOT_RESET	N / A	1.0
39	Start/Stop All Totals	TOTAL_INV --> START_STOP_ALL_TOTALS	N / A	1.0
40	Reset Config Total 1	TOTAL_INV --> CFG_TOT1_RESET	N / A	1.0
41	Reset Config Total 2	TOTAL_INV --> CFG_TOT2_RESET	N / A	1.0
42	Reset Config Total 3	TOTAL_INV --> CFG_TOT3_RESET	N / A	1.0
43	Reset Config Total 4	TOTAL_INV --> CFG_TOT4_RESET	N / A	1.0
44	Reset Config Total 5	TOTAL_INV --> CFG_TOT5_RESET	N / A	1.0
45	Reset Config Total 6	TOTAL_INV --> CFG_TOT6_RESET	N / A	1.0
46	Reset Config Total 7	TOTAL_INV --> CFG_TOT7_RESET	N / A	1.0

B FOUNDATION Fieldbus function blocks

B.1 Analog Input (AI) function block



The Analog Input (AI) Function Block processes the measurement from the Transducer Block and makes it available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The AI block supports alarming, signal scaling, signal filtering, signal status calculation, mode control, and simulation. In Automatic mode, the block's output parameter (**OUT**) reflects the process variable (PV) value and status. In Manual mode, **OUT** may be set manually. The Manual mode is reflected on the output status. A discrete output (**OUT_D**) is provided to indicate whether a selected alarm condition is active. Alarm detection is based on the **OUT** value and user specified alarm limits.

B.1.1 AI block configuration parameters

- **CHANNEL**: The **CHANNEL** value is used to select the measurement value. Configure the **CHANNEL** parameter before configuring the **XD_SCALE** parameter.
- **L_TYPE**: Linearization type. Determines whether the field value is used directly (Direct), is converted linearly (Indirect), or is converted with the square root (Indirect Square Root).
- **XD_SCALE**: The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the channel input value. The **XD_SCALE** units code must match the units code of the measurement channel in the transducer block. If the units do not match, the block will not transition to **MAN** or **AUTO**.
- **OUT_SCALE**: The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with **OUT** when **L_TYPE** is not direct.
- **SIMULATE**: A group of data that contains the current transducer value and status, the simulated transducer value and status, and the enable/disable bit.
- **PV_FTIME**: The time constant of the first-order PV filter. It is the time required for a 63% change in the **IN** value.
- **LOW_CUT**: If percentage value of transducer input fails below this, PV = 0.
- **LOW_LIM**: The setting for the alarm limit used to detect the LO alarm condition for process variable in EU of **PV_SCALE**.
- **LO_PRI**: The priority of the **LO** alarm.
- **HI_LIM**: The setting for the alarm limit used to detect the HI alarm condition for process variable in EU of **PV_SCALE**.
- **HI_PRI**: The priority of the HI alarm.
- **ALARM_HYS**: The percent amount the alarm value must return within the alarm limit before the associated active alarm condition clears.

B.1.2 AI block modes

The AI Function Block supports three modes of operation as defined by the MODE_BLK parameter:

- *Manual (Man)*: The block output (**OUT**) may be set manually.
- *Automatic (Auto)*: **OUT** reflects the analog input measurement or the simulated value when simulation is enabled.
- *Out of Service (O/S)*: The block is not processed. **FIELD_VAL** and PV are not updated and the **OUT** status is set to Bad: Out of Service. The **BLOCK_ERR** parameter shows Out of Service. In this mode, you can make changes to all configured parameters. The target mode of a block may be restricted to one or more of the supported modes.

B.1.3 AI block simulation

To support testing, either change the mode of the block to manual and adjust the output value, or enable simulation through the configuration tool and manually enter a value for the measurement value and its status. To enable simulation, the Simulation switch has to be ON. With simulation enabled, the actual measurement value has no impact on the OUT value or the status.

Note
The transmitter has a simulation switch on the display. As a safety measure, the switch has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

B.1.4 AI block configuration

A minimum of four parameters are required to configure the AI Block: **CHANNEL**, **L_TYPE**, **XD_SCALE**, and **OUT_SCALE**.

CHANNEL

Select the channel that corresponds to the desired sensor measurement.

Table B-1: AI block channel definitions

Channel	Description
1	Mass flow
2	Temperature
3	Density
4	Volume flow
5	Drive gain
6	Flow velocity
7	PM corrected density
8	PM corrected volume flow
9	PM average corrected density
10	PM average corrected temperature
11	PM CTL

Table B-1: AI block channel definitions *(continued)*

Channel	Description
12	CM reference density
13	CM specific gravity
14	CM standard volume flow
15	CM net mass flow
16	CM net volume flow
17	CM concentration
18	CM baume
19	Gas standard volume flow
20	Phase flow severity
21	APM net oil flow at line
22	APM watercut at line
23	APM net water flow at line
24	Net oil flow at reference
25	Watercut at reference
26	Net water flow at reference
27	Gas void fraction

L_TYPE

The **L_TYPE** parameter defines the relationship of the sensor measurement to the desired output of the AI block. The relationship can be direct, indirect, or indirect square root.

L_TYPE setting	Reason for selecting
Direct	Select direct when the desired output will be the same as the sensor measurement. This is the most common configuration.
Indirect	Select indirect when the desired output is a calculated measurement based on the sensor measurement. The relationship between the sensor measurement and the calculated measurement will be linear.
Indirect square root	Select indirect square root when the desired output is an inferred measurement based on the sensor measurement and the relationship between the sensor measurement and the inferred measurement is square root.

XD_SCALE and OUT_SCALE

The **XD_SCALE** and **OUT_SCALE** each include three parameters **0%**, **100%**, and **UNITS** (engineering units). Set these based on the **L_TYPE** parameter setting.

L_TYPE setting	Scaling effect
Direct	• **(XD_SCALE) 0%** = 0 • **(XD_SCALE) 100%** = desired upper range value • **(XD_SCALE) UNITS** = desired flow units **Note** **XD_SCALE** units are written to transducer block units.
Indirect	When an inferred measurement is made based on the sensor measurement, set the **XD_SCALE** to represent the operating range that the sensor will see in the process. Determine the inferred measurement values that correspond to the **(XD_SCALE) 0%** and **(XD_SCALE) 100%** points and set these for the **OUT_SCALE**.

B.1.5 AI block filtering

The filtering feature changes the response time of the device to smooth variations in output readings caused by rapid changes in input. Adjust the filter time constant (in seconds) using the **PV_FTIME** parameter. Set the filter time constant to zero to disable the filter feature.

B.1.6 AI block signal conversion

Set the signal conversion type with the Linearization Type (**L_TYPE**) parameter. Choose from direct, indirect, or indirect square root signal conversion with the **L_TYPE** parameter.

- *Direct* signal conversion allows the signal to pass through the accessed channel input value (or the simulated value when simulation is enabled).

$$PV = \text{Channel Value}$$

- *Indirect* signal conversion converts the signal linearly to the accessed channel input value (or the simulated value when simulation is enabled) from its specified range (**XD_SCALE**) to the range and units of the **PV** and **OUT** parameters (**OUT_SCALE**).

$$PV = \frac{(\text{Channel Value})}{100} \times (EU@100\% - EU@0\%) + EU@0\%$$

- *Indirect Square Root* signal conversion takes the square root of the value computed with the indirect signal conversion and scales it to the range and units of the **PV** and **OUT** parameters.

$$PV = \sqrt{\frac{(\text{Channel Value})}{100}} \times (EU@100\% - EU@0\%) + EU@0\%$$

B.1.7 AI block alarm detection

A block alarm will be generated whenever the **BLOCK_ERR** has an error bit set. The types of block error for the AI block are defined above. Process alarm detection is based on the **OUT** value.

Configure the alarm limits of the following standard alarms:

- High (**HI_LIM**)
- High high (**HI_HI_LIM**)
- Low (**LO_LIM**)

- Low low (**LO_LO_LIM**)

To avoid alarm chatter when the variable is oscillating around the alarm limit, an alarm hysteresis in percent of the PV span can be set using the **ALARM_HYS** parameter. The priority of each alarm is set in the following parameters:

- **HI_PRI**
- **HI_HI_PRI**
- **LO_PRI**
- **LO_LO_PRI**

Number	Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts).
3–7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8–15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

B.1.8 AI block status handling

Normally, the status of the **PV** reflects the status of the measurement value, the operating condition of the I/O card, and any active alarm condition. In Auto mode, **OUT** reflects the value and status quality of the **PV**. In Man mode, the **OUT** status constant limit is set to indicate that the value is a constant and the **OUT** status is **Good**. If the sensor limit exceeds the high or low range, **PV** status is set high or low and EU range status is set to uncertain.

In the **STATUS_OPTS** parameter, select from the following options to control the status handling.

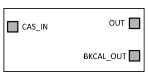
Status handling setting	Effect
Bad if limited	Sets the **OUT** status quality to **Bad** when the value is higher or lower than the sensor limits.
Uncertain if limited	Sets the **OUT** status quality to **Uncertain** when the value is higher or lower than the sensor limits.
Uncertain if in manual mode	Sets the **OUT** status quality to **Uncertain** when the mode is set to Manual.

B.1.9 AI block default configuration

	AI1 (AI_2600_xxxx)	AI2 (AI_2800_xxxx)	AI3 (AI3000_xxxx)	AI4 (AI_3200_xxxx
Channel	**Mass flow (1)**	**Temperature (2)**	**Density (3)**	**Volume flow (4)**
XD_SCALE				
EU_100	100	100	100	100
EU_0	0	0	0	0
Unit_Index	g/s	degC	g/cm³	L/s

	AI1 (AI_2600_xxxx)	AI2 (AI_2800_xxxx)	AI3 (AI3000_xxxx)	AI4 (AI_3200_xxxx
Channel	**Mass flow (1)**	**Temperature (2)**	**Density (3)**	**Volume flow (4)**
Decimal	2	2	2	2
OUT_SCALE				
EU_100	100	100	100	100
EU_0	0	0	0	0
Unit_Index	%	%	%	%
Decimal	0	0	0	0
L_TYPE	Direct	Direct	Direct	Direct

B.2 Analog Output (AO) function block



The AO block converts the FF value to a channel value by using two sets of scaling values. **PV_SCALE** is used to convert the FF value in SP to percent. The **IO_OPT** Increase to Close may be used to reverse the output direction. **XD_SCALE** is used to convert the percent FF value to the value for the channel, which should be given in the device manual. **XD_SCALE** high and low can be reversed to give reverse action, rather than using Increase to Close. There are no nonlinear conversions, at this time. The block output is a copy of the value that is sent to transducer processing via the channel. It may be linked to the input of a controller or control selector to perform valve position control.

B.2.1 AO block configuration parameters

- **CHANNEL**: Defines the output that drives the field device. The block will be forced into OOS mode until a channel number for an analog output is entered. Select the channel that corresponds to the desired sensor measurement.

Table B-2: AO block channel definitions

Channel	Description
28	Pressure
29	Temperature
30	Watercut

- **PV_SCALE**: **PV_SCALE** is used to convert the FF value in SP to percent. The units are usually percent.
- **XD_SCALE**: **XD_SCALE** is used to convert the percent FF value to the value for the channel, which should be given in the device manual. Choose scaling units that are compatible with the transducer block parameter. A configuration alarm is generated if the channel is not an analog output or the scaling limits or units of **XD_SCALE** are not available from the transducer. The block will be forced into OOS mode until the correct entries are made.

B.2.2 AO block modes

The AO function block supports following modes of operation defined by **MODE_BLK** parameter:

- *Out of Service (O/S)*: The AO algorithm of the block is not executed. The last value is issued at **OUT** or the determined value when the Fault State is activated.
- *Manual (MAN)*: The user can directly enter the output value of the AO Block.
- *Automatic (AUTO)*: The set point entered by the user is used over the SP parameter on implementation of the AO Block.
- *Cascade (CAS)*: The AO Function Block receives the set point directly from an upstream function block over the **CAS_IN** parameter to calculate the output value internally. The AO Block is implemented.
- *Remote Cascade (RCAS)*: The AO Function Block receives the set point directly from the host system over the **RCAS_IN** parameter to calculate the output value internally. The AO Block is implemented.

B.2.3 AO block errors

The following conditions are reported in the **BLOCK_ERR** attribute:

- *Block Configuration Error*: The selected channel is incompatible with the engineering units selected in XD_SCALE or the CHANNEL is zero.
- *Link Configuration Error*
- *Simulate Active*: Simulation is enabled and the block is using a simulated value in its execution.
- *Local Override*: The output of the block is not responding to OUT because the resource block has been placed into LO mode or fault state action is active.
- *Device Fault State set*:
- *Output Failure*: May be propagated backward as BAD, Device Failure
- *Readback Check Failed*: May be propagated backward as BAD, Sensor Failure
- *Out-of-Service*: The actual mode is out of service (OOS)

B.2.4 AO block simulation

When simulation is enabled, the last value of **OUT** is maintained and reflected in the field value of the **SIMULATE** attribute. In this case, the **PV** and **READBACK** values and statuses are based on the **SIMULATE** value and the status that you enter.

Note
The transmitter has a simulation Switch on the display. As a safety measure, the switch has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

B.2.5 AO block status handling

Output or readback fault detection are reflected in the status of **PV**, **OUT**, and **BKCAL_OUT**.

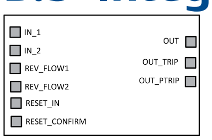
A limited SP condition is reflected in the **BKCAL_OUT** status. When simulation is enabled through the **SIMULATE** attribute, you can set the value and status for **PV** and **READBACK**.

When the block is in Cas mode and the **CAS_IN** input goes bad, the block sheds mode to the next permitted mode.

B.2.6 AO block default configuration

	AO1 (AO_3400_xxxx)	AO2 (AI_3600_xxxx)
Channel	**Pressure (28)**	**Temperature (29)**
XD_SCALE		
EU_100	100	100
EU_0	0	0
Unit_Index	Psi	degC
Decimal	2	2
OUT_SCALE		
EU_100	100	100
EU_0	0	0
Unit_Index	%	%
Decimal	0	0
L_TYPE	Direct	Direct

B.3 Integrator (INT) Function Block



The Integrator (INT) function block integrates one or two variables over time. The block compares the integrated or accumulated value to pre-trip and trip limits and generates discrete output signals when the limits are reached.

The INT integrates one process value. Each input may be an analog value or a pulse count from a Pulse Input block. Two inputs are provided so that a net total can be calculated.

The two inputs are added to produce a result that is used by the integrator. Options may be applied to limit the result to positive or negative flow. The status of the result is the worse of the two inputs.

The integrator calculates three totals that are not visible from Fieldbus. Total is the true integration of the signed value from the adder, regardless of status. Total is visible as the value of OUT. Atotal is the integration of the absolute value from the adder, regardless of status. Rtotal is the integration of the absolute value from the adder with bad status. The ratio of Rtotal to Atotal gives the approximate percent of Total that has good status. This determines the status of OUT.

The integrator may be used in seven ways. It may count until is is reset (standard totalizer) or count until periodically reset, or both. One of the other four ways is selected if the INT block is used as a batch ingredient loader. The amount to be loaded is set in TOTAL_SP. The integrator may count up to TOTAL_SP or count down to zero from TOTAL_SP. OUT_PTRIP turns on as the total approaches the set amount, possibly to reduce flow for fine control of the total. OUT_TRIP turns on when the total equals TOTAL_SP, which may automatically reset the integrator or not. Count up or count down and automatic reset or not are the four ways to use the INT block as a batch ingredient loader.

The totals may be reset by an operator or a discrete input, if permitted. Reset causes data to be stored in 'snapshot' registers, where it can be read until the next reset command. There is an option to disable the reset commands immediately after a successful reset, until the RESET_CONFIRM input is true. This option makes sure that the values at the time of the last reset are not changed by another reset until after the user has read them.

The block has no process alarms, but can generate a reset event.

This block is intended to have measurements that come from a process calculation path. It will work with input from a control path. The block output starts a process calculation path.

The block is unusual because the status of the output has to be calculated. The output status is not directly related to the status of the inputs. The output can be the input to another INT block.

B.3.1 INT block configuration parameters

- **INTEG_TYPE**: The integration type parameter (**INTEG_TYPE**) defines the integrate up, integrate down, and reset characteristics of the block.

INTEG_TYPE setting	Description
UP_AUTO	Integrates from zero to the setpoint and automatically resets when the SP is reached.
UP_DEM	Integrates from zero to the setpoint and resets when **RESET_IN** or the operator command to reset the integrator (**OP_CMT_INT**) transitions to True (1).
DN_AUTO	Integrates from the setpoint to zero and automatically resets when zero is reached.
DN_DEM	Integrates from the setpoint to zero and resets when **RESET_IN** or **OP_CMD_INT** transitions to True.
PERIODIC	Counts upward and resets periodically. The period is set by the **CLOCK_PER** attribute.
DEMAND	Counts upward and is reset when **RESET_IN** or **OP_CMD_INT** transitions to True.
PER&DEM	Counts upward and is reset periodically or by **RESET_IN**.

- **INTEG_OPTS**: The integration options parameter (**INTEG_OPTS**) defines the following options.

INTEG_OPTS setting	Description
Input 1 accumulate	The input value must be pulse count rather than rate. The accumulated pulse count must be for the same block execution time as the Pulse Input block.
Input 2 accumulate	The input value must be pulse count rather than rate. The accumulated pulse count must be for the same block execution time as the Pulse Input block.
Flow forward	The result of adder is limited to zero, when it would be negative.
Flow reverse	The result of adder is limited to zero, when it would be positive.
Use Uncertain	Integrate input even though the status of input is Uncertain.
Use Bad	Integrate input even though the status of input is Bad.
Carry	Carry the excess past the trip point into the next integration cycle as the initial value of the integration.
Add zero if bad	This option ignores Bad value at input. The input with Bad status is not integrated.

INTEG_OPTS setting	Description
Confirm reset	If the Confirm reset is set, the block shall not process subsequent reset at **RESET_IN** until **RESET_CONFIRM** discrete input is **TRUE**.
Input 1 pass through	This is special option only used for Emerson Integrator block to pass internal totals to Integrator block.

- **TIME_UNITn**: The integrator requires units per second, so **TIME_UNITn** is used to convert rate units of minutes, hours and days back to seconds. Minutes divides the input by 60, Hour by 3600, and Day by 86400 so that the result is engineering units per second.
- **TPTAL_SP**: The integrator may count up to **TOTAL_SP** or count down to zero from **TOTAL_SP**, depending upon the **INTEG_TYPE** selection. Same units as **OUT**.
- **UNIT_CONV**: Factor to convert the engineering units of input 2 into the engineering units of input 1. It can be any positive decimal number or fraction. It defaults to 1.
- **PULSE_VALn**: Factor to convert Inn pulses to engineering units to get a total in engineering units.
- **PRE_TRIP**: Adjusts the amount of IN that will set **OUT_PTRIP** when the integration reaches (**TOTAL_SP-PRE_TRIP**) when counting up or **PRE_TRIP** when counting down. Same units as **OUT**. It defaults to 0.

B.3.2 INT block other parameters

- **IN_1**: The main input to this block, normally a rate in units per **TIME_UNIT** of time. **INTEG_OPTS** allows the input to come from a pulse input block or another INT block, using **PULSE_VAL** for scaling.
- **IN_2**: The second input, with the same characteristics as **IN_1**. This input allows for totalizing the difference between (net) of two flows.
- **RESET_IN**: Momentary discrete input that resets the totalizers, if permitted. May not work if the type is **PERIODIC**.
- **RESET_CONFIRM**: Momentary discrete input that enables the next Reset command, if the Confirm option is set.
- **OUT**: The output that contains the value of the total register and a calculated status.
- **OUT_PTRIP**: The pre-trip discrete output.
- **OUT_TRIP**: The trip discrete output.
- **PCT_INCL**: Indicates the percentage of inputs with Good status compared to a total for all inputs.
- **RTOTAL**: Indicates the total of the absolute value of input values with Bad or Uncertain status, as chosen by **INTEG_OPTS**. Same units as **OUT**.
- **STOTAL**: The read-only snapshot of **TOTAL** just before a reset. Same units as **OUT**.
- **SRTOTAL**: The read-only snapshot of **RTOTAL** just before a reset. Same units as **OUT**.
- **N_RESET**: Counts the number of resets. It can not be written or reset.

B.3.3 INT block modes

The Integrator function block supports the following modes:

- *Manual (Man)* – The integration calculations are not performed. **OUT**, **OUT_TRIP**, and **OUT_PTRIP** may be set manually.
- *Automatic (Auto)* – The integration algorithm is performed and the result is written to OUT. Reset actions depend on the integration type attribute (**INTEG_TYPE**) and the inputs.
- *Out of Service (O/S)* – The block does not execute. **OUT** status is set to Bad: Out of Service. The **BLOCK_ERR** attribute shows Out of service.

The integrator initializes with the value in **OUT** when the mode changes from Manual to Automatic. The Manual, Automatic, and Out of Service modes may be configured as permitted modes for operator entry.

B.3.4 INT block errors

The following conditions are reported in the BLOCK_ERR parameter:

- Block Configuration Error: INTEG_TYPE is still zero, TIME_UNITn is still zero.
- Out-of-Service: The actual mode is out of service (OOS).

B.3.5 INT block status handling

The output status calculation is based on the accumulation of input statuses. The calculation includes the accumulations for both input channels when IN_2 is enabled.

Each time the function block executes, the input status is accumulated as Good or Bad as per the input status. The input as uncertain is considered as Bad input.

The output status is determined with the following logic:

- When less than 25% of the input status accumulation is Good, **OUT** status is set to Bad.
- When 25% to less than 50% of the input status accumulation is Good, **OUT** status is set to Uncertain.
- When 50% or more of the input status accumulation is Good, **OUT** status is set to Good.

The input status accumulation is reset when the integrator is reset.

B.3.6 INT block special mode

Enhanced FF host	**Overview** → **Totalizer Control** → **Configure Integrator Block**
Basic FF host	**Total Inventory TB** → **Integrator1 Configuration** (OD Index 14) **Total Inventory TB** → **Integrator2 Configuration** (OD Index 15)

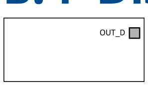
Along with standard operation of integrating the process value at **INn**, the Integrator function block has one special mode of operation: Input 1 pass through. In this special mode of operation, the device internal totals/inventories are controlled through the Integrator block. The Integrator block passes through the device total/inventory to output and the device total/inventory is reset by the **RESET_IN** input. To control the integrator block mode there is one additional parameter in the Total-Inventory TB for each INT block. By default the integrator function block operates in standard mode.

Fieldbus code	Label	Description
0	Standard	Block is working as per configuration of function block parameters.
1	Total 1	Block outputs Total 1 value and **RESET_IN** resets Total 1
2	Total 2	Block outputs Total 2 value and **RESET_IN** resets Total 2
3	Inventory 1	Block outputs Inventory 1 value and **RESET_IN** resets Inventory 1
4	Inventory 2	Block outputs Inventory 2 value and **RESET_IN** resets Inventory 2
5	Total 4	Block outputs Total 4 value and **RESET_IN** resets Total 4
6	Inventory 3	Block outputs Inventory 3 value and **RESET_IN** resets Inventory 3 and Inventory 4
7	Total 3	Block outputs Total 3 value and **RESET_IN** resets Total 3
8	Inventory 4	Block outputs Inventory 4 value and **RESET_IN** resets Inventory 3 and Inventory 4
9	Total 5	Block outputs Total 5 value and **RESET_IN** resets Total 5
10	Inventory 5	Block outputs Inventory 5 value and **RESET_IN** resets Inventory 5
11	Total 6	Block outputs Total 6 value and **RESET_IN** resets Total 6
12	Inventory 6	Block outputs Inventory 6 value and **RESET_IN** resets Inventory 6
13	Total 7	Block outputs Total 7 value and **RESET_IN** resets Total 7
14	Inventory 7	Block outputs Inventory 7 value and **RESET_IN** resets Inventory 7

B.3.7 INT block default configuration

	ITB1 (INTEG_4000_6830)	ITB2 (INTEG_4200_6830)
INTEG_TYPE	Uninitialized	Uninitialized
OUT_RANGE		
EU_100	100	100
EU_0	0	0
Unit_Index	%	%

B.4 Discrete Input (DI) function block



The Discrete Input (DI) function block processes a single discrete input from a field device and makes it available to other function blocks. You can configure inversion and alarm detection on the input value. The Discrete Input function block supports mode control, signal status propagation, and simulation.

B.4.1 DI block common configuration parameters

- **CHANNEL**: Defines the I/O input used for the field measurement.

Channel	Description
31	Actual flow direction
32	Zero in progress
33	Analog output fault
34	Meter verification failed

- **IO_OPTS**: allows the option to have the value of **FIELD_VAL_D** be logically inverted before becoming the **PV_D**, if the Invert option is selected.
- **STATUS_OPTS**: allows the option to have the status of **OUT_D** be Uncertain if Man mode. It also allows the option to Propagate Fault Forward.

B.4.2 DI block modes

The DI function block supports following modes:

- *Manual (MAN)*: The output (**OUT_D**) is disconnected from the field.
- *Automatic (AUTO)*: The block algorithm determines **OUT_D**.
- *Out of Service (O/S)*: The block is not processed. The output status is set to Bad: Out of Service. The **BLOCK_ERR** attribute shows Out of Service.

B.4.3 DI block errors

The following conditions are reported in the **BLOCK_ERR** attribute:

- *Simulate Active*: Simulation is enabled and the block is using a simulated value in its execution.
- *Input failure/process variable has Bad status*: The hardware is bad, the configured channel is invalid, or a Bad status is being simulated.
- *Out-of-Service*: The actual mode is out of service (OOS)

B.4.4 DI block simulation

When simulation is enabled, the value of **SIMULATE** is reflected in the field value of the **OUT_D**. With simulation enabled, the actual measurement value has no impact on the **OUT_D** value or the status.

Note
The transmitter has a simulation switch on the display. As a safety measure, the switch has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

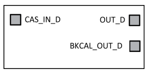
B.4.5 DI block status handling

Under normal conditions, a Good: Non-cascade status is passed through to **OUT_D**. The block also supports Status Action on Failure and Block Error indications.

B.4.6 DI block default configuration

	DI1 (DI_4400_xxxx)
CHANNEL	Analog Output Fault (33)
IO_OPTS	0x0000
STATUS_OPTS	0x0000

B.5 Discrete Output (DO) function block



The Discrete Output (DO) function block processes a discrete setpoint and saves it to a specified channel to produce an output signal. The block supports mode control, output tracking, and simulation. There is no process alarm detection in the block. In operation, the DO function block determines its setpoint, sets the output, and, as an option, checks a feedback signal from the field device to confirm the physical output operation.

B.5.1 DO block configuration

- **CHANNEL**: Selects transducer block input or output.

Channel	Description
35	Start Sensor Zero
36	Increment CM Curve
37	Smart Meter Verification in Continuous Measurement Mode
38	Reset All Process Totals
39	Start/Stop All Totals
40	Reset Config Total 1
41	Reset Config Total 2
42	Reset Config Total 3
43	Reset Config Total 4
44	Reset Config Total 5
45	Reset Config Total 6
46	Reset Config Total 7

- **IO_OPTS**: Options which the user may select to alter input and output block processing.
  - Invert - Causes the SP_D value to be inverted before it becomes the output. May be used for normally open solenoid valves and other inverted actuators.
  - SP-PV Track in Man - The value of SP is set to the value of PV when the target mode is Man.
  - SP-PV Track in LO or IMan - The value of SP is set to the value of PV when the actual mode is LO or IMan.
  - SP Track Retained Target - The SP is set to the PV when the actual mode is LO, IMan or Man. This option causes the value of the input selected by the retained target mode to be used instead of PV.

- Use PV for BKCAL_OUT - This only useful if **BKCAL_OUT_D** is connected to something.
- Fault State to value - Set **SP_D** and **OUT_D** to **FSTATE_VAL_D** when the block is in the fault state. If this option is not selected then the output will freeze. The block mode will be LO either way.
- Use Fault State value on restart - Use the value of **FSTATE_VAL_D** for **OUT_D** and **SP_D** if the device is restarted, otherwise use the non-volatile value. This will only be useful if the cascade input is bad at startup.
- Target to Man if Fault State activated - Set the target mode to Man if Fault State is activated. This latches an output block into the Man mode until an operator writes another target mode. Otherwise, the mode is LO while fault state is active, and returns to the target mode when the block state returns to normal.

- **SIMULATE_D**: Enables simulation.
- **FSTATE_TIME**: Time delay before Fault State is declared for this block if there is loss of communications to CAS_IN or there is Good Control, Initiate Fault State status at **CAS_IN** when the target mode is Cas, or there is Good Control, Initiate Fault State status at **RCAS_IN** when the target mode is RCas. Fault State declared by the Resource Block is not delayed.
- **CAS_IN_D**: Connection to this block's discrete SP from another discrete block's output, active only in Cascade mode. Always used for DO blocks.

B.5.2 DO block modes

The DO block supports the following modes:

- *Manual (MAN)*: The block output (**OUT_D**) may be entered manually.
- *Automatic (AUTO)*: The block algorithm uses the local setpoint value (**SP_D**) to determine **OUT_D**.
- *Cascade (CAS)*: The block uses a setpoint supplied by another function block.
- *RemoteCascade (RCAS)*: The block uses a setpoint supplied by a host computer.
- *Out of Service (O/S)*: The block is not processed and the output is not transferred to I/O. The **BLOCK_ERR** attribute shows Out of service.

B.5.3 DO block errors

The following conditions are reported in the **BLOCK_ERR** attribute:

- *Simulate Active*: **SIMULATE_D** is enabled; therefore, **PV_D** is not real.
- *Input failure/process variable has Bad status*: The readback value is bad.
- *Output Failure*: The output hardware or the configured channel is invalid.
- *Readback Failed*: The hardware providing readback is bad.
- *Out-of-Service*: The block is not being processed.

B.5.4 DO block simulation

With **SIMULATE_D** enabled, the specified value and status is reflected in **READBACK_D**. If **SIMULATE_D** is not enabled, and the mode is not Out of Service, the value of **OUT_D** is sent to the hardware

Note
The transmitter has a simulation Switch on the display. As a safety measure, the switch has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

B.5.5 DO block status handling

Under normal operating conditions, the output statuses (**OUT_D** and **BKCAL_OUT_D**) are Good: Cascade. If the output hardware fails, the status of **BKCAL_OUT_D** is set to Bad: DeviceFail, and the **BLOCK_ERR** attribute shows Output Failure. If the hardware used for output feedback fails, the status of **READBACK_D** and **PV_D** is set to Bad: DeviceFail, and the **BLOCK_ERR** attribute shows Bad PV and Readback Failed.

B.5.6 DO block default configuration

	DO1 (DO_4600_xxxx)
CHANNEL	Start Sensor Zero (35)
IO_OPTS	0x0000

C Using the transmitter display

This section explains how to use the 5700 display. Using the display, you can move through the menus, configure the application, monitor and control the application, and perform maintenance and diagnostic tasks.

C.1 Components of the transmitter display

The transmitter display includes a status LED, a multi-line LCD panel, two security switches, and four optical switches.

Figure C-1: 5700 transmitter display

Status LED

The status LED indicates the current state of the transmitter.

Figure C-2: 5700 transmitter status LED

Table C-1: Status LED and device status

Status LED condition	Device status
Solid green	No alerts are active.
Solid yellow	One or more alerts are active with **Alert Severity** = Out of Specification, Maintenance Required, or Function Check.
Solid red	One or more alerts are active with **Alert Severity** = Failure.
Flashing yellow (1 Hz)	The `Function Check in Progress` alert is active.

LCD panel

In normal operation, the LCD panel shows the current value of the display variables, and their measurement units.

Figure C-3: 5700 transmitter LCD panel

The LCD panel also provides access to the display menus and alert information. From the display menus, you can:

- View the current configuration and make configuration changes.
- Perform procedures such as loop testing and zero verification.
- Run batches.

The alert information allows you to see which alerts are active, acknowledge the alerts individually or as a group, and to see more detailed information for individual alerts.

C.2 Access and use the display menus

The display menus allow you to perform most configuration, administration, and maintenance tasks.

The four optical switches, ⇦⇧⇩⇨, are used to navigate the menus, make selections, and enter data. To activate an optical switch, hold your thumb or finger over it to block the light.

Figure C-4: Optical switches

Procedure

1. Observe the action bar at the bottom of the LCD panel.

   The action bar displays **Menu**⇨.

2. Place your thumb or finger over the ⇨ optical switch to activate it.

   The top-level menu is displayed.

3. Navigate the menus using the four optical switches:
   - Activate ⇧ or ⇩ to scroll to the previous or next item in the menu.
   - Activate and hold ⇧ or ⇩ (approximately 1 second to scroll rapidly through numbers or menu options, or to move to the previous screen or next screen in a multi-screen display.
   - Activate ⇨ to drill down to a lower menu or to select an option.
   - Activate and hold ⇨ to save and apply your action.
   - Activate ⇦ to return to the previous menu.
   - Activate and hold ⇦ to cancel your action.

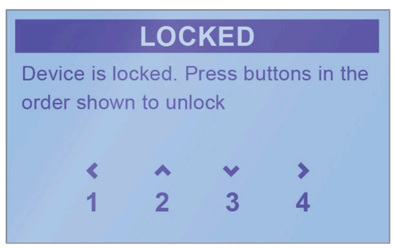
   The action bar is updated with context-sensitive information. The ⇨ and ⇦ symbols indicate the associated optical switch.

   If the menu or the topic is too large for a single display screen, the ⇩ and ⇧ symbols at the bottom and top of the LCD panel are used to indicate that you must scroll down or up to see more information.

Figure C-5: Navigation arrows

4. If you make a menu choice that leads to a possible configuration change, or to certain procedures such as zero calibration:
   - If display security is not enabled, the display prompts you to activate ⇦⇧⇩⇨, in that order. This feature protects against accidental changes to configuration, but does not provide any security.

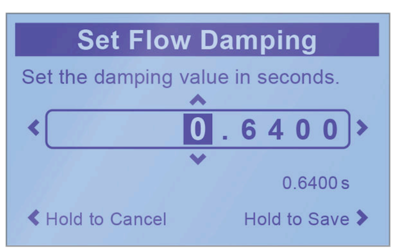
Figure C-6: Security prompts



   - If display security is enabled, the display prompts you to enter the display password.

5. If you make a menu choice that requires entering a numeric value or character string, the display provides a screen similar to the following:

Figure C-7: Numeric values and character strings



   - Activate ⇦ or ⇨ to position the cursor.
   - Activate ⇧ and ⇩ to scroll through the values that are valid for that position.
   - Repeat until all characters are set.
   - Activate and hold ⇨ to save the value.

6. To exit the display menu system, use either of the following methods:
   - Wait until the menu times out and returns to the display variables.
   - Exit each menu separately, working your way back to the top of the menu system.

D Using ProLink III with the transmitter

D.1 Connect with ProLink III

A connection from ProLink III to your transmitter allows you to read process data, configure the transmitter, and perform maintenance and troubleshooting tasks.

D.1.1 ProLink III connection types

You can connect a ProLink III PC to the transmitter with a USB connection to the service port.

To support all the latest features, ProLink III or later is required.

D.1.2 Make a service port connection from ProLink III to the transmitter

WARNING

If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

Prerequisites

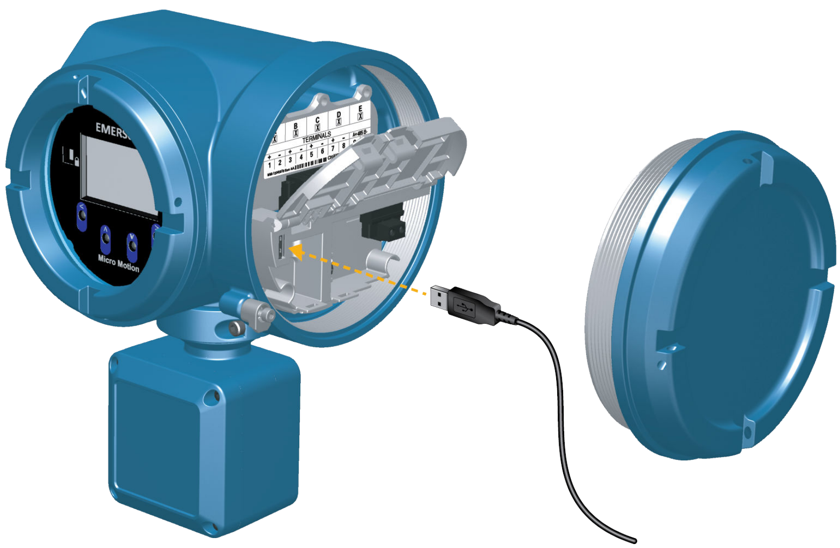
- Ensure the transmitter service port is enabled.
- Obtain a USB type A to type A cable.

Important
The USB cable should be no greater than 1 meter in length.

Procedure

1. Insert one end of the USB cable into the USB port on your PC.
2. Open the wiring compartment on the transmitter, and insert the other end of the USB cable into the service port on the transmitter.

Figure D-1: Service port inside transmitter wiring compartment



3. Start ProLink III.
4. Choose **Connect to Physical Device**.
5. Set parameters as shown here.

Parameter	Setting
Protocol	Service Port
PC Port	The number assigned to the USB port on your PC

6. Click **Connect**.

Need help?
If an error message appears:

- Ensure that you have specified the correct port on your PC.
- Ensure the transmitter service port is enabled at **Menu** → **Configuration** → **Security** → **Service Port**

E Using a field communicator with the transmitter

E.1 Basic information about field communicators

A field communicator is a handheld configuration and management tool that can be used with a variety of devices, including Micro Motion transmitters. It provides complete access to transmitter functions and data.

Field communicator documentation

Most of the instructions in this manual assume that you are already familiar with field communicators and can perform the following tasks:

- Turn on the field communicator
- Navigate the field communicator menus
- Establish communication with FOUNDATION Fieldbus-compatible devices
- Send configuration data to the device
- Use the alpha keys to enter information

Device descriptions (DDs)

In order for the field communicator to work with your device, the appropriate device description (DD) must be installed. Make sure that the DD version matches the transmitter version.

To view the device descriptions that are installed on your field communicator:

Type of field communicator	Procedure
475 handheld communicator	1. At the Fieldbus application menu, press **Utility** → **Available Device Descriptions**. 2. Scroll the list of manufacturers and select **Micro Motion**, then scroll the list of installed device descriptions.
AMS TREX	1. In the field communicator, tap Fieldbus Offline on the **Connect** → **Select** screen. 2. Tap **Simulate** → **Device manufacturer** → **Device type**. 3. Select the device revision and the device description revision.

If **Micro Motion** is not listed, or you do not see the required device description, use the field communicator's upgrade utility to install the device description or contact customer support.

Field communicator menus and messages

As you use a field communicator with a Micro Motion transmitter, you will see a number of messages and notes. This manual does not document all of these messages and notes.

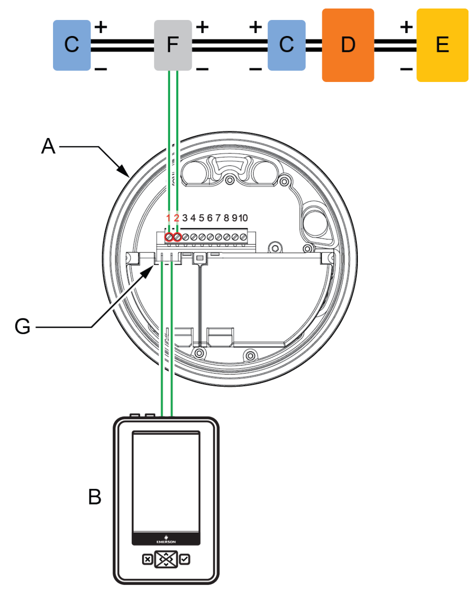
Important
The user is responsible for responding to messages and notes and complying with all safety messages.

E.2 Connect with a field communicator

A connection from a field communicator to your transmitter allows you to read process data, configure the transmitter, and perform maintenance and troubleshooting tasks.

Your field communicator must be connected directly to a fieldbus segment. It can be connected at any point between segment terminators, including directly on the fieldbus terminals on the transmitter.

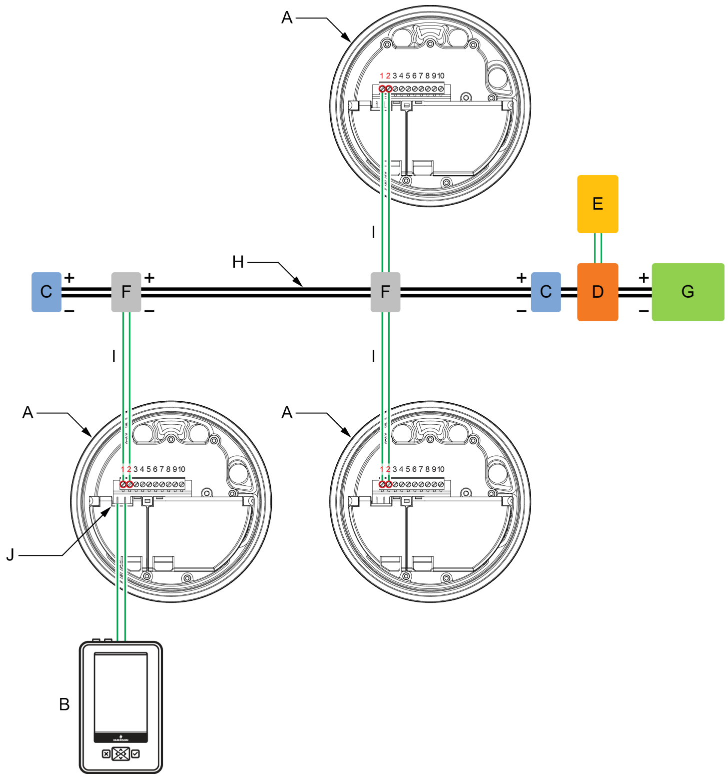
Figure E-1: Bench connection example (no fieldbus host)



- A. *Transmitter*
- B. *Field communicator*
- C. *Terminators*
- D. *Power conditioner*
- E. *Power supply*
- F. *Connection block*
- G. *FOUNDATION Fieldbus connection posts*

Note
The field communicator will not be able to communicate with the transmitter if it is simply connected to the wiring terminals on the bench. At minimum, you must have a power supply, power conditioner, and terminators.

Figure E-2: Field connection example (with fieldbus host and multiple devices)



- A. *Transmitters (or other devices)*
- B. *Field communicator*
- C. *Terminators*
- D. *Power conditioner*
- E. *Power supply*
- F. *Fieldbus junction box*
- G. *Fieldbus host*
- H. *Trunk line*[(2)]
- I. *Spurs*[(2)]
- J. *FOUNDATION Fieldbus connection posts*

E.2.1 Connect to a FOUNDATION Fieldbus transmitter using a TREX field communicator

Prerequisites

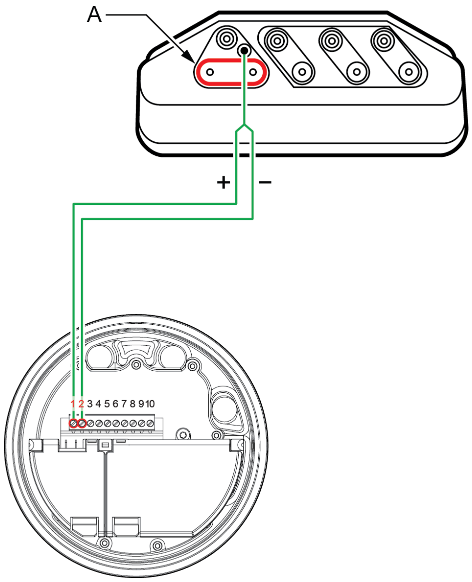
Make sure that the FOUNDATION Fieldbus segment is powered. Some configuration tools can power the segment. However, this is not true for all configuration tools on the market. For the AMS TREX, it is possible to use the FOUNDATION Fieldbus power plug for a bench connection.

(2) *The total spur length of all devices cannot exceed 120 meters. The total length of the trunk line and spurs cannot exceed 700 meters.*

Procedure

1. Identify the FOUNDATION Fieldbus terminals at the top of the TREX device.
2. Hook the TREX cables to the segment terminals.

Note
The terminals are polarity sensitive.



A. FOUNDATION Fieldbus power plug

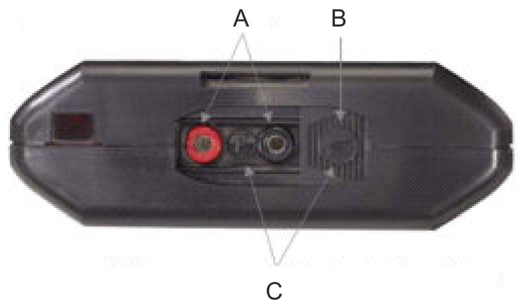
3. Power on the TREX.
4. Tap on the field communicator icon.
5. Tap **yes** when prompted if the TREX will power the device. Otherwise, tap **no**.
6. Select the device you are going to connect to and select **Online**.

Note
Powering the segment with the TREX will take the place of the power supply and conditioner. However, the terminating resistors are still required.

E.2.2 Connect to a FOUNDATION Fieldbus transmitter using a 475 field communicator

Procedure

1. At the top of the 475, slide the access door so that you can see the fieldbus communication terminal markings.



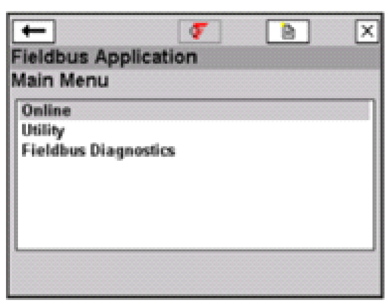
A. Communication terminals
B. Access door
C. Fieldbus communication terminal markings

2. Plug the connectors into the communication terminals on the 475.
3. On the segment, hook the 475 cables to the segment terminals.
4. Turn on the 475.
5. Select the fieldbus icon.

The ***Fieldbus Application Main Menu*** opens.

If connected to a live device or segment, the 475 will load the addresses/tags for the different transmitters.

6. Select the device you are going to connect to and select **Online**.



Note
The 475 cannot supply power to the FOUNDATION Fieldbus segment.

F Concentration measurement matrices, derived variables, and process variables

F.1 Standard matrices for the concentration measurement application

The standard concentration matrices available from Micro Motion are applicable for a variety of process fluids. These matrices are included in the ProLink III installation.

Tip
If the standard matrices are not appropriate for your application, you can build a custom matrix or purchase a custom matrix from Micro Motion.

Matrix name	Description	Density unit	Temperature unit	Derived variable
Deg Balling	Matrix represents percent extract, by mass, in solution, based on °Balling. For example, if a wort is 10 °Balling and the extract in solution is 100% sucrose, the extract is 10% of the total mass.	g/cm^3	°F	Mass Concentration (Density)
Deg Brix	Matrix represents a hydrometer scale for sucrose solutions that indicates the percent by mass of sucrose in solution at a given temperature. For example, 40 kg of sucrose mixed with 60 kg of water results in a 40 °Brix solution.	g/cm^3	°C	Mass Concentration (Density)
Deg Plato	Matrix represents percent extract, by mass, in solution, based on °Plato. For example, if a wort is 10 °Plato and the extract in solution is 100% sucrose, the extract is 10% of the total mass.	g/cm^3	°F	Mass Concentration (Density)
HFCS 42	Matrix represents a hydrometer scale for HFCS 42 (high-fructose corn syrup) solutions that indicates the percent by mass of HFCS in solution.	g/cm^3	°C	Mass Concentration (Density)
HFCS 55	Matrix represents a hydrometer scale for HFCS 55 (high-fructose corn syrup) solutions that indicates the percent by mass of HFCS in solution.	g/cm^3	°C	Mass Concentration (Density)
HFCS 90	Matrix represents a hydrometer scale for HFCS 90 (high-fructose corn syrup) solutions that indicates the percent by mass of HFCS in solution.	g/cm^3	°C	Mass Concentration (Density)

F.2 Derived variables and calculated process variables

The concentration measurement application calculates a different set of process variables from each derived variable. The process variables are then available for viewing or reporting.

Derived variable	Description	Calculated process variables					
		Density at reference temp	Standard volume flow rate	Specific gravity	Concentra tion	Net mass flow rate	Net volume flow rate
Density at Reference	Mass/unit volume, corrected to a given reference temperature	✓	✓				
Specific Gravity	The ratio of the density of a process fluid at a given temperature to the density of water at a given temperature The two given temperature conditions do not need to be the same. **Note** The two given temperature conditions do not need to be the same.	✓	✓	✓			
Mass Concentration (Density)	The percent mass of solute or of material in suspension in the total solution, derived from reference density	✓	✓		✓	✓	
Mass Concentration (Specific Gravity)	The percent mass of solute or of material in suspension in the total solution, derived from specific gravity	✓	✓	✓	✓	✓	
Volume Concentration (Density)	The percent volume of solute or of material in suspension in the total solution, derived from reference density	✓	✓		✓		✓
Volume Concentration (Specific Gravity)	The percent volume of solute or of material in suspension in the total solution, derived from specific gravity	✓	✓	✓	✓		✓

Derived variable	Description	Calculated process variables					
		Density at reference temp	Standard volume flow rate	Specific gravity	Concentration	Net mass flow rate	Net volume flow rate
Concentration (Density)	The mass, volume, weight, or number of moles of solute or of material in suspension in proportion to the total solution, derived from reference density	✓	✓		✓		
Concentration (Specific Gravity)	The mass, volume, weight, or number of moles of solute or of material in suspension in proportion to the total solution, derived from specific gravity	✓	✓	✓	✓		

G Environmental compliance

G.1 RoHS and WEEE

In compliance with the RoHS directive (Restriction of Hazardous Substances) and the WEEE directive (Waste Electrical and Electronic Equipment), the battery in the 5700 transmitter cannot be serviced or replaced by users. If the battery requires replacement, contact customer service for replacement and disposal.

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