Micro Motion™ 2700 Transmitters with Analog Outputs

Configuration and Use Manual
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 following are available: the EU Declaration of Conformity, with all applicable European directives, and the complete ATEX installation drawings and instructions. In addition, the IECEx installation instructions for installations outside of the European Union and the CSA installation instructions for installations in North America are available at Emerson.com or through your local Micro Motion support center.

Information affixed to equipment that complies with the Pressure Equipment Directive, can be found at Emerson.com. For hazardous installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

Other information

Troubleshooting information can be found in the Configuration Manual. Product data sheets and manuals are available from the Micro Motion web site at 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 Emerson.com, or by calling the Micro Motion Customer Service department.
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1 Before you begin

1.1 About this manual
This manual helps you configure, commission, use, maintain, and troubleshoot Micro Motion 2700 transmitters with analog outputs.

**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**

⚠️ **WARNING**
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 Transmitter model code
You can verify that this manual pertains to your transmitter by ensuring the model code on the transmitter tag matches the format.

Example:
The transmitter has a model number of the following form: 2700(R/I/E/B/C/M/P/H)***A******

- **R** 4-wire remote-mount with aluminum housing
- **I** Integral mount
- **E** 4-wire remote mount transmitter with 9-wire remote enhanced core processor
- **B** 4-wire remote mount transmitter with 9-wire remote core processor
- **C** 9-wire remote-mount with integral core processor and aluminum housing
- **M** 4-wire remote mount with stainless steel housing
- **P** 9-wire remote mount transmitter with integral core processor and stainless steel housing
- **H** 4-wire remote mount for connecting to CDM/FDM/FVM meters
- **A** Analog outputs option board

### 1.4 Communications tools and protocols

You can use several different communications tools and protocols to interface with the transmitter, use different tools in different locations, or use different tools for different tasks.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Supported protocols</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>• HART/RS-485</td>
</tr>
<tr>
<td></td>
<td>• HART/Bell 202</td>
</tr>
<tr>
<td></td>
<td>• Modbus/RS-485</td>
</tr>
<tr>
<td></td>
<td>• Service port</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>HART/Bell 202</td>
</tr>
</tbody>
</table>

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, or the Smart Wireless THUM™ Adapter. Use of AMS or the Smart Wireless THUM Adapter is not discussed in this manual. For more information on the Smart Wireless THUM Adapter, refer to the documentation available at Emerson.com.

### 1.5 Related documentation

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

See any of the following documents for more information:

- *Micro Motion Series 1000 and Series 2000 Transmitters with MVD Technology Product Data Sheet*
- *Micro Motion 1700 and 2700 Installation Manual*
- *Micro Motion Enhanced Density Application Manual*
- *Micro Motion Fuel Consumption Application for Transmitters Installation and Operation Guide*
• Micro Motion Oil and Gas Production Supplement
• Modbus Interface Tool
• Sensor installation manual
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. **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.

   Ensure that all transmitter and sensor covers and seals are closed.

2. Turn on the electrical power at the power supply.
   The transmitter will automatically perform diagnostic routines. The transmitter is self-switching and will automatically detect the supply voltage. When using DC power, a minimum of 1.5 amps of startup current is required. During this period, Alert 009 is active. The diagnostic routines should complete in approximately 30 seconds. The status LED will turn green and begin to flash when the startup diagnostics are complete. If the status LED exhibits different behavior, an alert is active.

Postrequisites

Although the sensor is ready to receive process fluid shortly after power-up, the electronics can take up to ten 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 ten 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, Alert A009 is active. This alert should clear automatically when the power-up sequence is complete.

2. Check the status LED on the transmitter.

Related information

View and acknowledge status alerts
Status alerts, causes, and recommendations
2.2.1 Transmitter status reported by LED

<table>
<thead>
<tr>
<th>LED state</th>
<th>Description</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid green</td>
<td>No alerts are active.</td>
<td>Continue with configuration or process measurement.</td>
</tr>
<tr>
<td>Flashing green (if enabled)</td>
<td>Unacknowledged corrected condition (no alert)</td>
<td>Continue with configuration or process measurement. Acknowledge the alert if you choose.</td>
</tr>
<tr>
<td>Solid yellow</td>
<td>One or more low-severity alerts are active. A low severity alarm can mean one or more process variables is at a set output level (i.e. simulation or two phase timeout).</td>
<td>A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement, but Micro Motion still recommends identifying and resolving the alert condition.</td>
</tr>
<tr>
<td>Flashing yellow (if enabled)</td>
<td>Calibration in progress, or Known Density Verification in progress. One or more low-severity alerts are active and have not been acknowledged.</td>
<td>A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement, but Micro Motion still recommends identifying and resolving the alert condition.</td>
</tr>
<tr>
<td>Solid red</td>
<td>One or more high-severity alerts are active.</td>
<td>A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing.</td>
</tr>
<tr>
<td>Flashing red (if enabled)</td>
<td>One or more high-severity alerts are active and have not been acknowledged.</td>
<td>A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing. Acknowledge the alert if you choose.</td>
</tr>
</tbody>
</table>

If Status LED Blinking is disabled, all LEDs will show a solid color rather than flashing.

2.3 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. Follow this procedure to make your first connection to the transmitter.

**Procedure**

Identify the connection type to use, and follow the instructions for that connection type in the appropriate appendix. Use the default communications parameters shown in the appendix.

<table>
<thead>
<tr>
<th>Communications tool</th>
<th>Connection type to use</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>HART/RS-485 Modbus/RS-485 Service port</td>
<td>Using ProLink III with the transmitter</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>HART/Bell 202</td>
<td>Using a field communicator with the transmitter</td>
</tr>
</tbody>
</table>
2.4 (Optional) Adjust digital communications settings

Change the communications parameters to site-specific values.

**Important**
If you are changing communications parameters for the connection type that you are using, you will lose the connection when you write the parameters to the transmitter. Reconnect using the new parameters.

**Procedure**

1. To change the communications parameters using ProLink III, choose Device Tools → Configuration → Communications.
2. To change the communications parameters using the Field Communicator, choose On-Line Menu → Configure → Manual Setup → Inputs/Outputs → Communications.

2.5 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.
  Menu → Operations → Process Variable Values
- 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.
For information about modifying these values, refer to Configure mass flow measurement.

2.6 Verify the zero

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.

The zero verification procedure analyzes the Live Zero value under conditions of zero flow, and compares it to the Zero Stability range for the sensor. If the average Live Zero value is within a reasonable range, the zero value stored in the transmitter is valid. Performing a field calibration will not 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. Allow the flowmeter to warm up for at least 20 minutes after applying power.
2. Run the process fluid through the sensor until the sensor temperature reaches the normal process operating temperature.
3. Stop flow through the sensor by shutting the downstream valve, and then the upstream valve if available.
4. Verify that the sensor is blocked in, that flow has stopped, and that the sensor is completely full of process fluid.
5. From ProLink III, choose **Device Tools** → **Calibration** → **Zero Verification and Calibration** → **Verify Zero** and wait until the procedure completes.
6. 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.
7. 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) Remove or reduce sources of electromechanical noise if appropriate.
   d) Repeat the zero verification procedure.
   e) If it fails again, zero the meter.

**Postrequisites**

Restore normal flow through the sensor by opening the valves.

**Related information**

Zero the meter

### 2.6.1 Terminology used with zero verification and zero calibration

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero</td>
<td>In general, the offset required to synchronize the left pickoff and the right pickoff under conditions of zero flow. Unit = microseconds.</td>
</tr>
<tr>
<td>Factory Zero</td>
<td>The zero value obtained at the factory, under laboratory conditions.</td>
</tr>
<tr>
<td>Field Zero</td>
<td>The zero value obtained by performing a zero calibration outside the factory.</td>
</tr>
<tr>
<td>Prior Zero</td>
<td>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.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Manual Zero</td>
<td>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”.</td>
</tr>
<tr>
<td>Live Zero</td>
<td>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.</td>
</tr>
<tr>
<td>Zero Stability</td>
<td>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.</td>
</tr>
<tr>
<td>Zero Calibration</td>
<td>The procedure used to determine the zero value.</td>
</tr>
<tr>
<td>Zero Time</td>
<td>The time period over which the Zero Calibration procedure is performed. Unit = seconds.</td>
</tr>
<tr>
<td>Field Verification Zero</td>
<td>A 3-minute running average of the Live Zero value, calculated by the transmitter. Unit = configured mass flow measurement unit.</td>
</tr>
<tr>
<td>Zero Verification</td>
<td>A procedure used to evaluate the stored zero and determine whether or not a field zero can improve measurement accuracy.</td>
</tr>
</tbody>
</table>
3 Introduction to configuration and commissioning

3.1 Configuration flowchart

Use the following flowchart as a general guide to the configuration and commissioning process. Some options may not apply to your installation. Detailed information is provided in the remainder of this manual. If you are using the Weights & Measures application, additional configuration and setup are required.
3.2 Default values and ranges

See Default values and ranges to view the default values and ranges for the most commonly used parameters.

3.3 Enable access to the off-line menu of the display

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>Not available</td>
</tr>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Transmitter Display → Display Security</td>
</tr>
</tbody>
</table>

By default, access to the off-line menu of the display is enabled. If it is disabled, you must enable it if you want to use the display to configure the transmitter.

**Restriction**

You cannot use the display to enable access to the off-line menu. You must make a connection from another tool.

3.4 Disable write-protection on the transmitter configuration

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>OFF-LINE MAINT → CONFIG → LOCK</td>
</tr>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Write-Protection</td>
</tr>
</tbody>
</table>

If the transmitter is write-protected, the configuration is locked and you must unlock it before you can change any configuration parameters. By default, the transmitter is not write-protected.

**Tip**

Write-protecting the transmitter prevents accidental changes to configuration. It does not prevent normal operational use. You can always disable write-protection, perform any required configuration changes, then re-enable write-protection.

3.5 Set the HART lock

If you plan to use a HART connection to configure the device, you can lock out all other HART masters. If you do this, other HART masters will be able to read data from the device but will not be able to write data to the device.

**Restriction**

- This feature is available only when you are using the Field Communicator or AMS.
- This feature requires HART 7.

**Procedure**

2. If you are locking the meter, set **Lock Option** as desired.
<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent</td>
<td>Only the current HART master can make changes to the device. The device will remain locked until manually unlocked by a HART master. The HART master can also change Lock Option to Temporary.</td>
</tr>
<tr>
<td>Temporary</td>
<td>Only the current HART master can make changes to the device. The device will remain locked until manually unlocked by a HART master, or a power-cycle or device reset is performed. The HART master can also change Lock Option to Permanent.</td>
</tr>
<tr>
<td>Lock All</td>
<td>No HART masters are allowed to make changes to the configuration. Before changing Lock Option to Permanent or Temporary, the device must be unlocked. Any HART master can be used to unlock the device.</td>
</tr>
</tbody>
</table>

**Postrequisites**

To avoid confusion or difficulties at a later date, ensure that the device is unlocked after you have completed your tasks.

### 3.6 Restore the factory configuration

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration Transfer → Restore Factory Configuration</td>
</tr>
<tr>
<td>Field communicator</td>
<td>Service Tools → Maintenance → Reset/Restore → Restore Factory Configuration</td>
</tr>
</tbody>
</table>

Restoring the factory configuration returns the transmitter to the same configuration it had when it left the factory. This may be useful if you experience problems during configuration.

**Important**

You cannot restore factory configurations with a 700 core.

**Tip**

Restoring the factory configuration is not a common action. You may want to contact customer support to see if there is a preferred method to resolve any issues.
4 Configure process measurement

4.1 Configure mass flow measurement

The mass flow measurement parameters control how mass flow is measured and reported.

4.1.1 Configure Mass Flow Measurement Unit

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → OFF-LINE CONFIG → UNITS → MASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → Flow → Mass Flow Unit</td>
</tr>
</tbody>
</table>

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

You can configure the mA and Frequency Outputs independently. For example, you can configure the mA Output for mass flow and the Frequency Output for liquid volume or gas standard volume. If the same process variable is assigned to both the mA and Frequency Outputs, then any selected measurement unit, (mass, volume or gas standard volume), is automatically applied to both outputs.

**Procedure**

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

The default setting for Mass Flow Measurement Unit is 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.

<table>
<thead>
<tr>
<th>Unit description</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grams per second</td>
<td>G/S, g/sec</td>
</tr>
<tr>
<td>Grams per minute</td>
<td>G/MIN, g/min</td>
</tr>
<tr>
<td>Grams per hour</td>
<td>G/H, g/hr</td>
</tr>
<tr>
<td>Kilograms per second</td>
<td>KG/S, kg/sec</td>
</tr>
<tr>
<td>Kilograms per minute</td>
<td>KG/MIN, kg/min</td>
</tr>
<tr>
<td>Kilograms per hour</td>
<td>KG/H, kg/hr</td>
</tr>
<tr>
<td>Kilograms per day</td>
<td>KG/D, kg/day</td>
</tr>
<tr>
<td>Metric tons per minute</td>
<td>T/MIN, mTon/min</td>
</tr>
<tr>
<td>Metric tons per hour</td>
<td>T/H, mTon/hr</td>
</tr>
</tbody>
</table>
Define a special measurement unit for mass flow

<table>
<thead>
<tr>
<th>Unit description</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metric tons per day</td>
<td>T/D</td>
<td>mTon/day</td>
<td>MetTon/d</td>
</tr>
<tr>
<td>Pounds per second</td>
<td>LB/S</td>
<td>lbs/sec</td>
<td>lb/s</td>
</tr>
<tr>
<td>Pounds per minute</td>
<td>LB/MIN</td>
<td>lbs/min</td>
<td>lb/min</td>
</tr>
<tr>
<td>Pounds per hour</td>
<td>LB/H</td>
<td>lbs/hr</td>
<td>lb/h</td>
</tr>
<tr>
<td>Pounds per day</td>
<td>LB/D</td>
<td>lbs/day</td>
<td>lb/d</td>
</tr>
<tr>
<td>Short tons (2000 pounds) per minute</td>
<td>ST/MIN</td>
<td>sTon/min</td>
<td>STon/min</td>
</tr>
<tr>
<td>Short tons (2000 pounds) per hour</td>
<td>ST/H</td>
<td>sTon/hr</td>
<td>STon/h</td>
</tr>
<tr>
<td>Short tons (2000 pounds) per day</td>
<td>ST/D</td>
<td>sTon/day</td>
<td>STon/d</td>
</tr>
<tr>
<td>Long tons (2240 pounds) per hour</td>
<td>LT/H</td>
<td>lTon/hr</td>
<td>lTon/h</td>
</tr>
<tr>
<td>Long tons (2240 pounds) per day</td>
<td>LT/D</td>
<td>lTon/day</td>
<td>lTon/d</td>
</tr>
<tr>
<td>Special unit</td>
<td>SPECL</td>
<td>special</td>
<td>Spcl</td>
</tr>
</tbody>
</table>

**Define a special measurement unit for mass flow**

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.

**Note**
Although you cannot define a special measurement unit using the display, you can use the display to select an existing special measurement unit, and to view process data using the special measurement unit.

**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** = \( \frac{x}{y} \)

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

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

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**

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.

### 4.1.2 Configure Flow Damping

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → Flow → Flow Damping</td>
</tr>
</tbody>
</table>

Damping is used to smooth out small, rapid fluctuations in process measurement. **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 will reflect 63% of the change in the actual measured value.

**Procedure**

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

The default value is 0.8 seconds. The range depends on the core processor type and the setting of **Update Rate**, as shown in the following table.

<table>
<thead>
<tr>
<th>Update Rate setting</th>
<th>Damping range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0 to 51.2 seconds</td>
</tr>
<tr>
<td>Special</td>
<td>0 to 40.96 seconds</td>
</tr>
</tbody>
</table>

The value you enter is automatically rounded off to the nearest valid value. For example, if the damping is currently set to 0.8 seconds, any value entered up to 1.2 seconds will be rounded down to 0.8 seconds, and any value entered from 1.21 to 1.59 seconds will be rounded up to 1.6 seconds.

<table>
<thead>
<tr>
<th>Update Rate setting</th>
<th>Valid damping values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0.0, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8, 25.6, 51.2</td>
</tr>
<tr>
<td>Special</td>
<td>0.0, 0.04, 0.08, 0.16, 0.32, 0.64, 1.28, 2.56, 5.12, 10.24, 20.48, 40.96</td>
</tr>
</tbody>
</table>
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 through 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.

4.1.3 Configure Mass Flow Cutoff

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow</td>
</tr>
</tbody>
</table>

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.

The default value for Mass Flow Cutoff is 0.0 g/sec or a sensor-specific value set at the factory. The recommended value is 0.5% of the nominal flow rate of the attached sensor. See the sensor specifications. Do not leave Mass Flow Cutoff at 0.0 g/sec.

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 through mA Output. If mA Output Process Variable is set to Mass Flow Rate, the mass flow rate reported through 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 through 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.

4.2 Configure volume flow measurement for liquid applications

The volume flow measurement parameters control how liquid 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.

**Note**

If you need to switch from gas standard volume to liquid volume, polling for base density will automatically be disabled.

4.2.1 Configure Volume Flow Type for liquid applications

<table>
<thead>
<tr>
<th>Display</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → GSV → Volume Flow Type → Liquid</td>
</tr>
</tbody>
</table>
**Volume Flow Type** controls whether liquid or gas standard volume flow measurement will be used.

**Restriction**
Gas standard volume measurement is incompatible with some applications. Set **Volume Flow Type** to Liquid if you are using any of the following applications:
- Petroleum measurement
- Concentration measurement
- Fuel consumption
- Production Volume Reconciliation (PVR)

**Procedure**
Set **Volume Flow Type** to Liquid.

### 4.2.2 Configure Volume Flow Measurement Unit for liquid applications

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → OFF-LINE CONFIG → UNITS → VOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → Flow → Volume Flow Unit</td>
</tr>
</tbody>
</table>

**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.

To read US gallons, select that unit from this menu. G/MIN stands for grams per minute (USGPM), not gallons per minute. The default setting for **Volume Flow Measurement Unit** is 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**
The transmitter provides a standard set of measurement units for **Volume Flow Measurement Unit**, plus one user-defined measurement unit. Different communications tools may use different labels for the units.

<table>
<thead>
<tr>
<th>Unit description</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cubic feet per second</td>
<td>CUFT/S</td>
</tr>
<tr>
<td>Cubic feet per minute</td>
<td>CUF/MN</td>
</tr>
<tr>
<td>Cubic feet per hour</td>
<td>CUFT/H</td>
</tr>
<tr>
<td>Display</td>
<td>ft³/sec</td>
</tr>
<tr>
<td>ProLink III</td>
<td>ft³/min</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>ft³/hr</td>
</tr>
<tr>
<td>Unit description</td>
<td>Display</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Cubic feet per day</td>
<td>CUFT/D</td>
</tr>
<tr>
<td>Cubic meters per second</td>
<td>M3/S</td>
</tr>
<tr>
<td>Cubic meters per minute</td>
<td>M3/MIN</td>
</tr>
<tr>
<td>Cubic meters per hour</td>
<td>M3/H</td>
</tr>
<tr>
<td>Cubic meters per day</td>
<td>M3/D</td>
</tr>
<tr>
<td>U.S. gallons per second</td>
<td>USGPS</td>
</tr>
<tr>
<td>U.S. gallons per minute</td>
<td>USGPM</td>
</tr>
<tr>
<td>U.S. gallons per hour</td>
<td>USGPH</td>
</tr>
<tr>
<td>U.S. gallons per day</td>
<td>USGPD</td>
</tr>
<tr>
<td>Million U.S. gallons per day</td>
<td>MILG/D</td>
</tr>
<tr>
<td>Liters per second</td>
<td>L/S</td>
</tr>
<tr>
<td>Liters per minute</td>
<td>L/MIN</td>
</tr>
<tr>
<td>Liters per hour</td>
<td>L/H</td>
</tr>
<tr>
<td>Million liters per day</td>
<td>MILL/D</td>
</tr>
<tr>
<td>Imperial gallons per second</td>
<td>UKGPS</td>
</tr>
<tr>
<td>Imperial gallons per minute</td>
<td>UKGPM</td>
</tr>
<tr>
<td>Imperial gallons per hour</td>
<td>UKGPH</td>
</tr>
<tr>
<td>Imperial gallons per day</td>
<td>UKGPD</td>
</tr>
<tr>
<td>Barrels per second(1)</td>
<td>BBL/S</td>
</tr>
<tr>
<td>Barrels per minute(1)</td>
<td>BBL/MN</td>
</tr>
<tr>
<td>Barrels per hour(1)</td>
<td>BBL/H</td>
</tr>
<tr>
<td>Barrels per day(1)</td>
<td>BBL/D</td>
</tr>
<tr>
<td>Beer barrels per second(2)</td>
<td>BBBL/S</td>
</tr>
<tr>
<td>Beer barrels per minute(2)</td>
<td>BBBL/MN</td>
</tr>
<tr>
<td>Beer barrels per hour(2)</td>
<td>BBBL/H</td>
</tr>
<tr>
<td>Beer barrels per day(2)</td>
<td>BBBL/D</td>
</tr>
<tr>
<td>Special unit</td>
<td>SPECL</td>
</tr>
</tbody>
</table>

(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**

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow → Special Units</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → Special Units → Volume Special Units</td>
</tr>
</tbody>
</table>
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.

**Note**
Although you cannot define a special measurement unit using the display, you can use the display to select an existing special measurement unit, and to view process data using the special measurement unit.

**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** = \( x \div y \)

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.

**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. \( 1 \text{ gal/sec} = 8 \text{ pints/sec} \)
   b. **Volume Flow Conversion Factor** = \( 1 \div 8 = 0.1250 \)

4. Set **Volume Flow Conversion Factor** to 0.1250.

5. Set **Volume Flow Label** to pints/sec.

6. Set **Volume Total Label** to pints.

**4.2.3 Configure Volume Flow Cutoff**

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → Flow → Volume Flow Cutoff</td>
</tr>
</tbody>
</table>
**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. The default value for **Volume Flow Cutoff** is 0.0 l/sec (liters per second). The lower limit is 0. Leaving the volume flow cutoff at 0 is not recommended.

**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 through mA Output. If **mA Output Process Variable** is set to Volume Flow Rate, the volume flow rate reported through 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 through 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.
4.3 Configure GSV flow measurement

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

**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 gas applications

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → GSV → Volume Flow Type → Standard Gas Volume</td>
</tr>
</tbody>
</table>

**Volume Flow Type** controls whether liquid or gas standard volume flow measurement is used.

**Restriction**
Gas standard volume measurement is incompatible with some applications. Set **Volume Flow Type** to Liquid if you are using any of the following applications:
- Petroleum measurement
- Concentration measurement
- Fuel consumption
- Production Volume Reconciliation (PVR)

**Procedure**
Set **Volume Flow Type** to Gas Standard Volume.

### 4.3.2 Configure Standard Density of Gas

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → GSV → Gas Ref Density</td>
</tr>
</tbody>
</table>

The **Standard Density of Gas** value is the gas density at standard reference conditions. Use it to convert the measured mass flow data to volume flow at reference conditions.

**Prerequisites**
Ensure that **Density Measurement Unit** is set to the measurement unit you want to use for **Standard Density of Gas**.

**Procedure**
From the **Source** field, choose the method to supply gas base density data and perform the required setup.
### Configure fixed value or digital communications

#### Prerequisites
Configure Standard Density of Gas

#### Procedure

1. Set **Standard Density of Gas** to the standard reference density of the gas you are measuring.

   **Note**
   ProLink III provides a guided method that you can use to calculate your gas base density, if you do not know it.

2. Continue to Configure Gas Standard Volume Flow Unit.

### Poll for external value

#### Prerequisites
Configure Standard Density of Gas

#### Procedure

1. Set **Polling Slot** to an available slot.

2. Set **Polling Control** $n$ as one of the following options:

   The $n$ is the value you selected in the **Polling Slot** field.

   If there is another master, and if that master is primary, then set this field to secondary. If the other master is secondary, then set this field to primary.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poll as Primary</td>
<td>No other HART masters will be on the network.</td>
</tr>
<tr>
<td>Poll as Secondary</td>
<td>Other HART masters will be on the network.</td>
</tr>
</tbody>
</table>

3. Set **External Device Tag** $n$ to the HART tag of the device being polled.

   The $n$ is the value you selected in the **Polling Slot** field.

   - The device being polled (slave) cannot have special units set for density. Otherwise, the master will reject the base density and report the following alarm:

     **A115: No External Input or Polled Data Alert**
• On the slave side, setup the HART Primary Variable for Base Density. The master will reject anything other than Base Density for the HART Primary Variable and trigger an A115 alarm.

• The density units on the transmitter and the polled device can be different as long as they can be classified as density units; for example, kg/m\(^3\) and g/cm\(^3\). The transmitter converts the polled units into compatible specified units.

For wiring and setup instructions for a polled device, refer to the Micro Motion Gas Density Meters (GDM) Installation Manual or the Micro Motion Specific Gravity Meters (SGM) Installation Manual.


4.3.3 Configure Gas Standard Volume Flow Unit

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → OFF-LINE CONFIG → UNITS → GSV</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → GSV → GSV Flow Unit</td>
</tr>
</tbody>
</table>

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

Prerequisites

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

For polling, the first transmitter (master) requests density from a second transmitter (slave) via HART communications. Special units for GSV are allowed on the master side, but the device being polled (slave) cannot have special units set for density, otherwise the master will reject the base density and report an A115: No External Input or Polled Data Alert.

Procedure

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

The default setting for Gas Standard Volume Flow Unit is 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 Unit

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

<table>
<thead>
<tr>
<th>Unit description</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal cubic meters per second</td>
<td>NM3/S</td>
<td>Nm3/sec</td>
<td>Nm3/sec</td>
</tr>
<tr>
<td>Normal cubic meters per minute</td>
<td>NM3/MN</td>
<td>Nm3/sec</td>
<td>Nm3/min</td>
</tr>
<tr>
<td>Normal cubic meters per hour</td>
<td>NM3/H</td>
<td>Nm3/hr</td>
<td>Nm3/hr</td>
</tr>
</tbody>
</table>
Define a special measurement unit for gas standard volume flow

<table>
<thead>
<tr>
<th>Unit description</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal cubic meters per day</td>
<td>NM3/D</td>
<td>Nm3/day</td>
<td>Nm3/day</td>
</tr>
<tr>
<td>Normal liters per second</td>
<td>NLPS</td>
<td>NLPS</td>
<td>NLPS</td>
</tr>
<tr>
<td>Normal liters per minute</td>
<td>NLPM</td>
<td>NLPM</td>
<td>NLPM</td>
</tr>
<tr>
<td>Normal liters per hour</td>
<td>NLPH</td>
<td>NLPH</td>
<td>NLPH</td>
</tr>
<tr>
<td>Normal liters per day</td>
<td>NLPD</td>
<td>NLPD</td>
<td>NLPD</td>
</tr>
<tr>
<td>Standard cubic feet per second</td>
<td>SCFS</td>
<td>SCFS</td>
<td>SCFS</td>
</tr>
<tr>
<td>Standard cubic feet per minute</td>
<td>SCFM</td>
<td>SCFM</td>
<td>SCFM</td>
</tr>
<tr>
<td>Standard cubic feet per hour</td>
<td>SCFH</td>
<td>SCFH</td>
<td>SCFH</td>
</tr>
<tr>
<td>Standard cubic feet per day</td>
<td>SCFD</td>
<td>SCFD</td>
<td>SCFD</td>
</tr>
<tr>
<td>Standard cubic meters per second</td>
<td>SM3/S</td>
<td>Sm3/sec</td>
<td>Sm3/sec</td>
</tr>
<tr>
<td>Standard cubic meters per minute</td>
<td>SM3/MN</td>
<td>Sm3/min</td>
<td>Sm3/min</td>
</tr>
<tr>
<td>Standard cubic meters per hour</td>
<td>SM3/H</td>
<td>Sm3/hr</td>
<td>Sm3/hr</td>
</tr>
<tr>
<td>Standard liters per second</td>
<td>SLPS</td>
<td>SLPS</td>
<td>SLPS</td>
</tr>
<tr>
<td>Standard liters per minute</td>
<td>SLPF</td>
<td>SLPM</td>
<td>SLPF</td>
</tr>
<tr>
<td>Standard liters per hour</td>
<td>SLPH</td>
<td>SLPD</td>
<td>SLPH</td>
</tr>
<tr>
<td>Special measurement unit</td>
<td>SPECL</td>
<td>special</td>
<td>Special</td>
</tr>
</tbody>
</table>

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.

**Note**
Although you cannot define a special measurement unit using the display, you can use the display to select an existing special measurement unit, and to view process data using the special measurement unit.

**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** = \( x \div y \)

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

4. Set **Gas Standard Volume Flow Conversion Factor** to 0.001.
5. Set **Gas Standard Volume Flow Label** to MSCFM.
6. Set **Gas Standard Volume Total Label** to MSCF.

### 4.3.4 Configure Gas Standard Volume Flow Cutoff

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → GSV → GSV Cutoff</td>
</tr>
</tbody>
</table>

**Gas Standard Volume Flow Cutoff** specifies the lowest gas standard volume flow rate that will be 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.

The default value for **Gas Standard Volume Flow Cutoff** is 0.0. The lower limit is 0.0. There is no upper limit. The recommended value is 0.5% of the nominal flow rate of the attached sensor. See the sensor specifications.
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 through mA Output. If mA Output Process Variable is set to Gas Standard Volume Flow Rate, the volume flow rate reported through 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 through 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.

4.4 Configure Flow Direction

<table>
<thead>
<tr>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
</table>
Flow Direction controls how forward flow and reverse flow affect flow measurement and reporting.

Flow Direction is defined with respect to the flow arrow on the sensor:

- Forward flow (positive flow) moves in the direction of the flow arrow on the sensor.
- Reverse flow (negative flow) moves in the direction opposite to the flow arrow on the sensor.

**Tip**
Micro Motion sensors are bidirectional. Measurement accuracy is not affected by actual flow direction or the setting of the Flow Direction parameter.

**Procedure**
Set Flow Direction to the value you want to use.

The default setting is Forward.

### 4.4.1 Options for Flow Direction

<table>
<thead>
<tr>
<th>Flow Direction setting</th>
<th>Relationship to Flow Direction arrow on sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Field Communicator</td>
</tr>
<tr>
<td>Forward</td>
<td>Forward</td>
</tr>
<tr>
<td>Reverse</td>
<td>Reverse</td>
</tr>
<tr>
<td>Absolute Value</td>
<td>Absolute Value</td>
</tr>
<tr>
<td>Bidirectional</td>
<td>Bi directional</td>
</tr>
<tr>
<td>Negate Forward</td>
<td>Negate/Forward Only</td>
</tr>
<tr>
<td>Negate Bidirectional</td>
<td>Negate/Bi-directional</td>
</tr>
</tbody>
</table>

**Effect of Flow Direction on mA Outputs**

Flow Direction affects how the transmitter reports flow values via the mA Outputs. The mA Outputs are affected by Flow Direction only if mA Output Process Variable is set to a flow variable.

**Flow Direction and mA Outputs**

The effect of Flow Direction on the mA Outputs depends on Lower Range Value configured for the mA Output:

- If Lower Range Value is set to 0, see Figure 4-1.
- If Lower Range Value is set to a negative value, see Figure 4-2.
Figure 4-1: Effect of Flow Direction on the mA Output: Lower Range Value = 0

- Lower Range Value = 0
- Upper Range Value = x

Figure 4-2: Effect of Flow Direction on the mA Output: Lower Range Value < 0

- Lower Range Value = −x
- Upper Range Value = x

Flow Direction = Forward and Lower Range Value = 0

Configuration:
- Flow Direction = Forward
- Lower Range Value = 0 g/sec
- Upper Range Value = 100 g/sec
Result:

- Under conditions of 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.

**Flow Direction = Forward and Lower Range Value < 0**

Configuration:

- **Flow Direction** = Forward
- **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.

**Flow Direction = Reverse**

Configuration:

- **Flow Direction** = Reverse
- **Lower Range Value** = 0 g/sec
- **Upper Range Value** = 100 g/sec

Result:

- Under conditions of zero flow, the mA Output is 4 mA.
- Under conditions of reverse flow, for flow rates between 0 and +100 g/sec, the mA Output level varies between 4 mA and 20 mA in 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 will be proportional to the absolute value of the flow rate up to 20.5 mA, and will be level at 20.5 mA at higher absolute values.
Effect of flow direction on Frequency Outputs

Flow direction affects how the transmitter reports flow values via the Frequency Outputs. The Frequency Outputs are affected by flow direction only if Frequency Output Process Variable is set to a flow variable.

Table 4-1: Effect of the flow direction parameter and actual flow direction on Frequency Outputs

<table>
<thead>
<tr>
<th>Flow Direction setting</th>
<th>Actual flow direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forward</td>
</tr>
<tr>
<td>Forward</td>
<td>Hz &gt; 0</td>
</tr>
<tr>
<td>Reverse</td>
<td>0 Hz</td>
</tr>
<tr>
<td>Bidirectional</td>
<td>Hz &gt; 0</td>
</tr>
<tr>
<td>Absolute Value</td>
<td>Hz &gt; 0</td>
</tr>
<tr>
<td>Negate Forward</td>
<td>0 Hz</td>
</tr>
<tr>
<td>Negate Bidirectional</td>
<td>Hz &gt; 0</td>
</tr>
</tbody>
</table>

Effect of flow direction on Discrete Outputs

The flow direction parameter affects the Discrete Output behavior only if Discrete Output Source is set to Flow Direction.

Table 4-2: Effect of the flow direction parameter and actual flow direction on Discrete Outputs

<table>
<thead>
<tr>
<th>Flow Direction setting</th>
<th>Actual flow direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forward</td>
</tr>
<tr>
<td>Forward</td>
<td>OFF</td>
</tr>
<tr>
<td>Reverse</td>
<td>OFF</td>
</tr>
<tr>
<td>Bidirectional</td>
<td>OFF</td>
</tr>
<tr>
<td>Absolute Value</td>
<td>OFF</td>
</tr>
<tr>
<td>Negate Forward</td>
<td>ON</td>
</tr>
<tr>
<td>Negate Bidirectional</td>
<td>ON</td>
</tr>
</tbody>
</table>

Effect of flow direction on digital communications

Flow direction affects how flow values are reported via digital communications. The following table describes the effect of the flow direction parameter and actual flow direction on flow values reported via digital communications.

Table 4-3: Effect of the flow direction on flow values

<table>
<thead>
<tr>
<th>Flow Direction setting</th>
<th>Actual flow direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forward</td>
</tr>
<tr>
<td>Forward</td>
<td>Positive</td>
</tr>
<tr>
<td>Reverse</td>
<td>Positive</td>
</tr>
<tr>
<td>Bidirectional</td>
<td>Positive</td>
</tr>
</tbody>
</table>
Table 4-3: Effect of the flow direction on flow values (continued)

<table>
<thead>
<tr>
<th>Flow Direction setting</th>
<th>Actual flow direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forward</td>
</tr>
<tr>
<td>Absolute Value</td>
<td>Positive(1)</td>
</tr>
<tr>
<td>Negate Forward</td>
<td>Negative</td>
</tr>
<tr>
<td>Negate Bidirectional</td>
<td>Negative</td>
</tr>
</tbody>
</table>

(1) Refer to the digital communications status bits for an indication of whether flow is positive or negative.

Effect of flow direction on flow totals

Flow direction affects how flow totals and inventories are calculated.

<table>
<thead>
<tr>
<th>Flow Direction setting</th>
<th>Actual flow direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forward</td>
</tr>
<tr>
<td>Forward</td>
<td>Totals increase</td>
</tr>
<tr>
<td>Reverse</td>
<td>Totals do not change</td>
</tr>
<tr>
<td>Bidirectional</td>
<td>Totals increase</td>
</tr>
<tr>
<td>Absolute Value</td>
<td>Totals increase</td>
</tr>
<tr>
<td>Negate Forward</td>
<td>Totals do not change</td>
</tr>
<tr>
<td>Negate Bidirectional</td>
<td>Totals decrease</td>
</tr>
</tbody>
</table>

4.5 Configure density measurement

The density measurement parameters control how density is measured and reported.

4.5.1 Configure Density Measurement Unit

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → OFF-LINE CONFIG → UNITS → DENS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Density</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → Density → Density Unit</td>
</tr>
</tbody>
</table>

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

Procedure

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

The default setting for Density Measurement Unit is g/cm3 (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.

<table>
<thead>
<tr>
<th>Unit description</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific gravity(1)</td>
<td>SGU</td>
</tr>
<tr>
<td>Grams per cubic centimeter</td>
<td>g/cm³</td>
</tr>
<tr>
<td>Grams per liter</td>
<td>g/l</td>
</tr>
<tr>
<td>Grams per milliliter</td>
<td>g/ml</td>
</tr>
<tr>
<td>Kilograms per liter</td>
<td>kg/l</td>
</tr>
<tr>
<td>Kilograms per cubic meter</td>
<td>kg/m³</td>
</tr>
<tr>
<td>Pounds per U.S. gallon</td>
<td>lbs/USgal</td>
</tr>
<tr>
<td>Pounds per cubic foot</td>
<td>lbs/ft³</td>
</tr>
<tr>
<td>Pounds per cubic inch</td>
<td>lbs/ft³</td>
</tr>
<tr>
<td>Degrees API</td>
<td>degAPI</td>
</tr>
<tr>
<td>Short ton per cubic yard</td>
<td>st/yd³</td>
</tr>
</tbody>
</table>

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

4.5.2 Configure two-phase flow parameters

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Density</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>• Configure → Manual Setup → Measurements → Density → Slug Low Limit</td>
</tr>
<tr>
<td></td>
<td>• Configure → Manual Setup → Measurements → Density → Slug High Limit</td>
</tr>
<tr>
<td></td>
<td>• Configure → Manual Setup → Measurements → Density → Slug Duration</td>
</tr>
</tbody>
</table>

The two-phase flow parameters control how the transmitter detects and reports two-phase flow (gas in a liquid process or liquid in a gas process).

Note
Two-phase flow is also referred to as slug flow.

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 Alert A105 (Two-Phase Flow).

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.

The default value for **Two-Phase Flow Low Limit** is 0.0 g/cm³. The range is 0.0 to 10.0 g/cm³.

2. **Set Two-Phase Flow High Limit** to the highest density value that is considered normal in your process. Micro Motion recommends leaving **Two-Phase Flow High Limit** at the default value.

Values above this will cause the transmitter to post Alert A105 (Two-Phase Flow).

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

The default value for **Two-Phase Flow High Limit** is 5.0 g/cm³. The range is 0.0 to 10.0 g/cm³.

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.

The default value for **Two-Phase Flow Timeout** is 0.0 seconds, meaning that the alert will be posted immediately. The range is 0.0 to 60.0 seconds.

   The Two-Phase Flow alert is set immediately. The flow rate will hold the last measured value for the Timeout time. Then the flow rate will report zero flow. If the density goes back in range, the error clears immediately.

### Detecting and reporting 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. By configuring the two-phase flow parameters appropriately for your application, you can detect process conditions that require correction.

Micro Motion recommends leaving **Two-Phase Flow High Limit** at the default value.

A two-phase flow condition occurs whenever the measured density goes below **Two-Phase Flow Low Limit** or above **Two-Phase Flow High Limit**. If this occurs:

- A two-phase flow alert is posted to the active alert log.
- All outputs that are configured to represent flow rate hold their last pre-alert value for the number of seconds configured in **Two-Phase Flow Timeout**.

If the two-phase flow condition clears before **Two-Phase Flow Timeout** expires:

- Outputs that represent flow rate revert to reporting actual flow.
- The two-phase flow alert is deactivated, but remains in the active alert log until it is acknowledged.

If the two-phase flow condition does not clear before **Two-Phase Flow Timeout** expires, the outputs that represent flow rate report a flow rate of 0.

If **Two-Phase Flow Timeout** is set to 0.0 seconds, the outputs that represent flow rate will report a flow rate of 0 as soon as two-phase flow is detected.

### 4.5.3 Configure Density Damping

| Display  | Not available |
Density Damping controls the amount of damping that will be applied to the line density value.

Damping is used to smooth out small, rapid fluctuations in process measurement. **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 will reflect 63% of the change in the actual measured value.

**Tip**
Density damping affects all process variables that are calculated from line density.

**Procedure**
Set **Density Damping** to the value you want to use.
The default value is 1.6 seconds. For most applications, the default density damping setting is sufficient. The range depends on the core processor type and the setting of **Update Rate**, as shown in the following table:

<table>
<thead>
<tr>
<th>Update Rate setting</th>
<th>Damping range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0 to 51.2 seconds</td>
</tr>
<tr>
<td>Special</td>
<td>0 to 40.96 seconds</td>
</tr>
</tbody>
</table>

**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.
- 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 value you enter is automatically rounded off to the nearest valid value. The valid values for **Density Damping** depend on the setting of **Update Rate**.

<table>
<thead>
<tr>
<th>Update Rate setting</th>
<th>Valid damping values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0.0, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8, 25.6, 51.2</td>
</tr>
<tr>
<td>Special</td>
<td>0.0, 0.04, 0.08, 0.16, 0.32, 0.64, 1.28, 2.56, 5.12, 10.24, 20.48, 40.96</td>
</tr>
</tbody>
</table>
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 Added Damping

When the mA Output is configured to report density, both Density Damping and Added 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. Added Damping controls the rate of change reported via the mA Output.

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

4.5.4 Configure Density Cutoff

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Density</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → Density → Density Cutoff</td>
</tr>
</tbody>
</table>

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.

For most applications, the default setting (0.2 g/cm³) is sufficient. The range is 0.0 g/cm³ to 0.5 g/cm³.

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. Density Cutoff does not affect gas standard volume measurement. Gas standard volume values are always calculated from the value configured for Standard Gas Density or polled value if configured for polled base density.

4.6 Configure temperature measurement

The temperature measurement parameters control how temperature data from the sensor is reported.

4.6.1 Configure Temperature Measurement Unit

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → OFF-LINE CONFIG → UNITS → TEMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Temperature</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → Temperature → Temperature Unit</td>
</tr>
</tbody>
</table>
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.

The default setting is Degrees 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.

<table>
<thead>
<tr>
<th>Unit description</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees Celsius</td>
<td>°C</td>
<td>°C</td>
<td>degC</td>
</tr>
<tr>
<td>Degrees Fahrenheit</td>
<td>°F</td>
<td>°F</td>
<td>degF</td>
</tr>
<tr>
<td>Degrees Rankine</td>
<td>°R</td>
<td>°R</td>
<td>degR</td>
</tr>
<tr>
<td>Kelvin</td>
<td>°K</td>
<td>°K</td>
<td>Kelvin</td>
</tr>
</tbody>
</table>

### 4.6.2 Configure Temperature Damping

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Temperature</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → Temperature → Temp Damping</td>
</tr>
</tbody>
</table>

Temperature Damping controls the amount of damping that will be applied to the line temperature value, when the on-board temperature data is used (RTD).

Damping is used to smooth out small, rapid fluctuations in process measurement. 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 will reflect 63% of the change in the actual measured value.

**Tip**

Temperature Damping affects all process variables, compensations, and corrections that use temperature data from the sensor.

**Procedure**

Enter the value you want to use for Temperature Damping.

The default value is 4.8 seconds. For most applications, the default temperature damping setting is sufficient. The range is 0.0 to 38.4 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.
- 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 value you enter is automatically rounded off to the nearest valid value. Valid values for Temperature Damping are 0, 0.6, 1.2, 2.4, 4.8, 9.6, 19.2, and 38.4.

4.6.3 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.

Petroleum measurement

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

4.6.4 Configure Temperature Input

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.

Procedure


4.7 Configure the petroleum measurement application

The petroleum measurement application corrects line density to reference temperature according to American Petroleum Institute (API) standards. The resulting process variable is referred density.

4.7.1 Configure petroleum measurement using ProLink III

The petroleum measurement 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 that you want to use.

**Procedure**

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.

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

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

c) Click **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 (CTL).

**Restriction**

Not all combinations are supported by the petroleum measurement 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.

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.
4.7.2 Set up temperature data for petroleum measurement using ProLink III

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

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

**Prerequisites**
If you plan to poll an external device, the primary mA Output (Channel A) must be wired to support HART communications.

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

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

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal RTD</td>
<td>Temperature data from the on-board temperature sensor (RTD) is used.</td>
<td>a. Set Line Temperature Source to Internal RTD.</td>
</tr>
<tr>
<td>temperature data</td>
<td></td>
<td>b. Click Apply.</td>
</tr>
<tr>
<td>Polling</td>
<td>The meter polls an external device for temperature data. This data will be available in addition to the internal RTD temperature data.</td>
<td>a. Set Line Temperature Source to Poll for External Value.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Set Polling Slot to an available slot.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Set Polling Control to Poll as Primary or Poll as Secondary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Set External Device Tag to the HART tag of the temperature device.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e. Click Apply.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poll as Primary</td>
<td>No other HART masters will be on the network. The Field Communicator is not a HART master.</td>
</tr>
<tr>
<td>Poll as Secondary</td>
<td>Other HART masters will be on the network. The Field Communicator is not a HART master.</td>
</tr>
</tbody>
</table>
### 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 polling:
  - Verify the wiring between the meter and the external device.
  - Verify the HART tag of the external device.
- 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.

### 4.7.3 Configure petroleum measurement using the Field Communicator

**Procedure**

2. Specify the API table to use.
   a) Open the *Petroleum Measurement Source* menu and select the API table number. Depending on your choice, you may be prompted to enter a reference temperature or a thermal expansion coefficient.
   b) Enter the API table letter. These two parameters uniquely specify the API table.
3. Determine how the transmitter will obtain temperature data for the petroleum measurement calculations, and perform the required setup.

<table>
<thead>
<tr>
<th>Option</th>
<th>Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature data from the sensor</td>
<td>a. Choose <strong>Online → Configure → Manual Setup → Measurements → External Pressure/Temperature → Temperature.</strong></td>
</tr>
</tbody>
</table>
### Configure process measurement

<table>
<thead>
<tr>
<th>Option</th>
<th>Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. Set <strong>External Temperature</strong> to Disabled.</td>
<td></td>
</tr>
</tbody>
</table>

**A user-configured static temperature value**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Set <strong>Correction Temperature</strong> to the value to be used.</td>
<td></td>
</tr>
</tbody>
</table>

**Polling for temperature**

<table>
<thead>
<tr>
<th>a. Ensure that the primary mA output has been wired to support HART polling.</th>
<th>b. Choose <strong>Online → Configure → Manual Setup → Measurements → External Pressure/Temperature → Temperature</strong>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Set <strong>External Temperature</strong> to Enabled.</td>
<td>d. Choose <strong>External Polling</strong>.</td>
</tr>
<tr>
<td>e. Set <strong>Poll Control</strong> to Poll As Primary or Poll as Secondary.</td>
<td>f. Determine whether you will use Polling Slot 1 or Polling Slot 2.</td>
</tr>
<tr>
<td>g. For the chosen slot, set <strong>Ext Dev Tag</strong> to the HART tag of the external temperature device.</td>
<td>h. For the chosen slot, set <strong>Polled Variable</strong> to Temperature.</td>
</tr>
</tbody>
</table>

**Tip**
- **Poll as Primary**: No other HART masters will be on the network.
- **Poll as Secondary**: Other HART masters will be on the network. The Field Communicator is not a HART master.

**A value written by digital communications**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Perform the necessary host programming and communications setup to write temperature data to the transmitter at appropriate intervals.</td>
<td></td>
</tr>
</tbody>
</table>

**Note**
If the Weights & Measures application is implemented and the transmitter is secured, digital communications cannot be used to write temperature or pressure data to the transmitter.
# 4.7.4 API tables supported by the petroleum measurement application

The API tables listed here are supported by the petroleum measurement application.

<table>
<thead>
<tr>
<th>Table name</th>
<th>Process fluid</th>
<th>CTL source data</th>
<th>Reference temperature</th>
<th>Density unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>5A</td>
<td>Generalized crude and JP4</td>
<td>Observed density and observed temperature</td>
<td>60 °F (configurable)</td>
<td>Degrees API</td>
</tr>
<tr>
<td>5B</td>
<td>Generalized products</td>
<td>Observed density and observed temperature</td>
<td>60 °F (configurable)</td>
<td>Degrees API</td>
</tr>
<tr>
<td>5D</td>
<td>Lubricating oils</td>
<td>Observed density and observed temperature</td>
<td>60 °F (configurable)</td>
<td>Degrees API</td>
</tr>
<tr>
<td>6C</td>
<td>Liquids with a constant density base or known thermal expansion coefficient</td>
<td>User-supplied reference density (or thermal expansion coefficient) and observed temperature</td>
<td>60 °F (configurable)</td>
<td>Degrees API</td>
</tr>
<tr>
<td>23A</td>
<td>Generalized crude and JP4</td>
<td>Observed density and observed temperature</td>
<td>60 °F (configurable)</td>
<td>Relative density</td>
</tr>
<tr>
<td>23B</td>
<td>Generalized products</td>
<td>Observed density and observed temperature</td>
<td>60 °F (configurable)</td>
<td>Relative density</td>
</tr>
<tr>
<td>23D</td>
<td>Lubricating oils</td>
<td>Observed density and observed temperature</td>
<td>60 °F (configurable)</td>
<td>Relative density</td>
</tr>
<tr>
<td>24C</td>
<td>Liquids with a constant density base or known thermal expansion coefficient</td>
<td>User-supplied reference density (or thermal expansion coefficient) and observed temperature</td>
<td>60 °F (configurable)</td>
<td>Relative density</td>
</tr>
<tr>
<td>53A</td>
<td>Generalized crude and JP4</td>
<td>Observed density and observed temperature</td>
<td>15 °C (configurable)</td>
<td>Base density</td>
</tr>
<tr>
<td>53B</td>
<td>Generalized products</td>
<td>Observed density and observed temperature</td>
<td>15 °C (configurable)</td>
<td>Base density</td>
</tr>
<tr>
<td>53D</td>
<td>Lubricating oils</td>
<td>Observed density and observed temperature</td>
<td>15 °C (configurable)</td>
<td>Base density</td>
</tr>
<tr>
<td>54C</td>
<td>Liquids with a constant density base or known thermal expansion coefficient</td>
<td>User-supplied reference density (or thermal expansion coefficient) and observed temperature</td>
<td>15 °C (configurable)</td>
<td>Base density in kg/m³</td>
</tr>
</tbody>
</table>
Restriction
These tables are not appropriate for the following process fluids: propane and propane mixes, butane and butane mixes, butadiene and butadiene mixes, isopentane, LNG, LPG, NGL, ethylene, propylene, cyclohexane, aromatics, asphalts, and road tars.

4.8 Set up concentration measurement

This section guides you through loading and setting up a concentration matrix used for measurement. It does not cover building a concentration matrix.

The concentration measurement application calculates concentration data from process temperature and density. Micro Motion provides a set of concentration matrices that provide the reference data for several standard industry applications and process fluids. If desired, you can build a custom matrix for your process fluid, or purchase a custom matrix from Micro Motion.

Note
Concentration matrices can be made available on your transmitter either by loading an existing matrix from a file or by building a new matrix. Up to 6 matrices can be available on your transmitter, but only 1 can be used for measurement at any given time. For detailed information on building a matrix, see the Micro Motion Enhanced Density Application Manual.

Prerequisites
Before you can configure concentration measurement:

- The concentration measurement application must be purchased on your transmitter.
- The concentration matrix you want to use must be available on your transmitter, or it must be available as a file on your computer.
- You must know the derived variable that your matrix is designed for.
- You must know the density unit used by your matrix.
- You must know the temperature unit used by your matrix.
- The concentration measurement application must be unlocked.

4.8.1 Configure concentration measurement using ProLink III

Procedure

1. Choose Device Tools → Configuration → Process Measurement → Density and set Density Unit to the density unit used by your matrix.
2. Choose Device Tools → Configuration → Process Measurement → Temperature and set Temperature Unit to the temperature unit used by your matrix.
4. Set Derived Variable to the derived variable that your matrix is designed for, and click Apply.

Important
- All concentration matrices on your transmitter must use the same derived variable. If you are using one of the standard matrices from Micro Motion, set Derived Variable to Mass Concentration (Density). If you are using a custom matrix, see the reference information for your matrix.
• If you change the setting of **Derived Variable**, all existing concentration matrices will be deleted from transmitter memory. Set **Derived Variable** before loading concentration matrices.

5. Load one or more matrices.
   a) Set **Matrix Being Configured** to the location to which the matrix will be loaded.
   b) Click **Load Matrix from a File**, navigate to the matrix file on your computer, and load it.
   c) Repeat until all required matrices are loaded.

6. Configure or review matrix data.
   a) If necessary, set **Matrix Being Configured** to the matrix you want to configure or review, and click **Change Matrix**.
   b) Set **Concentration Unit** to the label that will be used for the concentration unit.
   c) If you set **Concentration Unit** to Special, enter the custom label.
   d) If desired, change the matrix name.
   e) Review the data points for this matrix.
   f) Do not change **Reference Temperature** or **Curve Fit Maximum Order**.
   g) If you changed any matrix data, click **Apply**.

7. Set up extrapolation alarms.
   Each concentration matrix is built for a specific density range and a specific temperature range. If process density or process temperature goes outside the range, the transmitter will extrapolate concentration values. However, extrapolation may affect accuracy. Extrapolation alarms are used to notify the operator that extrapolation is occurring.
   a) If necessary, set **Matrix Being Configured** to the matrix you want to view, and select **Change Matrix**.
   b) Set **Extrapolation Alarm Limit** to the point, in percent, at which an extrapolation alarm will be posted.
   c) Enable or disable the high and low limit alarms for temperature and density, as desired, and select **Apply**.

   **Restriction**
   The high and low limit alarms require the enhanced core processor.

**Example**
If **Extrapolation Alarm Limit** is set to 5%, **High Extrapolation Limit (Temperature)** is enabled, and the matrix is built for a temperature range of 40 °F (4.4 °C) to 80 °F (26.7 °C), an extrapolation alarm will be posted if process temperature goes above 82 °F (27.8 °C).

8. Set **Temperature Source** to the method that the transmitter will use to obtain temperature data.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poll for external value (1)</td>
<td>The transmitter will poll an external temperature device, using HART protocol over the primary mA Output.</td>
</tr>
</tbody>
</table>
### Configure process measurement

#### Option Description

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTD</td>
<td>The transmitter will use the temperature data from the sensor.</td>
</tr>
<tr>
<td>Static or Digital Communications</td>
<td>The transmitter will use the temperature value that it reads from memory.</td>
</tr>
<tr>
<td></td>
<td>• Static: The configured value is used. (Not recommended.)</td>
</tr>
<tr>
<td></td>
<td>• Digital Communications: A host writes transmitter data to transmitter memory.</td>
</tr>
</tbody>
</table>

**Note**
If the Weights & Measures application is implemented and the transmitter is secured, digital communications cannot be used to write temperature or pressure data to the transmitter.

9. If you chose RTD, no more configuration is required. Select **Apply** and exit.

10. If you chose to poll for temperature data:
   a) Select the **Polling Slot** to use.
   b) Set **Polling Control** to Poll as Primary or Poll as Secondary, and click **Apply**.

   **Tip**
   • Poll as Primary: No other HART masters will be on the network.
   • Poll as Secondary: Other HART masters will be on the network. The Field Communicator is not a HART master.

   c) Set **External Device Tag** to the HART tag of the external temperature device, and select **Apply**.

11. If you chose to use a static temperature value, set **External Temperature** to the value to use, and select **Apply**.

12. If you want to use digital communications, select **Apply**, then perform the necessary host programming and communications setup to write temperature data to the transmitter at appropriate intervals.

13. Set **Active Matrix** to the matrix to be used for measurement.

Concentration process variables are now available on the transmitter. You can view and report them in the same way that you view and report other process variables.

### 4.8.2 Configure concentration measurement using the Field Communicator

**Procedure**

1. Choose **Online → Configure → Manual Setup → Measurements → Density** and set **Density Unit** to match the density unit used by your matrix.

2. Choose **Online → Configure → Manual Setup → Measurements → Temperature** and set **Temperature Unit** to match the temperature unit used by your matrix.
3. Choose **Online → Configure → Manual Setup → Measurements** and click **Concentration Measurement**.

4. Enable or disable matrix switching, as desired.

5. Set up extrapolation alerts.
   Each concentration matrix is built for a specific density range and a specific temperature range. If process density or process 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.
   a) Click **Next**.
   b) On the **Matrix Configuration** page, set **Matrix Being Configured** to the matrix that you want to configure.
   c) Modify the matrix name if desired.
   d) Set **Extrapolation Alert Limit** to the point, in percent, at which an extrapolation alert will be posted.
   e) Choose **Online → Configure → Alert Setup → CM Alerts**.
   f) Enable or disable the high and low limit alarms for temperature and density, as desired.

   **Restriction**
   The high and low limit alarms require the enhanced core processor.

6. Select the label that will be used for the concentration unit.
   a) Click **Next**.
   b) On the **Concentration Measurement** page, set **Concentration Units** to the desired label.
   c) Set **Concentration Units** to the desired label.
   d) If you set **Units** to **Special**, enter the custom label.
   e) Click **Finish**.

7. Determine how the transmitter will obtain temperature data for the concentration measurement calculations, and perform the required setup.

<table>
<thead>
<tr>
<th>Option</th>
<th>Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature data from the sensor</td>
<td>a. Choose <strong>Online → Configure → Manual Setup → Measurements</strong>.</td>
</tr>
<tr>
<td></td>
<td>b. Click <strong>External Inputs</strong>.</td>
</tr>
<tr>
<td></td>
<td>c. Click <strong>Next</strong>.</td>
</tr>
<tr>
<td></td>
<td>d. Disable <strong>External Temperature</strong>.</td>
</tr>
<tr>
<td>Option</td>
<td>Setup</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>temperature value</td>
<td></td>
</tr>
</tbody>
</table>
|                                | b. Click External Inputs.  
|                                | c. Click Next.  
|                                | d. Enable External Temperature.  
|                                | e. Set Correction Temperature to the value to be used.  
| Polling for temperature(1)    | a. Ensure that the primary mA output has been wired to support HART polling.  
|                                | c. Click External Inputs.  
|                                | d. Click Next.  
|                                | e. Enable External Temperature.  
|                                | f. Click Next.  
|                                | g. Choose an unused polling slot.  
|                                | h. Set Poll Control to Poll As Primary Host or Poll as Secondary Host.  
|                                | i. Set External Tag to the HART tag of the external temperature device.  
|                                | j. Set Polled Variable to Temperature.  
| Tip                            | **Poll as Primary**: No other HART masters will be on the network.  
|                                | **Poll as Secondary**: Other HART masters will be on the network. The Field Communicator is not a HART master.  
| digital communications         | b. Enable External Temperature.  
|                                | c. Perform the necessary host programming and communications setup to write temperature data to the transmitter at appropriate intervals.  
| Note                           | If the Weights & Measures application is implemented and the transmitter is secured, digital communications cannot be used to write temperature or pressure data to the transmitter.  

8. Choose Online → Configure → Manual Setup → Measurements → Conc Measurement (CM) → CM Configuration and set Active Matrix to the matrix to be used for measurement.

Concentration process variables are now available on the transmitter. You can view and report them in the same way that you view and report other process variables.
4.8.3 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 folder.

**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.

<table>
<thead>
<tr>
<th>Matrix name</th>
<th>Description</th>
<th>Density unit</th>
<th>Temperature unit</th>
<th>Derived variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deg Balling</td>
<td>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.</td>
<td>g/cm³</td>
<td>°F</td>
<td>Mass Concentration (Density)</td>
</tr>
<tr>
<td>Deg Brix</td>
<td>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.</td>
<td>g/cm³</td>
<td>°C</td>
<td>Mass Concentration (Density)</td>
</tr>
<tr>
<td>Deg Plato</td>
<td>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.</td>
<td>g/cm³</td>
<td>°F</td>
<td>Mass Concentration (Density)</td>
</tr>
<tr>
<td>HFCS 42</td>
<td>Matrix represents a hydrometer scale for HFCS 42 (high-fructose corn syrup) solutions that indicates the percent by mass of HFCS in solution.</td>
<td>g/cm³</td>
<td>°C</td>
<td>Mass Concentration (Density)</td>
</tr>
<tr>
<td>HFCS 55</td>
<td>Matrix represents a hydrometer scale for HFCS 55 (high-fructose corn syrup) solutions that indicates the percent by mass of HFCS in solution.</td>
<td>g/cm³</td>
<td>°C</td>
<td>Mass Concentration (Density)</td>
</tr>
<tr>
<td>HFCS 90</td>
<td>Matrix represents a hydrometer scale for HFCS 90 (high-fructose corn syrup) solutions that indicates the percent by mass of HFCS in solution.</td>
<td>g/cm³</td>
<td>°C</td>
<td>Mass Concentration (Density)</td>
</tr>
</tbody>
</table>
### 4.8.4 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.

<table>
<thead>
<tr>
<th>Derived variable</th>
<th>Description</th>
<th>Calculated process variables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Density at reference temp</td>
</tr>
<tr>
<td>Density at Reference</td>
<td>Mass/unit volume, corrected to a given reference temperature</td>
<td>✓</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>The ratio of the density of a process fluid at a given temperature to the density of water at a given temperature</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The two given temperature conditions do not need to be the same.</td>
<td></td>
</tr>
<tr>
<td>Mass Concentration</td>
<td>The percent mass of solute or of material in suspension in the total solution, derived from reference density</td>
<td>✓</td>
</tr>
<tr>
<td>(Density)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass Concentration</td>
<td>The percent mass of solute or of material in suspension in the total solution, derived from specific gravity</td>
<td>✓</td>
</tr>
<tr>
<td>(Specific Gravity)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume Concentration</td>
<td>The percent volume of solute or of material in suspension in the total solution, derived from reference density</td>
<td>✓</td>
</tr>
<tr>
<td>(Density)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume Concentration</td>
<td>The percent volume of solute or of material in suspension in the total solution, derived from specific gravity</td>
<td>✓</td>
</tr>
<tr>
<td>(Specific Gravity)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Derived variable

<table>
<thead>
<tr>
<th>Derived variable</th>
<th>Description</th>
<th>Calculated process variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration (Density)</td>
<td>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</td>
<td>✓</td>
</tr>
<tr>
<td>Concentration (Specific Gravity)</td>
<td>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</td>
<td>✓</td>
</tr>
</tbody>
</table>

### 4.9 Configure 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 [Emerson.com](https://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.

### 4.9.1 Configure 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 appropriate unit.
   - If you will use an external pressure value, set **Pressure Unit** to match the pressure unit used by the external pressure device.
4. Enter **Flow Calibration Pressure** for your sensor.
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.

5. 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 0.000004 % per PSI, enter \(-0.000004 \ % \) per PSI.

6. 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 \(+0.000006 \ g/cm^3/PSI\).

7. Set **Pressure Source** to the method that the transmitter will use to obtain pressure data.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poll for external value</td>
<td>The transmitter will poll an external pressure device, using HART protocol over the primary mA Output.</td>
</tr>
<tr>
<td>Fixed Value or Digital Communications</td>
<td>The transmitter will use the pressure value that it reads from memory.</td>
</tr>
<tr>
<td></td>
<td>• Fixed Value: The configured value is used.</td>
</tr>
<tr>
<td></td>
<td>• Digital Communications: A host writes transmitter data to transmitter memory.</td>
</tr>
</tbody>
</table>

**Note**

If the Weights & Measures application is implemented and the transmitter is secured, digital communications cannot be used to write temperature or pressure data to the transmitter.

8. If you chose to poll for pressure data:
   
   a) Select the **Polling Slot** to use.
   
   b) Set **Polling Control** to Poll as Primary or Poll as Secondary, and click **Apply**.

   **Tip**
   
   • Poll as Primary: No other HART masters will be on the network.
   • Poll as Secondary: Other HART masters will be on the network. The Field Communicator is not a HART master.

   c) Set **External Device Tag** to the HART tag of the external pressure device, and click **Apply**.
   
   d) Ensure that the primary mA Output is wired to support HART communications with the external pressure device.
9. If you chose to use a fixed pressure value:
   a) Set **Fixed Value** to the value to use, and click **Apply**

10. If you want to use digital communications, click **Apply**, then perform the necessary host programming and communications setup to write pressure data to the transmitter at appropriate intervals.

**Postrequisites**

If you are using an external pressure value, verify the setup by checking the **External Pressure** value displayed in the **Inputs** area of the main window.

### 4.9.2 Configure pressure compensation using the Field Communicator

**Procedure**

1. Choose **Online** → **Configure** → **Manual Setup** → **Measurements** → **External Pressure/Temperature** → **Pressure**.

2. Set **Pressure Compensation** to Enabled.

3. Enter **Flow Cal Pressure** for your sensor.
   
   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 **Dens Press 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/cm$^3$/PSI.

6. Determine how the transmitter will obtain pressure data, and perform the required setup.

<table>
<thead>
<tr>
<th>Option</th>
<th>Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>A user-configured static pressure value</td>
<td>a. Set <strong>Pressure Unit</strong> to the desired unit.</td>
</tr>
<tr>
<td></td>
<td>b. Set <strong>Compensation Pressure</strong> to the desired value.</td>
</tr>
<tr>
<td>Polling for pressure</td>
<td>a. Ensure that the primary mA Output has been wired to support HART polling.</td>
</tr>
</tbody>
</table>
### Option Setup

<table>
<thead>
<tr>
<th>Option</th>
<th>Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Set Poll Control to Poll As Primary Host or Poll as Secondary Host.</td>
<td></td>
</tr>
<tr>
<td>d. Choose an unused polling slot.</td>
<td></td>
</tr>
<tr>
<td>e. Set External Tag to the HART tag of the external pressure device.</td>
<td></td>
</tr>
<tr>
<td>f. Set Polled Variable to Pressure.</td>
<td></td>
</tr>
</tbody>
</table>

**Tip**
- Poll as Primary: No other HART masters will be on the network.
- Poll as Secondary: Other HART masters will be on the network. The Field Communicator is not a HART master.

<table>
<thead>
<tr>
<th>A value written by digital communications</th>
<th>a. Set Pressure Unit to the desired unit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. Perform the necessary host programming and communications setup to write pressure data to the transmitter at appropriate intervals.</td>
<td></td>
</tr>
</tbody>
</table>

**Note**
If the Weights & Measures application is implemented and the transmitter is secured, digital communications cannot be used to write temperature or pressure data to the transmitter.

### Postrequisites

If you are using an external pressure value, verify the setup by choosing Service Tools → Variables → External Variables and checking the value displayed for External Pressure.

### 4.9.3 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, Pressure Measurement Unit should be set to match the pressure measurement unit used by the remote device.

<table>
<thead>
<tr>
<th>Unit description</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feet water @ 68 °F</td>
<td>FTH₂O</td>
<td>Ft Water @ 68 °F</td>
<td>ftH₂O</td>
</tr>
<tr>
<td>Inches water @ 4 °C</td>
<td>INW4C</td>
<td>In Water @ 4 °C</td>
<td>inH₂O @4DegC</td>
</tr>
<tr>
<td>Inches water @ 60 °F</td>
<td>INW60</td>
<td>In Water @ 60 °F</td>
<td>inH₂O @60DegF</td>
</tr>
<tr>
<td>Inches water @ 68 °F</td>
<td>INH₂O</td>
<td>In Water @ 68 °F</td>
<td>inH₂O</td>
</tr>
<tr>
<td>Millimeters water @ 4 °C</td>
<td>mmW4C</td>
<td>mm Water @ 4 °C</td>
<td>mmH₂O @4DegC</td>
</tr>
<tr>
<td>Millimeters water @ 68 °F</td>
<td>mmH₂O</td>
<td>mm Water @ 68 °F</td>
<td>mmH₂O</td>
</tr>
<tr>
<td>Millimeters mercury @ 0 °C</td>
<td>mmHG</td>
<td>mm Mercury @ 0 °C</td>
<td>mmHg</td>
</tr>
<tr>
<td>Unit description</td>
<td>Label</td>
<td>Display</td>
<td>ProLink III</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Inches mercury @ 0 °C</td>
<td>INHG</td>
<td>In Mercury @ 0 °C</td>
<td>inHG</td>
</tr>
<tr>
<td>Pounds per square inch</td>
<td>PSI</td>
<td>PSI</td>
<td>psi</td>
</tr>
<tr>
<td>Bar</td>
<td>BAR</td>
<td>bar</td>
<td>bar</td>
</tr>
<tr>
<td>Millibar</td>
<td>mBAR</td>
<td>millibar</td>
<td>mbar</td>
</tr>
<tr>
<td>Grams per square centimeter</td>
<td>G/SCM</td>
<td>g/cm2</td>
<td>g/Sqcm</td>
</tr>
<tr>
<td>Kilograms per square centimeter</td>
<td>KG/SCM</td>
<td>kg/cm2</td>
<td>kg/Sqcm</td>
</tr>
<tr>
<td>Pascals</td>
<td>PA</td>
<td>pascals</td>
<td>Pa</td>
</tr>
<tr>
<td>Kilopascals</td>
<td>KPA</td>
<td>Kilopascals</td>
<td>kPa</td>
</tr>
<tr>
<td>Megapascals</td>
<td>MPA</td>
<td>Megapascals</td>
<td>MPa</td>
</tr>
<tr>
<td>Torr @ 0 °C</td>
<td>TORR</td>
<td>Torr @ 0 °C</td>
<td>torr</td>
</tr>
<tr>
<td>Atmospheres</td>
<td>ATM</td>
<td>atms</td>
<td>atms</td>
</tr>
</tbody>
</table>
5 Configure device options and preferences

5.1 Configure the transmitter display

You can control the process variables shown on the display and a variety of display behaviors.

5.1.1 Configure the language used for the display

<table>
<thead>
<tr>
<th>Display Language</th>
<th>Configuration Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Language</td>
<td>controls the language used for process data and menus on the display.</td>
</tr>
<tr>
<td><strong>Procedure</strong></td>
<td>Select the language you want to use.</td>
</tr>
<tr>
<td>The languages available depend on your transmitter model and version.</td>
<td></td>
</tr>
</tbody>
</table>

5.1.2 Configure the process variables and diagnostic variables shown on the display

<table>
<thead>
<tr>
<th>Display</th>
<th>Configuration Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Language</td>
<td>Not available</td>
</tr>
<tr>
<td><strong>Procedure</strong></td>
<td>You can control the process variables and diagnostic variables shown on the display, and the order in which they appear. The display can scroll through up to 15 variables in any order you choose. In addition, you can repeat variables or leave slots unassigned.</td>
</tr>
</tbody>
</table>

**Restriction**

- You cannot set Display Variable 1 to None or to a diagnostic variable. Display Variable 1 must be set to a process variable.
- If you have configured Display Variable 1 to track the primary mA Output, you cannot change the setting of Display Variable 1 using this procedure. To change the setting of Display Variable 1, you must change the configuration of mA Output Process Variable for the primary mA Output.

**Note**

If you configure a display variable as a volume process variable and then change Volume Flow Type, the display variable is automatically changed to the equivalent process variable. For example, Volume Flow Rate would be changed to Gas Standard Volume Flow Rate.

**Procedure**

For each display variable you want to change, assign the process variable you want to use.
Default display variable configuration

<table>
<thead>
<tr>
<th>Display variable</th>
<th>Process variable assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Variable 1</td>
<td>Mass flow</td>
</tr>
<tr>
<td>Display Variable 2</td>
<td>Mass total</td>
</tr>
<tr>
<td>Display Variable 3</td>
<td>Volume flow</td>
</tr>
<tr>
<td>Display Variable 4</td>
<td>Volume total</td>
</tr>
<tr>
<td>Display Variable 5</td>
<td>Density</td>
</tr>
<tr>
<td>Display Variable 6</td>
<td>Temperature</td>
</tr>
<tr>
<td>Display Variable 7</td>
<td>Drive gain</td>
</tr>
<tr>
<td>Display Variable 8</td>
<td>None</td>
</tr>
<tr>
<td>Display Variable 9</td>
<td>None</td>
</tr>
<tr>
<td>Display Variable 10</td>
<td>None</td>
</tr>
<tr>
<td>Display Variable 11</td>
<td>None</td>
</tr>
<tr>
<td>Display Variable 12</td>
<td>None</td>
</tr>
<tr>
<td>Display Variable 13</td>
<td>None</td>
</tr>
<tr>
<td>Display Variable 14</td>
<td>None</td>
</tr>
<tr>
<td>Display Variable 15</td>
<td>None</td>
</tr>
</tbody>
</table>

Configure Display Variable 1 to track the primary mA Output

<table>
<thead>
<tr>
<th>Device</th>
<th>Configuration path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>OFF-LINE MAINT → OFF-LINE CONFIG → DISPLY → VAR 1</td>
</tr>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Transmitter Display → Display Security</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Not available</td>
</tr>
</tbody>
</table>

You can configure Display Variable 1 to track mA Output Process Variable for the primary mA Output. When tracking is enabled, you can control Display Variable 1 from the display menu.

**Tip**
This feature is the only way to configure a display variable from the display menus, and it applies only to Display Variable 1.

**Procedure**
Configure Display Variable 1 to track the primary mA Output.

Display Variable 1 will automatically be set to match mA Output Process Variable for the primary mA Output. If you change the configuration of mA Output Process Variable, Display Variable 1 will be updated automatically.

5.1.3 Configure the number of decimal places (precision) shown on the display

| Display | Not available |
You can specify the number of decimal places (precision) that are shown on the display for each process variable or diagnostic variable. You can set the precision independently for each variable.

The display precision does not affect the actual value of the variable or the value used in calculations.

**Procedure**

1. Select a variable.
2. Set **Number of Decimal Places** to the number of decimal places you want shown when the process variable or diagnostic variable appears on the display.

   For temperature and density process variables, the default value is 2 decimal places. For all other variables, the default value is 4 decimal places. The range is 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 the precision too low or too high to be useful.

### 5.1.4 Configure the refresh rate of data shown on the display

You can set **Refresh Rate** to control how frequently data is refreshed on the display.

**Procedure**

Set **Refresh Rate** to the desired value.

The default value is 200 milliseconds. The range is 100 milliseconds to 10,000 milliseconds (10 seconds).

### 5.1.5 Enable or disable automatic scrolling through the display variables

You can configure the display to automatically scroll through the configured display variables or to show a single display variable until the operator activates **Scroll**. When you set automatic scrolling, you can also configure the length of time each display variable is displayed.

**Procedure**

1. Enable or disable **Auto Scroll** as desired.
<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled</td>
<td>The display automatically scrolls through each display variable as specified by Scroll Rate. The operator can move to the next display variable at any time using Scroll.</td>
</tr>
<tr>
<td>Disabled</td>
<td>The display shows Display Variable 1 and does not scroll automatically. The operator can move to the next display variable at any time using Scroll.</td>
</tr>
</tbody>
</table>

2. If you enabled Auto Scroll, set Scroll Rate as desired. The default value is 10 seconds.

**Tip**
Scroll Rate may not be available until you apply Auto Scroll.

### 5.1.6 Enable or disable the display backlight

<table>
<thead>
<tr>
<th>Device</th>
<th>Configuration Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>OFF-LINE MAINT → OFF-LINE CONFIG → DISPLAY → BKLT</td>
</tr>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Transmitter Display → General</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Display → Backlight</td>
</tr>
</tbody>
</table>

You can enable or disable the display backlight.

**Procedure**
Enable or disable Backlight. The default setting is Enabled.

### 5.1.7 Enable or disable Status LED Blinking

<table>
<thead>
<tr>
<th>Device</th>
<th>Configuration Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>Not available</td>
</tr>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Transmitter Display → General</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Display → Display Variable Menu Features → Status LED Blinking</td>
</tr>
</tbody>
</table>

By default, the status LED blinks (flashes) to indicate unacknowledged alerts. If you disable Status LED Blinking, the status LED does not blink, whether alerts are acknowledged or not. It still changes color to indicate active alerts.

**Procedure**
Enable or disable Status LED Blinking. The default setting is Enabled.
5.2 Enable or disable operator actions from the display

You can configure the transmitter to let the operator perform specific actions using the display.

5.2.1 Enable or disable Totalizer Start/Stop from the display

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → OFF-LINE CONFIG → DISPLAY → TOTALS STOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Totalizer Control Methods</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Display → Display Variable Menu Features → Start/Stop Totalizers</td>
</tr>
</tbody>
</table>

You can control whether or not the operator is able to start and stop totalizers and inventories from the display.

Restriction

• You cannot start and stop totalizers individually from the display. All totalizers are started or stopped together.

• You cannot start or stop inventories separately from totalizers. When a totalizer is started or stopped, the associated inventory is also started or stopped.

• If the petroleum measurement application is installed, the operator must enter the off-line password to perform this function, even if the off-line password is not enabled.

Procedure

1. Ensure that at least one totalizer is configured as a display variable.
2. Enable or disable Totalizer Reset as desired.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled</td>
<td>Operators can start and stop totalizers and inventories from the display, if at least one totalizer is configured as a display variable.</td>
</tr>
<tr>
<td>Disabled (default)</td>
<td>Operators cannot start and stop totalizers and inventories from the display.</td>
</tr>
</tbody>
</table>

5.2.2 Enable or disable Totalizer Reset from the display

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → OFF-LINE CONFIG → DISPLAY → TOTALS RESET</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Totalizer Control Methods</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Display → Display Variable Menu Features → Totalizer Reset</td>
</tr>
</tbody>
</table>

You can configure whether or not the operator is able to reset totalizers from the display.

Restriction

• This parameter does not apply to inventories. You cannot reset inventories from the display.

• You cannot use the display to reset all totalizers as a group. You must reset totalizers individually.
• If the petroleum measurement application is installed, the operator must enter the off-line password to perform this function, even if the off-line password is not enabled.

### Procedure

1. Ensure that the totalizers you want to reset have been configured as display variables.
   If the totalizer is not configured as a display variable, the operator will not be able to reset it.
2. Enable or disable resetting the totalizer as desired.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled</td>
<td>Operators can reset a totalizer from the display, if the totalizer is configured as a display variable.</td>
</tr>
<tr>
<td>Disabled (default)</td>
<td>Operators cannot reset totalizers from the display.</td>
</tr>
</tbody>
</table>

### 5.2.3 Enable or disable the Acknowledge All Alerts display command

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → OFF-LINE CONFIG → DISPLAY → ALERT</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Transmitter Display → Ack All</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Display → Offline Variable Menu Features → Acknowledge All</td>
</tr>
</tbody>
</table>

You can configure whether or not the operator can use a single command to acknowledge all alerts from the display.

### Procedure

1. Ensure that the alert menu is accessible from the display.
   To acknowledge alerts from the display, operators must have access to the alert menu.
2. Enable or disable **Acknowledge All Alerts** as desired.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled (default)</td>
<td>Operators can use a single display command to acknowledge all alerts at once.</td>
</tr>
<tr>
<td>Disabled</td>
<td>Operators cannot acknowledge all alerts at once. Each alert must be acknowledged separately.</td>
</tr>
</tbody>
</table>

### 5.3 Configure security for the display menus

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → OFF-LINE CONFIG → DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Transmitter Display → Display Security</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Display → Offline Variable Menu Features</td>
</tr>
</tbody>
</table>
You can control operator access to different sections of the display off-line menu. You can also configure a password to control access.

**Procedure**

1. To control operator access to the maintenance section of the off-line menu, enable or disable **Off-Line Menu**.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled (default)</td>
<td>Operator can access the maintenance section of the off-line menu. This access is required for configuration and calibration, but is not required to view alerts or to access Smart Meter Verification (if applicable).</td>
</tr>
<tr>
<td>Disabled</td>
<td>Operator cannot access the maintenance section of the off-line menu.</td>
</tr>
</tbody>
</table>

2. To control operator access to the alert menu, enable or disable **Alert Menu**.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled (default)</td>
<td>Operator can access the alert menu. This access is required to view and acknowledge alerts, but is not required for Smart Meter Verification (if applicable), configuration, or calibration.</td>
</tr>
<tr>
<td>Disabled</td>
<td>Operator cannot access the alert menu.</td>
</tr>
</tbody>
</table>

**Note**
The transmitter status LED changes color to indicate that there are active alerts, but does not show specific alerts.

3. To require a password for access to the maintenance section of the off-line menu and the Smart Meter Verification menu, enable or disable **Off-Line Password**.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled</td>
<td>Operator is prompted for the off-line password at entry to the Smart Meter Verification menu (if applicable), or entry to the maintenance section of the off-line menu.</td>
</tr>
<tr>
<td>Disabled (default)</td>
<td>No password is required for entry to the Smart Meter Verification menu (if applicable) or entry to the maintenance section of the off-line menu.</td>
</tr>
</tbody>
</table>

4. To require a password to access the alert menu, enable or disable **Alert Password**.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled</td>
<td>Operator is prompted for the off-line password at entry to the alert menu.</td>
</tr>
<tr>
<td>Disabled (default)</td>
<td>No password is required for entry to the alert menu.</td>
</tr>
</tbody>
</table>

If both **Off-Line Password** and **Alert Password** are enabled, the operator is prompted for the off-line password to access the off-line menu, but is not prompted thereafter.

5. Set **Off-Line Password** to the desired value.
The default value is 1234. The range is 0000 to 9999.
The same value is used for both the off-line password and the alert password.

Tip
Record your password for future reference.

5.4 Configure response time parameters
You can configure the rate at which process data is polled and process variables are calculated.

5.4.1 Configure Update Rate

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Response → Update Rate</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → Update Rate</td>
</tr>
</tbody>
</table>

Update Rate controls the rate at which process data is polled and process variables are calculated. Update Rate = Special produces faster and “noisier” response to changes in the process. Do not use Special mode unless required by your application.

Prerequisites
Before setting Update Rate to Special:

- Check the effects of Special mode on specific process variables.
- Contact customer support.

Tip
For systems with a standard core processor, Special mode can improve performance for applications with entrained air or Empty-Full-Empty conditions. This does not apply to systems with an enhanced core processor.

Procedure

1. Set Update Rate as desired.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>All process data is polled at the rate of 20 times per second (20 Hz). All process variables are calculated at 20 Hz. This option is appropriate for most applications.</td>
</tr>
<tr>
<td>Special</td>
<td>A single, user-specified process variable is polled at the rate of 100 times per second (100 Hz). Other process data is polled at 6.25 Hz. Some process, diagnostic, and calibration data is not polled. All available process variables are calculated at 100 Hz. Use this option only if required by your application.</td>
</tr>
</tbody>
</table>

If you change Update Rate, the settings for Flow Damping, and Density Damping are automatically adjusted.
2. If you set **Update Rate** to Special, select the process variable to be polled at 100 Hz.

**Effects of Update Rate = Special**

**Incompatible features and functions**

Special mode is not compatible with the following features and functions:

- Enhanced events. Use basic events instead.
- All calibration procedures.
- Zero verification.
- Restoring the factory zero or the prior zero.

If required, you can switch to Normal mode, perform the desired procedures, and then return to Special mode.

**Process variable updates**

Some process variables are not updated when Special mode is enabled.

**Table 5-1: Special mode and process variable updates**

<table>
<thead>
<tr>
<th>Always polled and updated</th>
<th>Updated only when the petroleum measurement application is disabled</th>
<th>Never updated</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mass flow</td>
<td>• RPO amplitude</td>
<td>All other process variables and calibration data. They retain the values held at the time you enabled Special mode.</td>
</tr>
<tr>
<td>• Volume flow</td>
<td>• Core input voltage</td>
<td></td>
</tr>
<tr>
<td>• Gas standard volume flow</td>
<td>• Mass inventory</td>
<td></td>
</tr>
<tr>
<td>• Density</td>
<td>• Volume inventory</td>
<td></td>
</tr>
<tr>
<td>• Temperature</td>
<td>• Gas standard volume inventory</td>
<td></td>
</tr>
<tr>
<td>• Drive gain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• LPO amplitude</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Status [contains Event 1 and Event 2 (basic events)]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mass total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Volume total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Live zero</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Gas standard volume total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Temperature-corrected volume total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Temperature-corrected density</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Temperature-corrected volume flow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Batch-weighted average temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Batch-weighted average density</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.4.2 Configure Response Time

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Response → Response Time</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Not available</td>
</tr>
</tbody>
</table>

**Response Time** is used to apply a different algorithm to the calculation of process variables from the raw process data.

**Restriction**

**Response Time** is available only on systems with the enhanced core processor.

**Procedure**

Set **Response Time** as desired.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal (Legacy)</td>
<td>Transmitter calculates process variables at the standard speed. This option is selected if this parameter was configured on an earlier version of ProLink III software.</td>
</tr>
<tr>
<td>Special (Legacy)</td>
<td>Transmitter calculates process variables at a faster speed. This option is selected if this parameter was configured on an earlier version of ProLink III software.</td>
</tr>
<tr>
<td>Normal - Optimal Filtering</td>
<td>Transmitter calculates process variables at standard filtering and speed.</td>
</tr>
<tr>
<td>Low Filtering - Fastest Response</td>
<td>Transmitter calculates process variables at the fastest speed.</td>
</tr>
<tr>
<td>High Filtering - Smoothest Output</td>
<td>Transmitter calculates process variables at the smoothest (least noisy) response to changes in the process.</td>
</tr>
<tr>
<td>Service</td>
<td>For factory use only.</td>
</tr>
</tbody>
</table>

5.5 Configure alert handling

The alert handling parameters control the transmitter’s response to process and device conditions.

5.5.1 Configure Fault Timeout

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Fault Processing</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Alert Setup → Alert Severity → Fault Timeout</td>
</tr>
</tbody>
</table>

**Fault Timeout** controls the delay before fault actions are performed.

**Restriction**

**Fault Timeout** is applied only to the following alerts (listed by Status Alert Code): A003, A004, A005, A008, A016, A017, A033. For all other alerts, fault actions are performed as soon as the alert is detected.
**Procedure**

Set **Fault Timeout** as desired.

The default value is 0 seconds. The range is 0 to 60 seconds.

If you set **Fault Timeout** to 0, fault actions are performed as soon as the alert condition is detected.

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.

**5.5.2 Configure Status Alert Severity**

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Alert Severity</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Alert Setup → Alert Severity → Set Alert Severity</td>
</tr>
</tbody>
</table>

Use **Status Alert Severity** to control the fault actions that the transmitter performs when it detects an alert condition.

**Restriction**

- For some alerts, **Status Alert Severity** is not configurable.
- For some alerts, **Status Alert Severity** can be set only to two of the three options.

**Tip**

Use the default settings for **Status Alert Severity** unless you have a specific requirement to change them.

**Procedure**

1. Select a status alert.
2. For the selected status alert, set **Status Alert Severity** as desired.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
</table>
| Fault  | Actions when fault is detected:  
  • The alert is posted to the Alert List.  
  • Outputs go to the configured fault action (after **Fault Timeout** has expired, if applicable).  
  • Digital communications go to the configured fault action (after **Fault Timeout** has expired, if applicable).  
  • The status LED (if available) changes to red or yellow (depending on alert severity).  
Actions when alert clears:  
  • Outputs return to normal behavior.  
  • Digital communications return to normal behavior.  
  • The status LED (if available) returns to green and may or may not flash. |
### Actions when fault is detected:
- The alert is posted to the Alert List.
- The status LED (if available) changes to red or yellow (depending on alert severity).

### Actions when alert clears:
- The status LED (if available) returns to green and may or may not flash.

## Status alerts and options for Status Alert Severity

### Table 5-2: Status alerts and Status Alert Severity

<table>
<thead>
<tr>
<th>Alert code</th>
<th>Status message</th>
<th>Default severity</th>
<th>Notes</th>
<th>Configurable?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A001</td>
<td>EEPROM Error (Core Processor)</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>A002</td>
<td>RAM Error (Core Processor)</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>A003</td>
<td>No Sensor Response</td>
<td>Fault</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A004</td>
<td>Temperature Overrange</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>A005</td>
<td>Mass Flow Rate Overrange</td>
<td>Fault</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A006</td>
<td>Characterization Required</td>
<td>Fault</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A008</td>
<td>Density Overrange</td>
<td>Fault</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A009</td>
<td>Transmitter Initializing/ Warming Up</td>
<td>Fault</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A010</td>
<td>Calibration Failure</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>A011</td>
<td>Zero Calibration Failed: Low</td>
<td>Fault</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A012</td>
<td>Zero Calibration Failed: High</td>
<td>Fault</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A013</td>
<td>Zero Calibration Failed: Unstable</td>
<td>Fault</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A014</td>
<td>Transmitter Failure</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>A016</td>
<td>Sensor RTD Failure</td>
<td>Fault</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A017</td>
<td>T-Series RTD Failure</td>
<td>Fault</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A018</td>
<td>EEPROM Error (Transmitter)</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>A019</td>
<td>RAM Error (Transmitter)</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>A020</td>
<td>No Flow Cal Value</td>
<td>Fault</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A021</td>
<td>Incorrect Sensor Type (K1)</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>A022</td>
<td>Configuration Database Corrupt (Core Processor)</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

Applies only to flowmeters with the standard core processor.
### Table 5-2: Status alerts and Status Alert Severity (continued)

<table>
<thead>
<tr>
<th>Alert code</th>
<th>Status message</th>
<th>Default severity</th>
<th>Notes</th>
<th>Configurable?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A023</td>
<td>Internal Totals Corrupt (Core Processor)</td>
<td>Fault</td>
<td>Applies only to flowmeters with the standard core processor.</td>
<td>No</td>
</tr>
<tr>
<td>A024</td>
<td>Program Corrupt (Core Processor)</td>
<td>Fault</td>
<td>Applies only to flowmeters with the standard core processor.</td>
<td>No</td>
</tr>
<tr>
<td>A025</td>
<td>Boot Sector Fault (Core Processor)</td>
<td>Fault</td>
<td>Applies only to flowmeters with the standard core processor.</td>
<td>No</td>
</tr>
<tr>
<td>A026</td>
<td>Sensor/Transmitter Communications Failure</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>A027</td>
<td>Security Breach</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>A028</td>
<td>Core Processor Write Failure</td>
<td>Fault</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>A031</td>
<td>Low Power</td>
<td>Fault</td>
<td>Applies only to flowmeters with the enhanced core processor.</td>
<td>No</td>
</tr>
<tr>
<td>A032</td>
<td>Meter Verification in Progress: Outputs to Fault</td>
<td>Varies</td>
<td>Applies only to transmitters with Smart Meter Verification. If outputs are set to Last Measured Value, severity is Info. If outputs are set to Fault, severity is Fault.</td>
<td>No</td>
</tr>
<tr>
<td>A033</td>
<td>Insufficient Right/Left Pickoff Signal</td>
<td>Fault</td>
<td>Applies only to flowmeters with the enhanced core processor.</td>
<td>Yes</td>
</tr>
<tr>
<td>A034</td>
<td>Meter Verification Failed</td>
<td>Fault</td>
<td>Applies only to transmitters with Smart Meter Verification.</td>
<td>Yes</td>
</tr>
<tr>
<td>A035</td>
<td>Meter Verification Aborted</td>
<td>Fault</td>
<td>Applies only to transmitters with Smart Meter Verification.</td>
<td>Yes</td>
</tr>
<tr>
<td>A100</td>
<td>mA Output 1 Saturated</td>
<td>Informational</td>
<td>Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>Yes</td>
</tr>
<tr>
<td>A101</td>
<td>mA Output 1 Fixed</td>
<td>Informational</td>
<td>Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>Yes</td>
</tr>
<tr>
<td>A102</td>
<td>Drive Overrange</td>
<td>Informational</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>A103</td>
<td>Data Loss Possible (Totals and Inventories)</td>
<td>Informational</td>
<td>Applies only to flowmeters with the enhanced core processor. Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>Yes</td>
</tr>
<tr>
<td>A104</td>
<td>Calibration in Progress</td>
<td>Informational</td>
<td>Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>Yes</td>
</tr>
<tr>
<td>A105</td>
<td>Slug Flow</td>
<td>Informational</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Table 5-2: Status alerts and Status Alert Severity (continued)

<table>
<thead>
<tr>
<th>Alert code</th>
<th>Status message</th>
<th>Default severity</th>
<th>Notes</th>
<th>Configurable?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A106</td>
<td>Burst Mode Enabled</td>
<td>Informational</td>
<td>Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>Yes</td>
</tr>
<tr>
<td>A107</td>
<td>Power Reset Occurred</td>
<td>Informational</td>
<td>Normal transmitter behavior; occurs after every power cycle.</td>
<td>Yes</td>
</tr>
<tr>
<td>A108</td>
<td>Basic Event 1 On</td>
<td>Informational</td>
<td>Applies only to basic events.</td>
<td>Yes</td>
</tr>
<tr>
<td>A109</td>
<td>Basic Event 2 On</td>
<td>Informational</td>
<td>Applies only to basic events.</td>
<td>Yes</td>
</tr>
<tr>
<td>A110</td>
<td>Frequency Output Saturated</td>
<td>Informational</td>
<td>Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>Yes</td>
</tr>
<tr>
<td>A111</td>
<td>Frequency Output Fixed</td>
<td>Informational</td>
<td>Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>Yes</td>
</tr>
<tr>
<td>A112</td>
<td>Upgrade Transmitter Software</td>
<td>Informational</td>
<td>Applies only to systems with transmitter software earlier than v5.0.</td>
<td>Yes</td>
</tr>
<tr>
<td>A113</td>
<td>mA Output 2 Saturated</td>
<td>Informational</td>
<td>Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>Yes</td>
</tr>
<tr>
<td>A114</td>
<td>mA Output 2 Fixed</td>
<td>Informational</td>
<td>Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>Yes</td>
</tr>
<tr>
<td>A115</td>
<td>No External Input or Polled Data</td>
<td>Informational</td>
<td>Applies only to transmitters with Smart Meter Verification.</td>
<td>Yes</td>
</tr>
<tr>
<td>A118</td>
<td>Discrete Output 1 Fixed</td>
<td>Informational</td>
<td>Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>Yes</td>
</tr>
<tr>
<td>A119</td>
<td>Discrete Output 2 Fixed</td>
<td>Informational</td>
<td>Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>Yes</td>
</tr>
<tr>
<td>A120</td>
<td>Curve Fit Failure (Concentration)</td>
<td>Informational</td>
<td>Applies only to transmitters with the concentration measurement application.</td>
<td>No</td>
</tr>
<tr>
<td>A121</td>
<td>Extrapolation Alarm (Concentration)</td>
<td>Informational</td>
<td>Applies only to transmitters with the concentration measurement application.</td>
<td>Yes</td>
</tr>
<tr>
<td>A131</td>
<td>Meter Verification in Progress: Outputs to Last Measured Value</td>
<td>Informational</td>
<td>Applies only to transmitters with Smart Meter Verification.</td>
<td>Yes</td>
</tr>
<tr>
<td>A132</td>
<td>Sensor Simulation Active</td>
<td>Informational</td>
<td>Applies only to flowmeters with the enhanced core processor. Can be set to either Informational or Ignore, but cannot be set to Fault.</td>
<td>To Informational or Ignore only</td>
</tr>
</tbody>
</table>
Table 5-2: Status alerts and Status Alert Severity (continued)

<table>
<thead>
<tr>
<th>Alert code</th>
<th>Status message</th>
<th>Default severity</th>
<th>Notes</th>
<th>Configurable?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A141</td>
<td>DDC trigger(s) have completed</td>
<td>Informational</td>
<td>Applies only to flowmeters with the enhanced core processor.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Can be set to either Informational or Ignore, but cannot be set to</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fault.</td>
<td></td>
</tr>
</tbody>
</table>

5.6 Configure informational parameters

The informational parameters can be used to identify or describe your meter. They are not used in process measurement and they are not required.

5.6.1 Configure Sensor Serial Number

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Informational Parameters → Sensor</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Info Parameters → Sensor Information → Sensor Serial Number</td>
</tr>
</tbody>
</table>

**Sensor Serial Number** lets you store the serial number of the sensor component of your flowmeter in transmitter memory. This parameter is not used in processing and is not required.

**Procedure**

1. Obtain the sensor serial number from your sensor tag.
2. Enter the serial number in the **Sensor Serial Number** field.

5.6.2 Configure Sensor Material

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Informational Parameters → Sensor</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Info Parameters → Sensor Information → Tube Wetted Material</td>
</tr>
</tbody>
</table>

**Sensor Material** lets you store the type of material used for your sensor’s wetted parts in transmitter memory. This parameter is not used in processing and is not required.

**Procedure**

1. Obtain the material used for your sensor’s wetted parts from the documents shipped with your sensor, or from a code in the sensor model number.

   To interpret the model number, refer to the product data sheet for your sensor.

2. Set **Sensor Material** to the appropriate option.

5.6.3 Configure Sensor Liner Material

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
</table>

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**Sensor Liner Material** lets you store the type of material used for your sensor liner in transmitter memory. This parameter is not used in processing and is not required.

**Procedure**

1. Obtain your sensor’s liner material from the documents shipped with your sensor, or from a code in the sensor model number.
   
   To interpret the model number, refer to the product data sheet for your sensor.

2. Set **Sensor Liner Material** to the appropriate option.

### 5.6.4 Configure Sensor Flange Type

**Sensor Flange Type** lets you store your sensor’s flange type in transmitter memory. This parameter is not used in processing and is not required.

**Procedure**

1. Obtain your sensor’s flange type from the documents shipped with your sensor, or from a code in the sensor model number.

   To interpret the model number, refer to the product data sheet for your sensor.

2. Set **Sensor Flange Type** to the appropriate option.

### 5.6.5 Configure Descriptor

**Descriptor** lets you store a description in transmitter memory. The description is not used in processing and is not required.

**Procedure**

Enter a description for the transmitter or device

You can use up to 16 characters for the description.

### 5.6.6 Configure Message

**Display**

Not available

**ProLink III**

Device Tools → Configuration → Informational Parameters → Transmitter

**Field Communicator**

Configure → Manual Setup → Info Parameters → Transmitter Info → Descriptor
**Message** lets you store a short message in transmitter memory. This parameter is not used in processing and is not required.

**Procedure**

Enter a short message for the transmitter or device.
Your message can be up to 32 characters long.

### 5.6.7 Configure Date

**Display**

- **Not available**

**ProLink III**

Device Tools → Configuration → Informational Parameters → Transmitter

**Field Communicator**

Configure → Manual Setup → Info Parameters → Transmitter Info → Date

**Date** lets you store a static date (not updated by the transmitter) in transmitter memory. This parameter is not used in processing and is not required.

**Procedure**

Enter the date you want to use, in the form *mm/dd/yyyy*.

**Tip**

ProLink III provides a calendar tool to help you select the date.
6 Integrate the meter with the control system

6.1 Configure the transmitter channels

You can configure Channel B on your transmitter to operate as a Frequency Output or a Discrete Output. The channel configuration must match the wiring at the transmitter terminals.

**Prerequisites**
To avoid causing process errors:
- Configure the channels before configuring the outputs.
- Before changing the channel configuration, ensure that all control loops affected by the channel are under manual control.

**Procedure**
Set Channel B as desired.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Output</td>
<td>Channel B will operate as a Frequency Output.</td>
</tr>
<tr>
<td>Discrete Output</td>
<td>Channel B will operate as a Discrete Output.</td>
</tr>
</tbody>
</table>

**Postrequisites**
For each channel that you configured, perform or verify the corresponding input or output configuration. When the configuration of a channel is changed, the channel’s behavior will be controlled by the configuration that is stored for the selected input or output type, and the stored configuration may not be appropriate for your process.

After verifying channel and output configuration, return the control loop to automatic control.

6.2 Configure the mA Output

The mA Output is used to report the configured process variable. The mA Output parameters control how the process variable is reported.

Your transmitter has one mA Output: Channel A.

**Important**
Whenever you change an mA Output parameter, verify all other mA Output parameters before returning the meter to service. In some situations, the transmitter automatically loads a set of stored values, and these values may not be appropriate for your application.
6.2.1 Configure mA Output Process Variable

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → OFF-LINE CONFG → IO → CH A</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → I/O → Outputs → mA Output</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Inputs/Outputs → mA Output</td>
</tr>
</tbody>
</table>

Use **mA Output Process Variable** to select the variable that is reported over the mA Output. The mA and Frequency Outputs are configured independently. You can assign one process variable to the mA Output and a different process variable to 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.
- If you are using the HART variables, be aware that changing the configuration of **mA Output Process Variable** will change the configuration of the HART Primary Variable (PV) and/or the HART Secondary Variable (SV).
- If you are using the HART variables, be aware that changing the configuration of **mA Output Process Variable** will change the configuration of the HART Primary Variable (PV).
- If you have configured **Display Variable 1** to track **mA Output Process Variable**, be aware that changing the configuration of **mA Output Process Variable** will change the contents of **Display Variable 1**.

**Procedure**

Set **mA Output Process Variable** as desired.

The default setting is Mass Flow Rate.

**Postrequisites**

If you changed the setting of **mA Output Process Variable**, verify the settings of **Lower Range Value (LRV)** and **Upper Range Value (URV)**.

**Options for mA Output Process Variable**

The transmitter provides a basic set of options for **mA Output Process Variable**, plus several application-specific options. Different communications tools may use different labels for the options.

**Table 6-1: Standard mA Output process variables**

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>DENS</td>
<td>Density</td>
<td>Dens</td>
</tr>
<tr>
<td>Drive gain</td>
<td>DGAIN</td>
<td>Drive Gain</td>
<td>Driv signl</td>
</tr>
<tr>
<td>External pressure</td>
<td>EXT P</td>
<td>External Pressure</td>
<td>External pres</td>
</tr>
<tr>
<td>External temperature</td>
<td>EXT T</td>
<td>External Temperature</td>
<td>External temp</td>
</tr>
</tbody>
</table>
**Table 6-1: Standard mA Output process variables (continued)**

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas standard volume flow rate</td>
<td>GSV F</td>
<td>Gas Standard Volume Flow Rate</td>
<td>Gas vol flo</td>
</tr>
<tr>
<td>Mass flow rate</td>
<td>MFLOW</td>
<td>Mass Flow Rate</td>
<td>Mass flo</td>
</tr>
<tr>
<td>Temperature</td>
<td>TEMP</td>
<td>Temperature</td>
<td>Temp</td>
</tr>
<tr>
<td>Volume flow rate</td>
<td>VFLOW</td>
<td>Volume Flow Rate</td>
<td>Vol flo</td>
</tr>
</tbody>
</table>

**Table 6-2: Petroleum measurement mA Output process variables**

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average corrected density</td>
<td>AVE D</td>
<td>Average Density</td>
<td>TC Avg Dens</td>
</tr>
<tr>
<td>Average temperature</td>
<td>AVE T</td>
<td>Average Temperature</td>
<td>TC Avg Temp</td>
</tr>
<tr>
<td>Temperature-corrected (standard) volume flow rate</td>
<td>TCVOL</td>
<td>Volume Flow Rate at Reference Temperature</td>
<td>TC Vol</td>
</tr>
<tr>
<td>Temperature-corrected density</td>
<td>TCDEN</td>
<td>Density at Reference Temperature</td>
<td>TC Dens</td>
</tr>
</tbody>
</table>

**Table 6-3: Concentration measurement mA Output process variables**

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baume</td>
<td>BAUME</td>
<td>Baume</td>
<td>ED Dens (Baume)</td>
</tr>
<tr>
<td>Concentration</td>
<td>CONC</td>
<td>Concentration</td>
<td>ED Concentration</td>
</tr>
<tr>
<td>Density at reference</td>
<td>RDENS</td>
<td>Density at Reference Temperature</td>
<td>ED Dens at Ref</td>
</tr>
<tr>
<td>Net mass flow rate</td>
<td>NET M</td>
<td>Net Mass Flow Rate</td>
<td>ED Net Mass flo</td>
</tr>
<tr>
<td>Net volume flow rate</td>
<td>NET V</td>
<td>Net Volume Flow Rate</td>
<td>ED Net Vol flo</td>
</tr>
<tr>
<td>Specific gravity</td>
<td>SGU</td>
<td>Density (Fixed SG Units)</td>
<td>ED Dens (SGU)</td>
</tr>
<tr>
<td>Standard volume flow rate</td>
<td>STD V</td>
<td>Volume Flow Rate at Reference Temperature</td>
<td>ED Std Vol flo</td>
</tr>
</tbody>
</table>

**Table 6-4: Fuel consumption mA Output process variables**

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential mass flow</td>
<td>DFLOW</td>
<td>Differential Mass Flow Rate</td>
<td>Differential Mass Flow Rate</td>
</tr>
</tbody>
</table>
Table 6-5: PVR mA Output process variables

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncorrected oil flow</td>
<td>OIL</td>
<td>Oil Flow Rate At Line</td>
<td>Oil Flow Rate at Line</td>
</tr>
<tr>
<td>Uncorrected water cut</td>
<td>WATER%</td>
<td>Water Cut At Line</td>
<td>Water Cut at Line</td>
</tr>
<tr>
<td>Uncorrected water flow</td>
<td>WATER</td>
<td>Water Flow Rate At Line</td>
<td>Water Flow Rate at Line</td>
</tr>
<tr>
<td>Corrected oil flow</td>
<td>OIL60</td>
<td>Oil Flow Rate At Reference</td>
<td>Oil Flow Rate at Reference</td>
</tr>
<tr>
<td>Corrected water cut</td>
<td>WCT60%</td>
<td>Water Cut At Reference</td>
<td>Water Cut at Reference</td>
</tr>
<tr>
<td>Corrected water flow</td>
<td>WTR60</td>
<td>Water Flow Rate At Reference</td>
<td>Water Flow Rate at Reference</td>
</tr>
<tr>
<td>Shrinkage factor corrected net oil at line</td>
<td>SFOIL</td>
<td>SF Oil Flow Rate At Line</td>
<td>Shrinkage Factor Oil Flow Rate at Line</td>
</tr>
<tr>
<td>Shrinkage factor corrected net oil at 60F</td>
<td>SFO60</td>
<td>SF Oil Flow Rate At Reference</td>
<td>Shrinkage Factor Oil Flow Rate at Reference</td>
</tr>
<tr>
<td>Shrinkage factor corrected volume of mix at 60F</td>
<td>SFM60</td>
<td>SF Volume Flow Rate At Reference</td>
<td>Shrinkage Factor Volume Flow Rate at Reference</td>
</tr>
</tbody>
</table>

6.2.2 Configure Lower Range Value (LRV) and Upper Range Value (URV)

Display
- OFF-LINE MAINT → OFF-LINE CONFIG → IO → CH A → AO 4 mA
- OFF-LINE MAINT → OFF-LINE CONFIG → IO → CH A → AO 20 mA

ProLink III
Device Tools → Configuration → I/O → Outputs → mA Output 1

Field Communicator
- Configure → Manual Setup → Inputs/Outputs → mA Output → mA Output Settings → PV LRV
- Configure → Manual Setup → Inputs/Outputs → mA Output → mA Output Settings → PV URV

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 level.

**Prerequisites**

Ensure that **mA Output Process Variable** is set to the desired process variable. Each process variable has its own set of LRV and URV values. When you change the values of LRV and URV, you are configuring values for the currently assigned mA Output process variable.

Ensure that the measurement unit for the configured process variable has been set as desired.

**Note**

For transmitter software v5.0 and later, if you change LRV and URV from the factory default values, and you later change **mA Output Process Variable**, LRV and URV will not reset to the default values.

For example, if you set **mA Output Process Variable** to Mass Flow Rate and change the LRV and URV, then you set **mA Output Process Variable** to Density, and finally you change **mA Output Process Variable** back to...
Mass Flow Rate, LRV and URV for Mass Flow Rate reset to the values that you configured. In earlier versions of the transmitter software, LRV and URV reset to the factory default values.

**Procedure**

Set LRV and URV as desired.

- LRV is the value of mA Output Process Variable represented by an output of 4 mA. The default value for LRV depends on the setting of mA Output Process Variable. Enter LRV in the measurement units that are configured for mA Output Process Variable.

- URV is the value of mA Output Process Variable represented by an output of 20 mA. The default value for URV depends on the setting of mA Output Process Variable. Enter URV in the measurement units that are configured for mA Output Process Variable.

The mA Output uses a range of 4–20 mA to represent mA Output Process Variable. 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.

**Default values for Lower Range Value (LRV) and Upper Range Value (URV)**

Each option for mA Output Process Variable has its own LRV and URV. If you change the configuration of mA Output Process Variable, the corresponding LRV and URV are loaded and used.

**Table 6-6: Default values for Lower Range Value (LRV) and Upper Range Value (URV)**

<table>
<thead>
<tr>
<th>Process variable</th>
<th>LRV</th>
<th>URV</th>
</tr>
</thead>
<tbody>
<tr>
<td>All mass flow variables</td>
<td>−200.000 g/sec</td>
<td>200.000 g/sec</td>
</tr>
<tr>
<td>All liquid volume flow variables</td>
<td>−0.200 l/sec</td>
<td>0.200 l/sec</td>
</tr>
<tr>
<td>All density variables</td>
<td>0.000 g/cm³</td>
<td>10.000 g/cm³</td>
</tr>
<tr>
<td>All temperature variables</td>
<td>−240.000 °C</td>
<td>450.000 °C</td>
</tr>
<tr>
<td>Drive gain</td>
<td>0.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Gas standard volume flow</td>
<td>−423.78 SCFM</td>
<td>423.78 SCFM</td>
</tr>
<tr>
<td>External temperature</td>
<td>−240.000 °C</td>
<td>450.000 °C</td>
</tr>
<tr>
<td>External pressure</td>
<td>0.000 bar</td>
<td>100.000 bar</td>
</tr>
<tr>
<td>Concentration</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Baume</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Specific gravity</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

**6.2.3 Configure AO Cutoff**

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → I/O → Outputs → mA Output</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Inputs/Outputs → mA Output → mA Output Settings → MAO Cutoff</td>
</tr>
</tbody>
</table>
AO Cutoff (Analog Output Cutoff) specifies the lowest mass flow rate, volume flow rate, or gas standard volume flow rate that will be reported through the mA Output. Any flow rates below AO Cutoff will be reported as 0.

**Restriction**
AO Cutoff is applied only if mA Output Process Variable is set to Mass Flow Rate, Volume Flow Rate, or Gas Standard Volume Flow Rate. If mA Output Process Variable is set to a different process variable, AO Cutoff is not configurable, and the transmitter does not implement the AO cutoff function.

**Procedure**
Set AO Cutoff as desired.

The default value for AO Cutoff is 0.0 g/sec.

**Tip**
For most applications, the default value of AO Cutoff should be used. Contact customer service before changing AO Cutoff.

**Interaction between AO 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), AO 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.

**Example: Cutoff interaction**

Configuration:
- mA Output Process Variable = Mass Flow Rate
- Frequency Output Process Variable = Mass Flow Rate
- AO Cutoff = 10 g/sec
- Mass Flow Cutoff = 15 g/sec

Result: If the mass flow rate drops below 15 g/sec, all outputs representing mass flow will report zero flow.

**Example: Cutoff interaction**

Configuration:
- mA Output Process Variable = Mass Flow Rate
- Frequency Output Process Variable = Mass Flow Rate
- AO 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.
- If the mass flow rate drops below 10 g/sec, both outputs will report zero flow.
6.2.4 Configure Added Damping

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → I/O → Outputs → mA Output</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Inputs/Outputs → mA Output → mA Output Settings → PV Added Damping</td>
</tr>
</tbody>
</table>

**Added 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. **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 will reflect 63% of the change in the actual measured value.

**Added Damping** affects the reporting of **mA Output Process Variable** through the mA Output only. It does not affect the reporting of that process variable via any other method (e.g., a Frequency Output or digital communications), or the value of the process variable used in calculations.

**Note**
**Added Damping** is not applied if the mA Output is fixed (for example, during loop testing) or if the mA Output is reporting a fault. **Added Damping** is applied while sensor simulation is active.

**Procedure**

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

The default value is 0.0 seconds. The range is 0.0 to 440 seconds.

When you specify a value for **Added Damping**, the transmitter automatically rounds the value down to the nearest valid value.

**Note**
**Added Damping** values are affected by the setting of **Update Rate** and **100 Hz Variable**.

**Table 6-7: Valid values for Added Damping**

<table>
<thead>
<tr>
<th>Setting of Update Rate</th>
<th>Process variable</th>
<th>Update rate in effect</th>
<th>Valid values for Added Damping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>N/A</td>
<td>20 Hz</td>
<td>0.0, 0.1, 0.3, 0.75, 1.6, 3.3, 6.5, 13.5, 27.5, 55, 110, 220, 440</td>
</tr>
<tr>
<td>Special</td>
<td>100 Hz variable (if assigned to the mA Output)</td>
<td>100 Hz</td>
<td>0.0, 0.04, 0.12, 0.30, 0.64, 1.32, 2.6, 5.4, 11, 22, 44, 88, 176, 350</td>
</tr>
<tr>
<td></td>
<td>100 Hz variable (if not assigned to the mA Output) All other process variables</td>
<td>6.25 Hz</td>
<td>0.0, 0.32, 0.96, 2.40, 5.12, 10.56, 20.8, 43.2, 88, 176, 352</td>
</tr>
</tbody>
</table>

**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.

6.2.5 Configure mA Output Fault Action and mA Output Fault Level

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Fault Processing</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Inputs/Outputs → mA Output → MAO Fault Settings</td>
</tr>
</tbody>
</table>

**mA Output Fault Action** controls the behavior of the mA Output if the transmitter encounters an internal fault condition.

**Note**
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** to the desired value.
   The default setting is Downscale.

   **Restriction**
   If **Digital Communications Fault Action** is set to NAN (not a number), 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.

2. If you set **mA Output Fault Action** to Upscale or Downscale, set **mA Output Fault Level** as desired.

**Postrequisites**

**NOTICE**
If you set **mA Output Fault Action** or **Frequency Output Fault Action** to None, be sure to set **Digital Communications Fault Action** to None. If you do not, the output will not report actual process data, and this may result in measurement errors or unintended consequences for your process.

**Options for mA Output Fault Action and mA Output Fault Level**

<table>
<thead>
<tr>
<th>Option</th>
<th>mA Output behavior</th>
<th>mA Output Fault Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upscale</td>
<td>Goes to the configured fault level</td>
<td>Default: 22.0 mA Range: 21.0 to 24.0 mA</td>
</tr>
<tr>
<td>Option</td>
<td>mA Output behavior</td>
<td>mA Output Fault Level</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------------------------------------------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>Downslope (default)</td>
<td>Goes to the configured fault level</td>
<td>Default: 2.0 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Range: 1.0 to 3.6 mA</td>
</tr>
<tr>
<td>Internal Zero</td>
<td>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</td>
<td>Not applicable</td>
</tr>
<tr>
<td>None</td>
<td>Tracks data for the assigned process variable; no fault action</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### 6.3 Configure the Frequency Output

The Frequency Output is used to report a process variable. The Frequency Output parameters control how the process variable is reported. Your transmitter may have zero or one Frequency Output: Channel B can be configured as a Frequency Output or a Discrete Output. The default assignment for Channel B is Frequency Output.

**Important**

Whenever you change a Frequency Output parameter, verify all other Frequency Output parameters before returning the flowmeter to service. In some situations, the transmitter automatically loads a set of stored values, and these values may not be appropriate for your application.

#### 6.3.1 Configure Frequency Output Process Variable

**Frequency Output Process Variable** controls the variable that is reported over 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.
- If you are using the HART variables, be aware that changing the configuration of **Frequency Output Process Variable** will change the configuration of the HART Tertiary Variable (TV).

**Procedure**

Set **Frequency Output Process Variable** as desired.

The default setting is Mass Flow Rate.
Options for Frequency Output Process Variable

The transmitter provides a basic set of options for **Frequency Output Process Variable**, plus several application-specific options. Different communications tools may use different labels for the options.

**Table 6-8: Standard FO process variables**

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Display</th>
<th>Label</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas standard volume flow rate</td>
<td>GSV F</td>
<td>Gas Standard Volume Flow Rate</td>
<td>Gas vol flo</td>
<td></td>
</tr>
<tr>
<td>Mass flow rate</td>
<td>MFLOW</td>
<td>Mass Flow Rate</td>
<td>Mass flo</td>
<td></td>
</tr>
<tr>
<td>Volume flow rate</td>
<td>VFLOW</td>
<td>Volume Flow Rate</td>
<td>Vol flo</td>
<td></td>
</tr>
</tbody>
</table>

**Table 6-9: Petroleum measurement FO process variables**

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Display</th>
<th>Label</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature-corrected (standard) volume flow rate</td>
<td>TCVOL</td>
<td>Volume Flow Rate at Reference Temperature</td>
<td>TC Vol</td>
<td></td>
</tr>
</tbody>
</table>

**Table 6-10: Concentration measurement FO process variables**

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Display</th>
<th>Label</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net mass flow rate</td>
<td>NET M</td>
<td>Net Mass Flow Rate</td>
<td>ED Net Mass flo</td>
<td></td>
</tr>
<tr>
<td>Net volume flow rate</td>
<td>NET V</td>
<td>Net Volume Flow Rate</td>
<td>ED Net Vol flo</td>
<td></td>
</tr>
<tr>
<td>Standard volume flow rate</td>
<td>STD V</td>
<td>Volume Flow Rate at Reference Temperature</td>
<td>ED Std Vol flo</td>
<td></td>
</tr>
</tbody>
</table>

**Table 6-11: Fuel consumption FO process variables**

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Display</th>
<th>Label</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential mass flow</td>
<td></td>
<td>Differential Mass Flow Rate</td>
<td>Differential Mass Flow</td>
<td></td>
</tr>
</tbody>
</table>

6.3.2 Configure Frequency Output Polarity

Display

OFF-LINE MAINT → OFF-LINE CFG → IO → CH B → SET FO → FO POLAR

ProLink III

Device Tools → Configuration → I/O → Outputs → Frequency Output

Field Communicator

Configure → Manual Setup → Inputs/Outputs → Frequency Output → FO Settings → FO Polarity
**Frequency Output Polarity** controls how the output indicates the ON (active) state. The default value, Active High, is appropriate for most applications. Your receiving device might require an Active Low setting.

**Procedure**
Set **Frequency Output Polarity** as desired.
The default setting is Active High.

**Options for Frequency Output Polarity**

<table>
<thead>
<tr>
<th>Polarity option</th>
<th>Reference voltage (OFF)</th>
<th>Pulse voltage (ON)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active High</td>
<td>0</td>
<td>As determined by power supply, pull-up resistor, and load. See the installation manual for your transmitter.</td>
</tr>
<tr>
<td>Active Low</td>
<td>As determined by power supply, pull-up resistor, and load. See the installation manual for your transmitter.</td>
<td>0</td>
</tr>
</tbody>
</table>

---

6.3.3 Configure Frequency Output Scaling Method

**Display**
OFF-LINE MAINT → OFF-LINE CONFIG → IO → CH B → SET FO → FO SCALE

**ProLink III**
Device Tools → Configuration → I/O → Outputs → Frequency Output

**Field Communicator**
Configure → Manual Setup → Inputs/Outputs → Frequency Output → FO Scaling

**Frequency Output Scaling Method** defines the relationship between output pulse and flow units. Set **Frequency Output Scaling Method** as required by your frequency receiving device.

**Procedure**
1. Set **Frequency Output Scaling Method**.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency=Flow (default)</td>
<td>Frequency calculated from flow rate</td>
</tr>
<tr>
<td>Pulses/Unit</td>
<td>A user-specified number of pulses represents one flow unit</td>
</tr>
<tr>
<td>Units/Pulse</td>
<td>A pulse represents a user-specified number of flow units</td>
</tr>
</tbody>
</table>

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.
For all scaling methods, the transmitter puts out a fixed number of pulses per unit, and at the same time, the Frequency Output signal varies in proportion to flowrate.

**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:

  \[ \text{Frequency Factor} = \left( \frac{\text{Rate Factor}}{T} \right) \times N \]

  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 0 to 10,000 Hz:
  - If **Frequency Factor** is less than 1 Hz, reconfigure the receiving device for a higher pulses/unit setting.
  - If **Frequency Factor** is greater than 10,000 Hz, reconfigure the receiving device for a lower pulses/unit setting.

**6.3.4 Configure Frequency Output Fault Action and Frequency Output Fault Level**

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Fault Processing</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>• Configure → Manual Setup → Inputs/Outputs → Frequency Output → FO Fault Parameters → FO Fault Action</td>
</tr>
<tr>
<td></td>
<td>• Configure → Manual Setup → Inputs/Outputs → Frequency Output → FO Fault Parameters → FO Fault Level</td>
</tr>
</tbody>
</table>

**Frequency Output Fault Action** controls the behavior of the Frequency Output if the transmitter encounters an internal fault condition.

**Note**

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.
   - The default value is Downscale (0 Hz).

2. If you set **Frequency Output Fault Action** to Upscale, set **Frequency Fault Level** to the desired value.
   - The default value is 15000 Hz. The range is 10 to 15000 Hz.
### Options for Frequency Output Fault Action

#### Table 6-12: Options for Frequency Output Fault Action

<table>
<thead>
<tr>
<th>Label</th>
<th>Frequency Output behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upscale</td>
<td>Goes to configured Upscale value:</td>
</tr>
<tr>
<td></td>
<td>• Range: 10 Hz to 15000 Hz</td>
</tr>
<tr>
<td></td>
<td>• Default: 15000 Hz</td>
</tr>
<tr>
<td>Downscale</td>
<td>0 Hz</td>
</tr>
<tr>
<td>Internal Zero</td>
<td>0 Hz</td>
</tr>
<tr>
<td>None (default)</td>
<td>Tracks data for the assigned process variable; no fault action</td>
</tr>
</tbody>
</table>

**NOTICE**

If you set **mA Output Fault Action** or **Frequency Output Fault Action** to None, be sure to set **Digital Communications Fault Action** to None. If you do not, the output will not report actual process data, and this may result in measurement errors or unintended consequences for your process.

**Restriction**

If **Digital Communications Fault Action** is set to NAN (not a number), 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.

### 6.4 Configure the Discrete Output

The Discrete Output is used to report specific meter or process conditions. The Discrete Output parameters control which condition is reported and how it is reported. Your transmitter may have zero or one Discrete Output: Channel B can be configured as a Frequency Output or a Discrete Output.

**Restriction**

Before you can configure the Discrete Output, you must configure a channel to operate as a Discrete Output.

**Important**

Whenever you change a Discrete Output parameter, verify all other Discrete Output parameters before returning the meter to service. In some situations, the transmitter automatically loads a set of stored values, and these values may not be appropriate for your application.

### 6.4.1 Configure Discrete Output Source

<table>
<thead>
<tr>
<th>Display</th>
<th>Configuration Path</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>ProLink III</strong></td>
</tr>
<tr>
<td></td>
<td>Device Tools → Configuration → I/O → Outputs → Discrete Output</td>
</tr>
<tr>
<td></td>
<td><strong>Field Communicator</strong></td>
</tr>
<tr>
<td></td>
<td>Configure → Manual Setup → Inputs/Outputs → Discrete Output → DO Assignment</td>
</tr>
</tbody>
</table>
Discrete Output Source controls which device condition or process condition is reported via the Discrete Output.

**Procedure**

Set Discrete Output Source to the desired option.

The default setting for Discrete Output Source is Flow Direction.

### Options for Discrete Output Source

<table>
<thead>
<tr>
<th>Option</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
<th>State</th>
<th>Discrete Output voltage</th>
</tr>
</thead>
</table>
| Discrete Event 1–5      | D EV x  | Enhanced Event 1
Enhanced Event 2
Enhanced Event 3
Enhanced Event 4
Enhanced Event 5 | Discrete Event x | ON           | Site-specific    |
|                         |         |             |                    | OFF         | 0 V                      |
| Event 1–2               | EVNT1   | Event 1
Event 2
Event 1 or Event 2 Status | Event 1
Event 2
Event 1 or Event 2 | ON           | Site-specific    |
|                         | EVNT2   |             |                    | OFF         | 0 V                      |
|                         | E1OR2   |             |                    |             |                          |
| Flow Switch             | FL SW   | Flow Switch Indicator | Flow Switch | ON           | Site-specific    |
|                         |         |             |                    | OFF         | 0 V                      |
| Flow Direction          | FLDIR   | Forward/Reverse Indicator | Forward/Reverse | Forward flow | 0 V                      |
|                         |         |             |                    | Reverse flow | Site-specific |
| Calibration in Progress | ZERO    | Calibration in Progress | Calibration in Progress | ON           | Site-specific    |
|                         |         |             |                    | OFF         | 0 V                      |
|Fault                   | FAULT   | Fault Indication | Fault             | ON           | Site-specific    |
|                         |         |             |                    | OFF         | 0 V                      |

(1) Events configured using the enhanced event model.
(2) Events configured using the basic event model.

**Important**

If you assign Flow Switch to the Discrete Output, you should also configure Flow Switch Variable, Flow Switch Setpoint, and Hysteresis.

**Related information**

Configure an enhanced event
Fault indication with a Discrete Output

**Configure Flow Switch parameters**

Display

OFF-LINE MAINT → OFF-LINE CONFIG → IO → CH B → SET DO → CONFIG FL SW
Flow Switch is used to indicate that the flow rate (measured by the configured flow variable) has moved past the configured setpoint, in either direction. The flow switch is implemented with a user-configurable hysteresis.

**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 switch.
3. Set **Flow Switch Setpoint** to the value at which the flow switch will be triggered (after **Hysteresis** is applied).
   - 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 switch will not change. The default is 5%. The valid range is 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.

**6.4.2 Configure Discrete Output Polarity**

Discrete Outputs have two states: ON (active) and OFF (inactive). Two different voltage levels are used to represent these states. **Discrete Output Polarity** controls which voltage level represents which state.

**Procedure**

Set **Discrete Output Polarity** as desired.

The default setting is Active High.
Options for Discrete Output Polarity

<table>
<thead>
<tr>
<th>Polarity option</th>
<th>Description</th>
</tr>
</thead>
</table>
| Active High    | • When asserted (condition tied to DO is true), the circuit provides a pull-up to 24 V.  
                | • When not asserted (condition tied to DO is false), the circuit provides 0 V. |
| Active Low     | • When asserted (condition tied to DO is true), the circuit provides 0 V.  
                | • When not asserted (condition tied to DO is false), the circuit provides a pull-up to 24 V. |

6.4.3 Configure Discrete Output Fault Action

Discrete Output Fault Action controls the behavior of the Discrete Output if the transmitter encounters an internal fault condition.

**Note**

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 Fault Action 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, set Discrete Output Source to Fault and set Discrete Output Fault Action to None.

**Procedure**

Set Discrete Output Fault Action as desired.

The default setting is None.

**Related information**

Fault indication with a Discrete Output

Options for Discrete Output Fault Action

<table>
<thead>
<tr>
<th>Label</th>
<th>Discrete Output behavior</th>
</tr>
</thead>
</table>
| Upscale   | • Fault: Discrete Output is ON (site-specific voltage)  
            | • No fault: Discrete Output is controlled by its assignment |
| Downscale | • Fault: Discrete Output is OFF (0 V)  
<pre><code>        | • No fault: Discrete Output is controlled by its assignment |
</code></pre>
<table>
<thead>
<tr>
<th>Label</th>
<th>Discrete Output behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (default)</td>
<td>Discrete Output is controlled by its assignment</td>
</tr>
</tbody>
</table>

**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.

### 6.5 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.

Your transmitter supports two event models:
- Basic event model
- Enhanced event model

#### 6.5.1 Configure a basic event

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Events → Basic Events</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Not available</td>
</tr>
</tbody>
</table>

A basic event is used to provide notification of process changes. A basic 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. You can define up to two basic events. Event status can be queried via digital communications, and a Discrete Output can be configured to report event status.

**Procedure**

1. Select the event that you want to configure.
2. Specify **Event Type**.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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. |

3. Assign a process variable to the event.
4. Set a value for **Setpoint A**.
5. Optional: Configure a Discrete Output to switch states in response to the event status.
6.5.2 Configure an enhanced event

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Events → Enhanced Events</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Alert Setup → Discrete Events</td>
</tr>
</tbody>
</table>

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.

**Procedure**

1. Select the event that you want to configure.
2. Specify **Event Type**.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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     | \( A \leq x \leq B \)  
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    | \( x \leq A \) or \( x \geq B \)  
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. |

3. Assign a process variable to the event.
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.
   - With the display: **OFF-LINE MAINT** → **OFF-LINE CFG** → **IO** → **CH C** → **SET DI** → **DI ACT**
   - With ProLink III: **Device Tools** → **Configuration** → **I/O** → **Action Assignment**
   - With a field communicator: **Configure** → **Alert Setup** → **Discrete Events** → **Assign Discrete Action**
## Options for Enhanced Event Action

<table>
<thead>
<tr>
<th>Action</th>
<th>Label</th>
<th>Display</th>
<th>ProLink III</th>
<th>Field Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None (default)</td>
<td>NONE</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Start sensor zero</td>
<td>START ZERO</td>
<td>Start Sensor Zero</td>
<td>Perform auto zero</td>
<td></td>
</tr>
<tr>
<td>Start/stop all totalizers</td>
<td>START STOP</td>
<td>Start/Stop All Totalization</td>
<td>Start/stop totals</td>
<td></td>
</tr>
<tr>
<td>Reset mass total</td>
<td>RESET MASS</td>
<td>Reset Mass Total</td>
<td>Reset mass total</td>
<td></td>
</tr>
<tr>
<td>Reset volume total</td>
<td>RESET VOL</td>
<td>Reset Volume Total</td>
<td>Reset volume total</td>
<td></td>
</tr>
<tr>
<td>Reset gas standard volume total</td>
<td>RESET GSVT</td>
<td>Reset Gas Std Volume Total</td>
<td>Reset gas standard volume total</td>
<td></td>
</tr>
<tr>
<td>Reset all totals</td>
<td>RESET ALL</td>
<td>Reset All Totals</td>
<td>Reset totals</td>
<td></td>
</tr>
<tr>
<td><strong>Petroleum measurement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reset volume total at reference temperature</td>
<td>TCVOL</td>
<td>Reset Volume Total at Reference Temperature</td>
<td>Reset corrected volume total</td>
<td></td>
</tr>
<tr>
<td><strong>Concentration measurement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reset CM reference volume total</td>
<td>RESET STD V</td>
<td>Reset Volume Total at Reference Temperature</td>
<td>Not available</td>
<td></td>
</tr>
<tr>
<td>Reset CM net mass total</td>
<td>RESET NET M</td>
<td>Reset Net Mass Total</td>
<td>Not available</td>
<td></td>
</tr>
<tr>
<td>Reset CM net volume total</td>
<td>RESET NET V</td>
<td>Reset Net Volume Total</td>
<td>Not available</td>
<td></td>
</tr>
<tr>
<td>Increment CM matrix</td>
<td>INCr CURVE</td>
<td>Increment Concentration Matrix</td>
<td>Not available</td>
<td></td>
</tr>
<tr>
<td><strong>Meter verification</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start meter verification test</td>
<td>START VERFY</td>
<td>Start Meter Verification</td>
<td>Not available</td>
<td></td>
</tr>
</tbody>
</table>

**Note**
Before assigning actions to an enhanced event, check the status of the event. If it is ON, all assigned actions will be performed when the new configuration is implemented. If this is not acceptable, wait until an appropriate time to assign actions to the event.

### 6.6 Configure digital communications

The digital communications parameters control how the transmitter will communicate using digital communications.

Your transmitter supports the following types of digital communications:

- HART/Bell 202 over the primary mA terminals
- HART/RS-485 over the RS-485 terminals
- Modbus/RS-485 over the RS-485 terminals
- Modbus RTU via the service port
6.6.1 Configure HART/Bell 202 communications

HART/Bell 202 communications parameters support HART communications with the transmitter's primary mA terminals over a HART/Bell 202 network.

Configure basic HART parameters

Basic HART parameters include the HART address, HART tags, and the operation of the primary mA Output.

HART/Bell 202 communications parameters support HART communication with the transmitter's primary mA terminals over a HART/Bell 202 network. The HART/Bell 202 communications parameters include:

- HART Address (Polling Address)
- mA Output Action
- Burst Parameters (optional)
- HART Variables (optional)

Procedure

1. Set HART Address to a value that is unique on your network.
   - Default: 0
   - Range: 0 to 15
   - Tip
     - The default address is typically used unless you are in a multidrop environment.
     - Devices using HART protocol to communicate with the transmitter may use either HART Address or HART Tag (Software Tag) to identify the transmitter. Configure either or both, as required by your other HART devices.

2. Ensure that mA Output Action is configured appropriately.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled (Live)</td>
<td>The primary mA Output reports process data as configured.</td>
</tr>
<tr>
<td>Disabled (Fixed)</td>
<td>The primary mA Output is fixed at 4 mA and does not report process data.</td>
</tr>
</tbody>
</table>

Important

If you use ProLink III to set HART Address to 0, the program automatically enables mA Output Action. If you use ProLink III to set HART Address to any other value, the program automatically disables mA Output Action. This is designed to make it easier to configure the transmitter for legacy behavior. Always verify mA Output Action after setting HART Address.

Configure burst parameters

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>Not available</td>
</tr>
</tbody>
</table>
Burst mode is a mode of communication during which the transmitter regularly broadcasts HART digital information over the mA Output. The burst parameters control the information that is broadcast when burst mode is enabled.

**Tip**
In typical installations, burst mode is disabled. Enable burst mode only if you are using a HART Triloop.

**Procedure**
1. Enable **Burst Mode**.
2. Set **Burst Mode Output** as desired.

<table>
<thead>
<tr>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source (Primary Variable)</td>
<td>The transmitter sends the primary variable (PV) in the configured measurement units in each burst (e.g., 14.0 g/sec, 13.5 g/sec, 12.0 g/sec.</td>
</tr>
<tr>
<td>Primary Variable (Percent Range/Current)</td>
<td>The transmitter sends the PV's percent of range and the PV's actual mA level in each burst (e.g., 25%, 11.0 mA.</td>
</tr>
<tr>
<td>Process Variables/Current</td>
<td>The transmitter sends PV, SV, TV, and QV values in measurement units and the PV's actual milliamp reading in each burst (e.g., 50 g/sec, 23 °C, 50 g/sec, 0.0023 g/cm³, 11.8 mA.</td>
</tr>
<tr>
<td>Transmitter variables</td>
<td>The transmitter sends four user-specified process variables in each burst.</td>
</tr>
</tbody>
</table>

3. Ensure that the burst output variables are set appropriately.
   - If you set **Burst Mode Output** to send four user-specified variables, set the four process variables to be sent in each burst.
   - If you set **Burst Mode Output** to any other option, ensure that the HART variables are set as desired.

**Configure HART variables (PV, SV, TV, QV)**

<table>
<thead>
<tr>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>Not available</td>
</tr>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Communications → Communications (HART)</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Inputs/Outputs → Communications → Set Up Burst Mode</td>
</tr>
</tbody>
</table>

The HART variables are a set of four variables predefined for HART use. The HART variables include the Primary Variable (PV), Secondary Variable (SV), Tertiary Variable (TV), and Quaternary Variable (QV). You can assign specific process variables to the HART variables, and then use standard HART methods to read or broadcast the assigned process data.

**Tip**
The Tertiary Variable and Quaternary Variable are also called the Third Variable (TV) and Fourth Variable (FV).
## Options for HART variables

### Table 6-13: Standard HART process variables

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Primary Variable (PV)</th>
<th>Secondary Variable (SV)</th>
<th>Third Variable (TV)</th>
<th>Fourth Variable (QV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board Temperature</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Density</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Drive Gain</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>External Pressure</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>External Temperature</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Gas Standard Volume Flow Rate</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Gas Standard Volume Inventory</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Gas Standard Volume Total</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Line (Gross) Volume Flow Rate</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Line (Gross) Volume Inventory</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Line (Gross) Volume Total</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Live Zero</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>LPO Amplitude</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Mass Flow Rate</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Mass Inventory</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Mass Total</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Meter Temperature (T-Series)</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>RPO Amplitude</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Temperature</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Tube Frequency</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

### Table 6-14: Petroleum measurement HART process variables

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Primary Variable (PV)</th>
<th>Secondary Variable (SV)</th>
<th>Third Variable (TV)</th>
<th>Fourth Variable (QV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>API Average Density</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>API Average Temperature</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>API Corrected Volume Flow</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>API Corrected Volume Inventory</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>API Corrected Volume Total</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>API CTL</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>API Density At Reference</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
Table 6-15: Concentration measurement HART process variables

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Primary Variable (PV)</th>
<th>Secondary Variable (SV)</th>
<th>Third Variable (TV)</th>
<th>Fourth Variable (QV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM Baume (700 core processor only)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CM Concentration</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CM Density at Reference</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CM Net Mass Flow</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CM Net Mass Inventory</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CM Net Mass Total</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CM Net Volume Flow</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CM Net Volume Inventory</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CM Net Volume Total</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CM Specific Gravity</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CM Standard Volume Flow</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CM Standard Volume Inventory</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CM Standard Volume Total</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 6-16: Fuel consumption HART process variables

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Primary Variable (PV)</th>
<th>Secondary Variable (SV)</th>
<th>Third Variable (TV)</th>
<th>Fourth Variable (QV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential mass flow</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Differential mass inventory</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Differential mass total</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 6-17: PVR-only HART process variables

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Primary Variable (PV)</th>
<th>Secondary Variable (SV)</th>
<th>Third Variable (TV)</th>
<th>Fourth Variable (QV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Oil Flow</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Corrected Oil Total</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Corrected Water Cut</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Corrected Water Flow</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Corrected Water Total</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Density of Oil @ Line Fixd degAPI</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Density of Oil @ Line Fixd SGU</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Oil Total @ Line</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Shrinkage Factor Corrected Oil Flow @ 60F</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Shrinkage Factor Corrected Oil Flow @ Line</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
## Table 6-17: PVR-only HART process variables (continued)

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Primary Variable (PV)</th>
<th>Secondary Variable (SV)</th>
<th>Third Variable (TV)</th>
<th>Fourth Variable (QV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrinkage Factor Corrected Oil Total @ 60F</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Shrinkage Factor Corrected Oil Total @ Line</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Shrinkage Factor Corrected Total of Mix @ 60F</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Shrinkage Factor Corrected Volume Of Mix @ 60F</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Uncorrected Oil Flow</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Uncorrected Water Cut</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Uncorrected Water Flow</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Volume Flow of Mix at Line</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Volume Total Of Mix @ Line</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Water Total @ Line</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

## Table 6-18: TMR-only HART process variables

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Primary Variable (PV)</th>
<th>Secondary Variable (SV)</th>
<th>Third Variable (TV)</th>
<th>Fourth Variable (QV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remediated Mass Flow</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Remediated Mass Total</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Remediated Mass Inventory</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

## Table 6-19: PVR- and TBR-only HART process variables

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Primary Variable (PV)</th>
<th>Secondary Variable (SV)</th>
<th>Third Variable (TV)</th>
<th>Fourth Variable (QV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unremediated Density</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

## Table 6-20: PVR, TBR, and TMR HART process variables

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Primary Variable (PV)</th>
<th>Secondary Variable (SV)</th>
<th>Third Variable (TV)</th>
<th>Fourth Variable (QV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Remediated Time</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

## Interaction of HART variables and transmitter outputs

The HART variables are automatically reported through specific transmitter outputs. They may also be reported through HART burst mode, if enabled on your transmitter.

## Table 6-21: HART variables and transmitter outputs

<table>
<thead>
<tr>
<th>HART variable</th>
<th>Reported via</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Variable (PV)</td>
<td>Primary mA output</td>
<td>If one assignment is changed, the other is changed automatically, and vice versa.</td>
</tr>
</tbody>
</table>
### Table 6-21: HART variables and transmitter outputs (continued)

<table>
<thead>
<tr>
<th>HART variable</th>
<th>Reported via</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary Variable (SV)</td>
<td>Not associated with an output</td>
<td>The SV must be configured directly, and the value of the SV is available only via digital communications.</td>
</tr>
<tr>
<td>Tertiary Variable (TV)</td>
<td>Frequency Output (if present on your transmitter)</td>
<td>If one assignment is changed, the other is changed automatically, and vice versa. If your transmitter does not have a Frequency Output, the TV must be configured directly, and the value of the TV is available only via digital communications.</td>
</tr>
<tr>
<td>Quaternary Variable (QV)</td>
<td>Not associated with an output</td>
<td>The QV must be configured directly, and the value of the QV is available only via digital communications.</td>
</tr>
</tbody>
</table>

### 6.6.2 Configure HART/RS-485 communications

<table>
<thead>
<tr>
<th>Display</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Communications → Communications (HART)</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Inputs/Outputs → Communications → HART Communications</td>
</tr>
</tbody>
</table>

HART/RS-485 communications parameters support HART communication with the transmitter’s RS-485 terminals.

HART/RS-485 communication parameters include:

- **Protocol**
- **HART Address** (Polling Address)
- **Parity, Stop Bits, and Baud Rate**

**Restriction**

The transmitter uses the same RS-485 terminals for HART/RS-485, Modbus RTU, and Modbus ASCII communications. All RS-485 connection requests must use the same protocol and connection parameters that are configured in the transmitter.

**Procedure**

1. Set **Protocol** to HART RS-485.
2. Set **Baud Rate** to match the baud rate that will be used by your HART master.
3. Set **Parity** to match the parity that will be used by your HART master.
4. Set **Stop Bits** to match the stop bits setting that will be used by your HART master.
5. Set **HART Address** to a unique value on your network.
   - Valid address values are between 0 and 15. The default address (0) is typically used unless you are in a multidrop environment.

**Tip**

Devices using HART protocol to communicate with the transmitter may use either **HART Address** or **HART Tag (Software Tag)** to identify the transmitter. Configure either or both, as required by your other HART devices.
6.6.3 Configure Modbus/RS-485 communications

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → OFF-LINE CFG → COMM</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Communications → RS-485 Terminals</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Inputs/Outputs → Communications → Set Up RS-485 Port</td>
</tr>
</tbody>
</table>

Modbus/RS-485 communications parameters control Modbus communication with the transmitter’s RS-485 terminals.

**Procedure**

1. Set **Protocol** to match the protocol used by your Modbus/RS-485 host.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modbus RTU (default)</td>
<td>8-bit communications</td>
</tr>
<tr>
<td>Modbus ASCII</td>
<td>7-bit communications</td>
</tr>
</tbody>
</table>

2. Set **Modbus Address** to a unique value on the network.
3. Set **Parity**, **Stop Bits**, and **Baud Rate** as appropriate for your network.
4. Set **Floating-Point Byte Order** to match the byte order used by your Modbus host.

<table>
<thead>
<tr>
<th>Code</th>
<th>Byte order</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1–2 3–4</td>
</tr>
<tr>
<td>1</td>
<td>3–4 1–2</td>
</tr>
<tr>
<td>2</td>
<td>2–1 4–3</td>
</tr>
<tr>
<td>3</td>
<td>4–3 2–1</td>
</tr>
</tbody>
</table>

See the following table for the bit structure of bytes 1 through 4.

**Table 6-22: Bit structure of floating-point bytes**

<table>
<thead>
<tr>
<th>Byte</th>
<th>Bits</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SEEEEEEE</td>
<td>S=Sign E=Exponent</td>
</tr>
<tr>
<td>2</td>
<td>EMMMMMMM</td>
<td>E=Exponent M=Mantissa</td>
</tr>
<tr>
<td>3</td>
<td>MMMMMMMM</td>
<td>M=Mantissa</td>
</tr>
<tr>
<td>4</td>
<td>MMMMMMMM</td>
<td>M=Mantissa</td>
</tr>
</tbody>
</table>

5. (Optional) Set **Additional Communications Response Delay** in delay units.

A delay unit is 2/3 of the time required to transmit one character, as calculated for the port currently in use and the character transmission parameters. Valid values range from 1 to 255.
**Additional Communications Response Delay** is used to synchronize Modbus communications with hosts that operate at a slower speed than the transmitter. The value specified here will be added to each response the transmitter sends to the host.

**Tip**
Do not set **Additional Communications Response Delay** unless required by your Modbus host.

### 6.6.4 Configure Digital Communications Fault Action

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Fault Processing</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Alert Setup → I/O Fault Actions → Comm Fault Action</td>
</tr>
</tbody>
</table>

**Digital Communications Fault Action** specifies the values that will be reported via digital communications if the device encounters an internal fault condition.

**Procedure**
Set **Digital Communications Fault Action** as desired.
The default setting is None.

**Restriction**
- If **mA Output Fault Action** or **Frequency Output Fault Action** is set to None, **Digital Communications Fault Action** should also be set to None. If you do not, the output will not report actual process data, and this may result in measurement errors or unintended consequences for your process.
- If you set **Digital Communications 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.

### Options for Digital Communications Fault Action

<table>
<thead>
<tr>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
</table>
| Upscale        | • Process variable values indicate that the value is greater than the upper sensor limit.  
                 • Totalizers stop incrementing. |
| Downscale      | • Process variable values indicate that the value is lower than the lower sensor limit.  
                 • Totalizers stop incrementing. |
<table>
<thead>
<tr>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Field Communicator</td>
</tr>
<tr>
<td>Zero</td>
<td>IntZero-All 0</td>
</tr>
<tr>
<td></td>
<td>• Flow rate variables go to the value that represents a flow rate of 0 (zero).</td>
</tr>
<tr>
<td></td>
<td>• Density is reported as 0.</td>
</tr>
<tr>
<td></td>
<td>• Temperature is reported as 0 °C, or the equivalent if other units are used (e.g., 32 °F).</td>
</tr>
<tr>
<td></td>
<td>• Drive gain is reported as measured.</td>
</tr>
<tr>
<td></td>
<td>• Totalizers stop incrementing.</td>
</tr>
<tr>
<td>Not a Number</td>
<td>Not-a-Number</td>
</tr>
<tr>
<td></td>
<td>• Process variables are reported as IEEE NAN.</td>
</tr>
<tr>
<td></td>
<td>• Drive gain is reported as measured.</td>
</tr>
<tr>
<td></td>
<td>• Modbus scaled integers are reported as Max Int.</td>
</tr>
<tr>
<td></td>
<td>• Totalizers stop incrementing.</td>
</tr>
<tr>
<td>Flow to Zero</td>
<td>IntZero-Flow 0</td>
</tr>
<tr>
<td></td>
<td>• Flow rates are reported as 0.</td>
</tr>
<tr>
<td></td>
<td>• Other process variables are reported as measured.</td>
</tr>
<tr>
<td></td>
<td>• Totalizers stop incrementing.</td>
</tr>
<tr>
<td>None</td>
<td>None (default)</td>
</tr>
<tr>
<td></td>
<td>• All process variables are reported as measured.</td>
</tr>
<tr>
<td></td>
<td>• Totalizers increment if they are running.</td>
</tr>
</tbody>
</table>

**NOTICE**

If you set mA Output Fault Action or Frequency Output Fault Action to None, be sure to set Digital Communications Fault Action to None. If you do not, the output will not report actual process data, and this may result in measurement errors or unintended consequences for your process.

**Restriction**

If Digital Communications Fault Action is set to NAN (not a number), 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.
7 Complete the configuration

7.1 Test or tune the system using sensor simulation

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.

Prerequisites
Before enabling sensor simulation, ensure that your process can tolerate the effects of the simulated process values.

Restriction
Sensor simulation is available only on flow meters with the enhanced core processor.

Procedure

1. Navigate to the sensor simulation menu.

<table>
<thead>
<tr>
<th>Communications tool</th>
<th>Menu path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>Not available</td>
</tr>
<tr>
<td>ProLink III</td>
<td>Device Tools → Diagnostics → Testing → Sensor Simulation</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Service Tools → Simulate → Simulate Sensor</td>
</tr>
</tbody>
</table>

2. Enable sensor simulation.

3. For mass flow, set Wave Form as desired and enter the required values.

<table>
<thead>
<tr>
<th>Option</th>
<th>Required values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>Fixed Value</td>
</tr>
<tr>
<td>Sawtooth</td>
<td>Period</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td>Sine</td>
<td>Period</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
</tr>
</tbody>
</table>

4. For density, set Wave Form as desired and enter the required values.

<table>
<thead>
<tr>
<th>Option</th>
<th>Required values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>Fixed Value</td>
</tr>
<tr>
<td>Sawtooth</td>
<td>Period</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
</tr>
</tbody>
</table>
5. For temperature, set **Wave Form** as desired and enter the required values.

<table>
<thead>
<tr>
<th>Option</th>
<th>Required values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sine</td>
<td>Period, Minimum, Maximum</td>
</tr>
</tbody>
</table>

6. Observe the system response to the simulated values and make any appropriate changes to the transmitter configuration or to the system.

7. Modify the simulated values and repeat.

8. When you have finished testing or tuning, disable sensor simulation.

### 7.1.1 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).
7.2 Back up transmitter configuration

ProLink III provides a configuration upload/download function which allows you to save configuration sets to your PC. This allows you to back up and restore your transmitter configuration. This is also a convenient way to replicate a configuration across multiple devices.

**Restriction**
This function is not available with any other communications tools.

**Procedure**

To back up the transmitter configuration using ProLink III:

a) Choose Device Tools → Configuration Transfer → Save or Load Configuration Data.

b) In the Configuration group box, select the configuration data you want to save.

c) Click Save, then specify a file name and location on your computer.

d) Click Start Save.

The backup file is saved to the specified name and location. It is saved as a text file and can be read using any text editor.

7.3 Enable write-protection on the transmitter configuration

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → CONFIG → LOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Write-Protection</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Info Parameters → Transmitter Info → Write Protect</td>
</tr>
</tbody>
</table>

If the transmitter is write-protected, the configuration is locked and nobody can change it until it is unlocked. This prevents accidental or unauthorized changes to the transmitter configuration parameters.
8 Set up the Weights & Measures application

Information in this chapter is applicable only if your transmitter was ordered with the Weights & Measures application.

8.1 Weights & Measures application

The Weights & Measures application is used to provide process data that is legal for custody transfer applications when an approved method is used to read or obtain the measurement.

Regulatory agencies

When installed, configured, and used as recommended by Micro Motion, the Weights & Measures application is certified by the following regulatory agencies:

- NTEP (National Type Evaluation Program). NTEP requirements apply in the U.S.A. and Canada.
- OIML (Organization of Legal Metrology). OIML requirements apply in all other world areas.

Depending on the regulatory agency that governs your installation, different setup, configuration, and operation methods are applicable.

Secured vs. unsecured

When the Weights & Measures application is installed, the transmitter is always “secured” or “unsecured.” The transmitter leaves the factory in unsecured mode, with Status Alarm A027: Security Breach active. Additionally, flow measurement may be disabled. Measurement data from an unsecured transmitter cannot be used for custody transfer applications.

To clear the alarm and enable flow measurement, you must configure the Weights & Measures application and secure the transmitter. When the transmitter is secured, the alarm is cleared and flow measurement is enabled automatically.

Security types and requirements

Before using the transmitter for Weights & Measures measurement, both metrological security and physical security must be implemented.

Metrological security

Metrological security protects the transmitter from all changes that would affect measurement. This includes changes to configuration and some maintenance procedures. Micro Motion implements metrological security via “software security.” Software security is a setting inside the transmitter that programmatically disables the prohibited actions. Software security can be enabled or disabled from ProLink III. Practically speaking, software security provides complete protection against unauthorized changes or actions.

Physical security

Physical security is implemented by a seal installed by a certified Weights & Measures inspector. The seal prevents access to the service port terminals. Although the seal can be broken easily, it cannot be replaced by anybody other than a Weights & Measures inspector. This makes it easy to detect that security has been violated. If the seal is not intact, transmitter measurements are not valid for custody transfer.

Configuration methods

You must use ProLink III and a service port connection to configure the Weights & Measures parameters.
8.2 Set up the Weights & Measures application using ProLink III

When your transmitter is set up to comply with OIML or NTEP requirements, and the transmitter is secured, selected measurement data from the transmitter is approved for Weights & Measures applications.

Prerequisites

---

**Important**

Review the Weights & Measures requirements for your location and ensure that you are complying with all local requirements as well as the OIML or NTEP requirements.

If necessary for your installation, arrange for a site visit by a certified Weights & Measures inspector, and ensure that the inspector is present for the appropriate portions of this procedure.

Ensure that the transmitter is ready to be secured, i.e., it is configured as desired and you have performed all appropriate tests and adjustments. After the transmitter is secured, you cannot make any changes to configuration, many maintenance actions are disallowed, and some operator actions are disallowed.

Procedure

1. Make a service port connection from ProLink III to your transmitter.

2. Choose **Device Tools** → **Configuration** → **Weights & Measures** and set **Regulatory Agency** to the appropriate regulatory agency for your application.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NTEP</td>
<td>Regulatory agency for the U.S.A. and Canada</td>
</tr>
<tr>
<td>OIML</td>
<td>Regulatory agency for all other world areas</td>
</tr>
</tbody>
</table>

3. Choose **Device Tools** → **Configuration** → **Totalizer Control Methods** and set totalizer control methods as desired.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reset Totalizers from Display</td>
<td>• Enabled: You can reset totalizers from the display, whether or not the transmitter is secured.</td>
</tr>
<tr>
<td></td>
<td>• Disabled: You can reset totalizers from the display only when the transmitter is unsecured.</td>
</tr>
<tr>
<td>Reset Totalizers via Remote Communications</td>
<td>• Enabled: You can reset totalizers using digital communications, whether or not the transmitter is secured.</td>
</tr>
<tr>
<td></td>
<td>• Disabled: You can reset totalizers using digital communications only when the transmitter is unsecured.</td>
</tr>
</tbody>
</table>

*Digital communications* refers to any method that uses Modbus or HART communications to interact with the transmitter. This includes ProLink III, the Field Communicator, and any host.

4. If required for your installation, choose **Device Tools** → **Configuration** → **Transmitter Display** → **Display Security**, then enable and configure a password for the alarm menu.

   Security for the alarm menu is required under German law for PTB-type approval for gas applications.
5. If required for your installation, choose **Device Tools → Device Information**, then read and record the firmware checksum values for the transmitter and the core processor.

The checksum values for the transmitter firmware and the core processor firmware must be read during meter commissioning to meet Weights & Measures requirements for gas applications in Germany. They may also be useful for MID/Welmec 7.2 test reports.

6. If required for your installation, monitor the zero value of your system:
   a) Choose **Device Tools → Configuration → Transmitter Display → Display Variables** and configure **Field Verification Zero (FVZ)** as a display variable.
   b) At the transmitter display, read and record the current value of **FVZ**.

**FVZ** is a diagnostic variable that monitors the zero value over a period of 3 minutes. It must be read during meter commissioning to comply with MID requirements for Weights & Measures applications in Measuring Instrument Directive (MID) 2004/22/EC. Refer to your Standard Operating Procedures documentation for detailed instructions.


**Important**  
Depending on local requirements, this step may need to be witnessed by a certified Weights & Measures inspector.

After this step, the transmitter is in a condition of metrological security (measurement security). The transmitter performs the following actions:

- Securing all measurement parameters. You can read the current configurations but you cannot change them.

8. Install the physical seal.

**Important**  
In most installations, the physical seal is a wire seal that must be installed by a certified Weights & Measures inspector. The seal is provided by the inspector. The physical seal is inserted through the locking clamps on the transmitter (if available on your transmitter).
Figure 8-1: Example of locking clamp and seal on transmitter
9 Transmitter operation

9.1 Record the process variables

Micro Motion suggests that you make a record of specific process variable measurements, including the acceptable range of measurements, under normal operating conditions. This data will help you recognize when the process or diagnostic variables are unusually high or low, and may help you diagnose and troubleshoot application issues.

**Procedure**

Record the following process and diagnostic variables, under normal operating conditions.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Typical average</th>
<th>Typical high</th>
<th>Typical low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tube frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickoff voltage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drive gain</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9.2 View process variables

**Display**

Scroll to the desired process variable. If **AutoScroll** is enabled, you can wait until the process variable is displayed. See **View process variables using the display** for more information.

**ProLink III**

View the desired variable on the main screen under **Process Variables**. See **View process variables and other data using ProLink III** for more information.

**Field Communicator**

Overview → Shortcuts → Variables → Process Variables

Process variables provide information about the state of the process fluid, such as flow rate, density, and temperature, as well as running totals. Process variables can also provide data about flowmeter operation, such as drive gain and pickoff voltage. This information can be used to understand and troubleshoot your process.

9.2.1 View process variables using the display

**Procedure**

View the desired process variables.

The display shows the configured display variables. For each display variable, the display reports the abbreviated name of the process variable (for example, DENS for density), the current value of that process variable, and the associated unit of measure (for example, G/CM3).
If Auto Scroll is enabled, the display cycles through the display variables, showing each display variable for a user-specified number of seconds. Whether or not Auto Scroll is enabled, you can activate Select to move to the next display variable.

Figure 9-1: Transmitter display features

A. Status LED  
B. Display (LCD panel)  
C. Process variable  
D. Scroll optical switch  
E. Optical switch indicator: turns red when either Scroll or Select is activated  
F. Select optical switch  
G. Unit of measure for process variable  
H. Current value of process variable

9.2.2 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 Prolink III user manual.
9.2.3 View process variables using the Field Communicator

Monitor process variables 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**.

9.3 View transmitter status using the status LED

The status LED shows the current alert condition of the transmitter. The status LED is located on the face of the transmitter.

Procedure

Observe the status LED.

- If your transmitter has a display, you can view the status LED with the transmitter housing cover in place.
- If your transmitter does not have a display, it does not have a status LED. This option is not available.

To interpret the status LED, see the following table.

**Restriction**

If **LED Blinking** is disabled, the status LED will flash only during calibration. It will not flash to indicate an unacknowledged alarm.

<table>
<thead>
<tr>
<th>LED state</th>
<th>Description</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid green</td>
<td>No alerts are active.</td>
<td>Continue with configuration or process measurement.</td>
</tr>
<tr>
<td>Flashing green (if enabled)</td>
<td>Unacknowledged corrected condition (no alert)</td>
<td>Continue with configuration or process measurement. Acknowledge the alert if you choose.</td>
</tr>
<tr>
<td>Solid yellow</td>
<td>One or more low-severity alerts are active. A low severity alarm can mean one or more process variables is at a set output level (i.e. simulation or two phase timeout).</td>
<td>A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement, but Micro Motion still recommends identifying and resolving the alert condition.</td>
</tr>
<tr>
<td>Flashing yellow (if enabled)</td>
<td>Calibration in progress, or Known Density Verification in progress. One or more low-severity alerts are active and have not been acknowledged.</td>
<td>A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement, but Micro Motion still recommends identifying and resolving the alert condition.</td>
</tr>
<tr>
<td>Solid red</td>
<td>One or more high-severity alerts are active.</td>
<td>A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing.</td>
</tr>
<tr>
<td>LED state</td>
<td>Description</td>
<td>Recommendation</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Flashing red (if enabled)</td>
<td>One or more high-severity alerts are active and have not been acknowledged.</td>
<td>A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing. Acknowledge the alert if you choose.</td>
</tr>
</tbody>
</table>

### 9.4 View and acknowledge status alerts

The transmitter posts status alerts whenever a process variable exceeds its defined limits or the transmitter detects a fault condition. You can view active alerts, and you can acknowledge alerts. Acknowledging alerts is not required.

#### 9.4.1 View and acknowledge alerts using the display

You can view a list containing all alerts that are active, or inactive but unacknowledged. From this list, you can acknowledge individual alerts.

**Prerequisites**

Operator access to the alert menu must be enabled (default setting). If operator access to the alert menu is disabled, you must use another method to view or acknowledge status alerts.

**Note**

Only Fault and Informational alerts are listed. The transmitter automatically filters out alerts with Status Alert Severity set to Ignore.

**Procedure**

See Figure 9-2.
**Figure 9-2: Using the display to view and acknowledge the status alerts (alarms)**

1. Scroll and Select simultaneously for 4 seconds

   **SEE ALERT**
   - Select
   - **Is ACK ALL enabled?**
     - Yes → **ACK ALL**
     - No → Scroll, Select

   **EXIT**
   - Select, Scroll
   - **Active/ unacknowledged alarms?**
     - Yes → **Alert code**, Scroll, Select → **ACK**, Select, Scroll
     - No → **NO ALERT**, Scroll → **EXIT**
   - Select, Scroll
Postrequisites

- To clear the following alerts, you must correct the problem, acknowledge the alert, then power-cycle the transmitter: A001, A002, A010, A011, A012, A013, A018, A019, A022, A023, A024, A025, A028, A029, A031.

- For all other alerts:
  - If the alert is inactive when it is acknowledged, it will be removed from the list.
  - If the alert is active when it is acknowledged, it will be removed from the list when the alert condition clears.

Related information

Alert data in transmitter memory

9.4.2 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.

Procedure

1. View alerts on the ProLink III **Device Tools** → **Alerts** tab.
   All active or unacknowledged alerts are listed, and displayed according to the following categories:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failed: Fix Now</td>
<td>A meter failure has occurred and must be addressed immediately.</td>
</tr>
<tr>
<td>Maintenance: Fix Soon</td>
<td>A condition has occurred that can be fixed at a later time.</td>
</tr>
<tr>
<td>Advisory: Informational</td>
<td>A condition has occurred, but requires no maintenance from you.</td>
</tr>
</tbody>
</table>

Notes

- All fault alerts are displayed in the **Failed: Fix Now** category.
- All information alerts are displayed in either the **Maintenance: Fix Soon** category or the **Advisory: Informational** category. The category assignment is hard-coded.
- The transmitter automatically filters out alerts with **Alert Severity** set to Ignore.

2. To acknowledge a single alert, check the **Ack** checkbox for that alert. To acknowledge all alerts at once, click **Ack All**.

Postrequisites

- To clear the following alerts, you must correct the problem, acknowledge the alert, then power-cycle the transmitter: A001, A002, A010, A011, A012, A013, A018, A019, A022, A023, A024, A025, A028, A029, A031.

- For all other alerts:
  - If the alert is inactive when it is acknowledged, it will be removed from the list.
  - If the alert is active when it is acknowledged, it will be removed from the list when the alert condition clears.
9.4.3 View alerts using the Field Communicator

You can view a list containing all alerts that are active, or inactive but unacknowledged.

Procedure

• To view active or unacknowledged alerts, choose Service Tools → Alerts.
  All active alerts and unacknowledged alerts are listed.

Note
Only Fault and Informational alerts are listed. The transmitter automatically filters out alerts with Status Alert Severity set to Ignore.

• To refresh the list, choose Service Tools → Alerts → Refresh Alerts.

9.4.4 Alert data in transmitter memory

The transmitter maintains three sets of data for every alert that is posted.

For each alert occurrence, the following three sets of data are maintained in transmitter memory:

• Alert List
• Alert Statistics
• Recent Alerts

<table>
<thead>
<tr>
<th>Alert data structure</th>
<th>Contents</th>
<th>Transmitter action if condition occurs</th>
</tr>
</thead>
</table>
| Alert List           | As determined by the alert status bits, a list of:  
  • All currently active alerts  
  • All previously active alerts that have not been acknowledged | Cleared and regenerated with every transmitter power cycle |
| Alert Statistics     | One record for each alert (by alert number) that has occurred since the last master reset.  
  Each record contains:  
  • A count of the number of occurrences  
  • Timestamps for the most recent posting and clearing | Not cleared; maintained across transmitter power cycles |
| Recent Alerts        | 50 most recent alert postings or alert clearings | Not cleared; maintained across transmitter power cycles |
9.5 Read totalizer and inventory values

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>To read a totalizer or inventory value from the display, it must be configured as a display variable.</td>
</tr>
<tr>
<td>ProLink III</td>
<td>View the desired variable on the main screen under <strong>Process Variables</strong>.</td>
</tr>
<tr>
<td>Field Communicator</td>
<td><strong>Service Tools</strong> → <strong>Variables</strong> → <strong>Totalizer Control</strong>.</td>
</tr>
</tbody>
</table>

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.

**Tip**
You can use the inventories to keep a running total of mass or volume across multiple totalizer resets.

9.6 Start and stop totalizers and inventories

<table>
<thead>
<tr>
<th>Method</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>See <a href="#">Start and stop totalizers and inventories using the display</a>.</td>
</tr>
<tr>
<td>ProLink III</td>
<td><strong>Device Tools</strong> → <strong>Totalizer Control</strong> → <strong>Totalizer and Inventories</strong> → <strong>Start All Totals</strong>&lt;br&gt;<strong>Device Tools</strong> → <strong>Totalizer Control</strong> → <strong>Totalizer and Inventories</strong> → <strong>Stop All Totals</strong></td>
</tr>
<tr>
<td>Field Communicator</td>
<td><strong>Service Tools</strong> → <strong>Variables</strong> → <strong>Totalizer Control</strong> → <strong>All Totalizers</strong> → <strong>Start Totalizers</strong>&lt;br&gt;<strong>Service Tools</strong> → <strong>Variables</strong> → <strong>Totalizer Control</strong> → <strong>All Totalizers</strong> → <strong>Stop Totalizers</strong></td>
</tr>
</tbody>
</table>

When you start a totalizer, it tracks process measurement. In a typical application, its value increases with flow. When you stop a totalizer, it stops tracking process measurement and its value does not change with flow. Inventories are started and stopped automatically, when totalizers are started and stopped.

**Important**
Totalizers and inventories are started or stopped as a group. When you start any totalizer, all other totalizers and all inventories are started simultaneously. When you stop any totalizer, all other totalizers and all inventories are stopped simultaneously. You cannot start or stop inventories directly.

9.6.1 Start and stop totalizers and inventories using the display

**Prerequisites**
- The Totalizer Start/Stop display function must be enabled.
- At least one totalizer must be configured as a display variable.

**Procedure**
- To start all totalizers and inventories using the display:
  
  **Note**
  If the PLC is connected and communicating, the start/stop and reset totalizers commands might be overriding any totalizer commands from the local display or from ProLink III.

  a) **Scroll** until the word TOTAL appears in the lower left corner of the display.

  **Important**
  Because all totalizers are started or stopped together, it does not matter which total you use.
b) Select.

c) Scroll until START appears beneath the current totalizer value. Exit displays beneath the current totalizer value.

d) Select.

e) Select again to confirm.

f) Scroll to EXIT.

To stop all totalizers and inventories using the display:

a) Scroll until the word TOTAL appears in the lower left corner of the display.

Important
Because all totalizers are started or stopped together, it does not matter which total you use.

b) Select.

c) Scroll until STOP appears beneath the current totalizer value.

d) Select.

e) Select again to confirm.

f) Scroll to EXIT.

9.7 Reset totalizers

<table>
<thead>
<tr>
<th>Display</th>
<th>See Reset totalizers using the display</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Totalizer Control → Totalizer and Inventories → Reset Mass Total</td>
</tr>
<tr>
<td></td>
<td>Device Tools → Totalizer Control → Totalizer and Inventories → Reset Volume Total</td>
</tr>
<tr>
<td></td>
<td>Device Tools → Totalizer Control → Totalizer and Inventories → Reset Gas Total</td>
</tr>
<tr>
<td></td>
<td>Device Tools → Totalizer Control → Totalizer and Inventories → Reset All Totals</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Service Tools → Variables → Totalizer Control → Mass → Mass Total</td>
</tr>
<tr>
<td></td>
<td>Service Tools → Variables → Totalizer Control → Gas Standard Volume → Volume Total</td>
</tr>
<tr>
<td></td>
<td>Service Tools → Variables → Totalizer Control → Gas Standard Volume → GSV Total</td>
</tr>
<tr>
<td></td>
<td>Service Tools → Variables → Totalizer Control → All Totalizers → Reset All Totals</td>
</tr>
</tbody>
</table>

When you reset a totalizer, the transmitter sets its value to 0. It does not matter whether the totalizer is started or stopped. If the totalizer is started, it continues to track process measurement.

Tip
When you reset a single totalizer, the values of other totalizers are not reset. Inventory values are not reset.

9.7.1 Reset totalizers using the display

Prerequisites
- The Totalizer Reset display function must be enabled.
- The totalizer that you want to reset must be configured as a display variable. For example:
— If you want to reset the mass totalizer, **Mass Total** must be configured as a display variable.
— If you want to reset the volume totalizer, **Volume Total** must be configured as a display variable.

**Procedure**

* To reset the mass totalizer:
  a) **Scroll** until the mass totalizer value appears.
  b) **Select**.
     * **Exit** displays beneath the current totalizer value.
  c) **Scroll** until **Reset** displays beneath the current totalizer value.
  d) **Select**.
     * **Reset** and **Yes?** alternately flash beneath the current totalizer value.
  e) **Select** again to confirm.
  f) **Scroll** to **EXIT**.
  g) **Select**.

* To reset the volume totalizer:
  a) **Scroll** until the volume totalizer value appears.
  b) **Select**.
     * **Exit** displays beneath the current totalizer value.
  c) **Scroll** until **Reset** displays beneath the current totalizer value.
  d) **Select**.
     * **Reset** and **Yes?** alternately flash beneath the current totalizer value.
  e) **Select** again to confirm.
  f) **Scroll** to **EXIT**.
  g) **Select**.

* To reset the gas standard volume totalizer:
  a) **Scroll** until the gas standard volume totalizer value appears.
  b) **Select**.
     * **Exit** displays beneath the current totalizer value.
  c) **Scroll** until **Reset** displays beneath the current totalizer value.
  d) **Select**.
     * **Reset** and **Yes?** alternately flash beneath the current totalizer value.
  e) **Select** again to confirm.
  f) **Scroll** to **EXIT**.
  g) **Select**.
9.8 Reset inventories

<table>
<thead>
<tr>
<th>ProLink III</th>
<th>Device Tools → Totalizer Control → Totalizer and Inventories → Reset Mass Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Device Tools → Totalizer Control → Totalizer and Inventories → Reset Volume Inventory</td>
</tr>
<tr>
<td></td>
<td>Device Tools → Totalizer Control → Totalizer and Inventories → Reset Gas Inventory</td>
</tr>
<tr>
<td></td>
<td>Device Tools → Totalizer Control → Totalizer and Inventories → Reset All Inventories</td>
</tr>
</tbody>
</table>

When you reset an inventory, the transmitter sets its value to 0. It does not matter whether the inventory is started or stopped. If the inventory is started, it continues to track process measurement.

**Tip**

Mass and volume inventory totals cannot be set separately. They can only be reset together simultaneously.
10 Operate the transmitter with the Weights & Measures application

Information in this chapter is applicable only if your transmitter was ordered with the Weights & Measures application.

10.1 Operate the transmitter when the Weights & Measures application is installed

When the Weights & Measures application is installed, many of the basic functions of the transmitter are modified.

Procedure

• To make a connection:
  • If the physical seal is not installed, you can use any supported connection type.
  • If the physical seal is installed, you cannot make a service port connection. You can use any other supported connection type.

• To read or obtain process data:
  • For an approved measurement, you must use an approved method.
  • If the measurement does not have to be approved, you can use any available method.

Important
The behavior of transmitter outputs and process variable values is modified by the Weights & Measures application. Ensure that you know the effects of this application on outputs and process variable values.

• To reset totalizers:
  • If the transmitter is unsecured, you can reset totalizers. If you reset one totalizer, all other totalizers are reset automatically.
  • If the transmitter is secured, you may or may not be able to reset totalizers, depending on configuration. If totalizer reset is enabled, you cannot reset totalizers unless the flow rate is 0. To reset totalizers from the display, you may need to enter the alarm menu password, whether or not you have enabled it. The default value for Alarm Menu Password is 1234.

• You cannot stop totalizers while the transmitter is secured.
• You cannot reset inventories while the transmitter is secured.

10.1.1 Approved methods to read or obtain process data

When the Weights & Measures application is installed, process data is approved for custody transfer use only if an approved method is used for reading or obtaining it.

Note
On the primary mA output, HART/Bell 202 communications may be used to poll for either temperature or pressure, in conjunction with process data reporting.
**Table 10-1: NTEP-approved methods to read or obtain process data**

<table>
<thead>
<tr>
<th>Process data</th>
<th>mA output</th>
<th>Modbus/RS-485 or HART/RS-485</th>
<th>Transmitter display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Volume</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Density</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Totalizer values</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Inventory values</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

**Table 10-2: OIML-approved methods to read or obtain process data**

<table>
<thead>
<tr>
<th>Process data</th>
<th>mA output</th>
<th>Modbus/RS-485 or HART/RS-485</th>
<th>Transmitter display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Volume</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Density</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Totalizer values</td>
<td>✓</td>
<td></td>
<td>✓ (1)</td>
</tr>
<tr>
<td>Inventory values</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

(1) Special handling is applied to large totalizer values.

### 10.1.2 Large totalizer values on the display (OIML applications only)

If Approval is set to OIML and totalizer values become large enough, the display handles large values in a special way. The value displayed may not reflect the actual value.

The display is able to show a maximum of eight characters, including the decimal point. For all totalizer values configured as display variables, the position of the decimal point on the display is fixed to the configured precision of the display variable.

When the totalizer reaches the largest value that can be displayed in these circumstances:

- The digits roll over.
- The decimal point does not move.
- The number of digits on the display does not change.
- The internal totalizer is reset to 0.

For example, the value 99999.999 rolls over to 00000.000.

**Tip**

If you are not sure whether or not the totalizer value on the display has rolled over, check the value by using another method to read the current data.

**Notes**

- The mass and volume totalizers do not necessarily roll over at the same time.
This feature does not apply to inventories. The display presents large inventory values in the standard manner.

### 10.1.3 Effect of the Weights & Measures application on process measurement and outputs

When the Weights & Measures application is installed, process measurement and reporting is modified to prevent unauthorized use of the data. Specific changes are controlled by whether the transmitter is secured or unsecured.

#### Table 10-3: Transmitter outputs and process data when Approvals=NTEP

<table>
<thead>
<tr>
<th>Function</th>
<th>Transmitter status</th>
<th>Unsecured</th>
<th>Secured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outputs</td>
<td>mA output behavior</td>
<td>If reporting a flow variable, mA output reports zero flow. Otherwise, normal.</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Frequency output behavior</td>
<td>Inactive (produces no pulses), even under fault conditions</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Discrete output behavior</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Process variables</td>
<td>All flow rates</td>
<td>Reported as zero</td>
<td>Reported normally</td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>Reported normally</td>
<td>Reported normally</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>Reported normally</td>
<td>Reported normally</td>
</tr>
<tr>
<td>Totalizers</td>
<td>Values</td>
<td>Do not increment or decrement</td>
<td>Increment normally</td>
</tr>
<tr>
<td>Inventories</td>
<td>Values</td>
<td>Do not increment or decrement</td>
<td>Increment normally</td>
</tr>
</tbody>
</table>

#### Table 10-4: Transmitter outputs and process data when Approvals=OIML

<table>
<thead>
<tr>
<th>Function</th>
<th>Transmitter status</th>
<th>Unsecured</th>
<th>Secured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outputs</td>
<td>mA output behavior</td>
<td>Performs configured fault action</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Frequency output behavior</td>
<td>Performs configured fault action</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Discrete output behavior</td>
<td>Performs configured fault action</td>
<td>Normal</td>
</tr>
<tr>
<td>Process variables</td>
<td>All flow rates</td>
<td>Reported normally</td>
<td>Reported normally</td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>Reported normally</td>
<td>Reported normally</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>Reported normally</td>
<td>Reported normally</td>
</tr>
<tr>
<td>Totalizers</td>
<td>Values</td>
<td>Do not increment or decrement</td>
<td>Increment normally</td>
</tr>
</tbody>
</table>
### Table 10-4: Transmitter outputs and process data when Approvals=OIML (continued)

<table>
<thead>
<tr>
<th>Function</th>
<th>Transmitter status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unsecured</td>
</tr>
<tr>
<td>Inventories</td>
<td>Values</td>
</tr>
</tbody>
</table>

#### 10.1.4 Effect of the Weights & Measures application on operation and maintenance functions

When the Weights & Measures application is installed, specific operations and maintenance activities may be disallowed. You can switch to unsecured mode, perform the required actions, then switch back to secured mode.

### Table 10-5: Available actions when Approvals=NTEP

<table>
<thead>
<tr>
<th>Function</th>
<th>Transmitter status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting from ProLink III, the Field Communicator, or a host</td>
<td>All supported connection types are available. Physical security prevents access to the service port terminals. Modbus/RS-485, HART/RS-485, and HART/Bell 202 connections can be used to read data from the transmitter, but software security prevents writing to the transmitter.</td>
</tr>
<tr>
<td>Configuration</td>
<td>Reading</td>
</tr>
<tr>
<td></td>
<td>Changing</td>
</tr>
<tr>
<td>Calibration</td>
<td>Zero</td>
</tr>
<tr>
<td></td>
<td>Density</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
</tr>
<tr>
<td>Smart Meter Verification</td>
<td>Outputs set to Continue Measuring</td>
</tr>
<tr>
<td></td>
<td>Outputs set to Fault</td>
</tr>
<tr>
<td></td>
<td>Outputs set to Last Measured Value</td>
</tr>
<tr>
<td>External pressure and temperature data</td>
<td>Retrieved by polling</td>
</tr>
<tr>
<td></td>
<td>Written by Modbus or HART host</td>
</tr>
<tr>
<td>Testing and trimming outputs</td>
<td>mA output loop test</td>
</tr>
<tr>
<td></td>
<td>mA output trim</td>
</tr>
<tr>
<td></td>
<td>Frequency output loop test</td>
</tr>
<tr>
<td></td>
<td>Discrete output loop test</td>
</tr>
</tbody>
</table>
### Table 10-5: Available actions when Approvals=NTEP (continued)

<table>
<thead>
<tr>
<th>Function</th>
<th>Transmitter status</th>
<th>Unsecured</th>
<th>Secured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Totalizers</td>
<td>Resetting</td>
<td>Allowed. If any single totalizer is reset, all other totalizers are reset automatically.</td>
<td>May or may not be allowed, depending on configuration. Can be performed only if flow rate is zero. If any single totalizer is reset, all other totalizers are reset automatically.</td>
</tr>
<tr>
<td></td>
<td>Starting</td>
<td>Not allowed</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Stopping</td>
<td>N/A</td>
<td>Not allowed</td>
</tr>
<tr>
<td>Inventories</td>
<td>Resetting</td>
<td>Not allowed</td>
<td>Not allowed</td>
</tr>
<tr>
<td>Sensor simulation</td>
<td></td>
<td>Allowed</td>
<td>Not allowed</td>
</tr>
</tbody>
</table>

### Table 10-6: Available actions when Approvals=OIML

<table>
<thead>
<tr>
<th>Function</th>
<th>Transmitter status</th>
<th>Unsecured</th>
<th>Secured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting from ProLink III, the Field Communicator, or a host</td>
<td>All supported connection types are available.</td>
<td>Physical security prevents access to the service port terminals. Modbus/RS-485, HART/RS-485, and HART/Bell 202 connections can be used to read data from the transmitter, but software security prevents writing to the transmitter.</td>
<td></td>
</tr>
<tr>
<td>Configuration</td>
<td>Reading</td>
<td>Allowed</td>
<td>Allowed</td>
</tr>
<tr>
<td></td>
<td>Changing</td>
<td>Allowed</td>
<td>Not allowed</td>
</tr>
<tr>
<td>Calibration</td>
<td>Zero</td>
<td>Allowed</td>
<td>Not allowed</td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>Allowed</td>
<td>Not allowed</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>Allowed</td>
<td>Not allowed</td>
</tr>
<tr>
<td>Smart Meter Verification</td>
<td>Outputs set to Continue Measuring</td>
<td>Allowed</td>
<td>Allowed</td>
</tr>
<tr>
<td></td>
<td>Outputs set to Fault</td>
<td>Allowed</td>
<td>Allowed</td>
</tr>
<tr>
<td></td>
<td>Outputs set to Last Measured Value</td>
<td>Allowed</td>
<td>Not allowed</td>
</tr>
<tr>
<td>External pressure and temperature data</td>
<td>Retrieved by polling</td>
<td>Allowed</td>
<td>Allowed</td>
</tr>
<tr>
<td></td>
<td>Written by Modbus or HART host</td>
<td>Allowed</td>
<td>Not allowed</td>
</tr>
<tr>
<td>Outputs</td>
<td>mA output loop test</td>
<td>Allowed</td>
<td>Not allowed</td>
</tr>
<tr>
<td></td>
<td>mA output trim</td>
<td>Allowed</td>
<td>Not allowed</td>
</tr>
</tbody>
</table>
Table 10-6: Available actions when Approvals=OIML (continued)

<table>
<thead>
<tr>
<th>Function</th>
<th>Transmitter status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unsecured</td>
</tr>
<tr>
<td>Frequency output loop test</td>
<td>Allowed</td>
</tr>
<tr>
<td>Discrete output loop test</td>
<td>Allowed</td>
</tr>
<tr>
<td>Process variables</td>
<td></td>
</tr>
<tr>
<td>All flow rates</td>
<td>Reported normally</td>
</tr>
<tr>
<td>Density</td>
<td>Reported normally</td>
</tr>
<tr>
<td>Temperature</td>
<td>Reported normally</td>
</tr>
<tr>
<td>Totalizers</td>
<td></td>
</tr>
<tr>
<td>Resetting</td>
<td>Allowed. If any single totalizer is reset, all other totalizers are reset automatically.</td>
</tr>
<tr>
<td>Starting</td>
<td>Not allowed</td>
</tr>
<tr>
<td>Stopping</td>
<td>N/A</td>
</tr>
<tr>
<td>Inventories</td>
<td>Resetting</td>
</tr>
<tr>
<td>Sensor simulation</td>
<td>Allowed</td>
</tr>
</tbody>
</table>

10.2 Switch between secured and unsecured mode

You must switch to unsecured mode to change the transmitter configuration or perform many administrative tasks. You must switch back to secured mode in order to meet Weights & Measures requirements for process measurement.

You must use one of the following tools to switch modes:

- ProLink III
- The Custody Transfer switching utility. The switching utility is free, and is available from the Software Downloads page at Emerson.com.

The controls are not accessible in any other way.

10.2.1 Switch between secured and unsecured mode using ProLink III

Prerequisites

Before switching to unsecured mode, ensure that you will be able to switch back to secured mode. Because switching to unsecured mode requires breaking the physical seal, switching back to secured mode may require a site visit from a certified Weights & Measures inspector and reinstallation of the physical seal.

Ensure that the wiring is in place for a service port connection. You may need to break the seal and remove the clamp.
Procedure

- To switch from secured mode to unsecured mode:
  a) Make a service port connection to your transmitter.
  b) Choose Device Tools → Configuration → Weights & Measures.
  c) Set Software Security to Disabled.

- To switch from unsecured mode to secured mode:
  a) Make a service port connection to your transmitter.
  b) Choose Device Tools → Configuration → Weights & Measures.
  c) Set Software Security to Enabled.

10.2.2 Switch between secured and unsecured mode using the switching utility

Prerequisites
The switching utility must be installed on your PC. The switching utility is available from the Software Downloads page at Emerson.com.

Before switching to unsecured mode, ensure that you will be able to switch back to secured mode. Because switching to unsecured mode requires breaking the physical seal, switching back to secured mode may require a site visit from a certified Weights & Measures inspector and reinstallation of the physical seal.

Ensure that the wiring is in place for a service port connection. You may need to break the seal and remove the clamp.

Procedure

- To switch from secured mode to unsecured mode:
  a) Run the switching utility.
  b) Select the COM port to use for the connection.
  c) Click Disable Custody Transfer.

- To switch from unsecured mode to secured mode:
  a) Run the switching utility.
  b) Select the COM port to use for the connection.
  c) Click Enable Custody Transfer.

10.3 Clear Status Alarm A027: Security Breach

Status Alarm A027: Security Breach is posted if the transmitter is switched to unsecured mode or if the transmitter detects that the core processor ID has changed.

Procedure

1. If the transmitter is in secured mode, switch to unsecured mode.
2. Take any required actions related to the cause of the security breach.
3. Switch to secured mode.

10.4 Replacing the core processor in a Weights & Measures installation

In a Weights & Measures installation, replacing the core processor requires re-sealing the transmitter. When the transmitter is first secured, the core processor’s unique ID is registered with the transmitter. If you replace the core processor with another core processor, the transmitter will post Status Alarm A026: Sensor/Xmtr Communication Error. To clear this alarm, you must switch the transmitter to unsecured mode and resecure it. This requires breaking the physical seal and reinstalling it when the entire process is complete.

Other procedures may be required. Refer to the Weights & Measurements documentation for your installation.

**Important**

In most cases, the physical seal must be installed by a certified Weights & Measures inspector.
11 Measurement support

11.1 Options for measurement support

Micro Motion provides several measurement support procedures to help you evaluate and maintain your flowmeter’s accuracy.

The following methods are available:

- Smart Meter Verification (SMV) evaluates the structural integrity of the sensor tubes by comparing current tube stiffness to the stiffness measured at the factory. Stiffness is defined as the load per unit deflection, or force divided by displacement. Because a change in structural integrity changes the sensor’s response to mass and density, this value can be used as an indicator of measurement performance.

- Meter validation compares flowmeter measurements reported by the transmitter to an external measurement standard. Meter validation requires one data point.

- Calibration establishes the relationship between a process variable and the signal produced at the sensor. You can calibrate the flowmeter for zero, density, and temperature. Density and temperature calibration require two data points (low and high) and an external measurement for each.

**Tip**

- Perform SMV at regular intervals to get the best data on your meter’s performance.
- To prove the meter against a regulatory standard, or to correct measurement error, use meter validation and meter factors.
- Before performing a field calibration, contact customer support to see if there is an alternative. In many cases, field calibrations have a negative effect on measurement accuracy.

11.2 Use Smart Meter Verification

Smart Meter Verification™ provides in-process flowmeter 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.

11.2.1 SMV requirements

To use SMV, the transmitter must be paired with an 800 enhanced core processor.

See Table 11-1 for the minimum version of the transmitter, 800 enhanced core processor, and communication tool needed to support SMV. (If you are going to perform SMV using the display, only the transmitter and enhanced core processor versions apply.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Minimum version (legacy)</th>
<th>Minimum basic SMV transmitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter</td>
<td>6.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Enhanced core processor</td>
<td>3.6</td>
<td>4.4</td>
</tr>
<tr>
<td>ProLink III</td>
<td>1.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>
### Table 11-1: Minimum SMV version (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Minimum version (legacy)</th>
<th>Minimum basic SMV transmitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Communicator</td>
<td>HART device description: device rev 6, DD rev 2</td>
<td>HART device description: device rev 8, DD rev 1</td>
</tr>
</tbody>
</table>

### 11.2.2 SMV test preparation

#### Prerequisites

The following information pertains to the transmitter when connected to an 800 enhanced core processor ≥ 4.7.

- 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.

### 11.2.3 Smart Meter Verification capabilities

<table>
<thead>
<tr>
<th>Capability</th>
<th>Basic</th>
<th>Professional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration coefficients audit</td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Zero audit</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Electronics verification</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Automatic test scheduler</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>History of previous 20 results</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>
### 11.2.4 Run SMV

**Run an SMV test using the display**

**Procedure**

1. Navigate to the *Smart Meter Verification* menu.

![Figure 11-1: SMV – Top-level menu](image)

2. Choose **Run Verify**.

3. Choose **Outputs** and select the desired output behavior.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue Measuring</td>
<td>During the test, all outputs will continue to report their assigned process variable. The test will run for approximately 90 seconds.</td>
</tr>
<tr>
<td>Fault</td>
<td>During the test, all outputs will go to their configured fault action. The test will run for approximately 140 seconds.</td>
</tr>
<tr>
<td>Last Value</td>
<td>During the test, all outputs will report the last measured value of their assigned process variable. The test will run for approximately 140 seconds.</td>
</tr>
</tbody>
</table>

While the test is in progress, dots traverse the display and test progress is shown.

**Postrequisites**

View the test results and take any appropriate actions.

(1) *Create and export with Prolink III, web page, or AMS SNAP-ON.*
SMV flowchart: Running a test using the display

Figure 11-2: Running an SMV test using the display

Run an SMV test using ProLink III

Procedure

1. Choose Device Tools → Diagnostics → Meter Verification → Run Test.
You may need to wait a few seconds while ProLink III synchronizes its database with the transmitter data.

2. Enter any desired information on the **Test Definition** screen, and click **Next**.
   All information on this screen is optional.

3. Choose the desired output behavior.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue Measuring</td>
<td>During the test, all outputs will continue to report their assigned process variable. The test will run for approximately 90 seconds.</td>
</tr>
<tr>
<td>Held at Last Value</td>
<td>During the test, all outputs will report the last measured value of their assigned process variable. The test will run for approximately 140 seconds.</td>
</tr>
<tr>
<td>Held at Fault</td>
<td>During the test, all outputs will go to their configured fault action. The test will run for approximately 140 seconds.</td>
</tr>
</tbody>
</table>

4. Press **Start**.
   Test progress is displayed on the screen.

**Postrequisites**

View the test results and take any appropriate actions. You can also print the report.

**Run an SMV test using the Field Communicator**

**Procedure**

1. Navigate to the **Smart Meter Verification** menu:
   - **Overview** → **Shortcuts** → **Meter Verification**
   - **Service Tools** → **Maintenance** → **Routine Maintenance** → **Meter Verification**

2. Choose **Manual Verification**.

3. Choose **Start**.

4. Set output behavior as desired, and press **OK** if prompted.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue Measuring</td>
<td>During the test, all outputs will continue to report their assigned process variable. The test will run for approximately 90 seconds.</td>
</tr>
<tr>
<td>Outputs Held at Last Value</td>
<td>During the test, all outputs will report the last measured value of their assigned process variable. The test will run for approximately 140 seconds.</td>
</tr>
<tr>
<td>Outputs Held at Fault</td>
<td>During the test, all outputs will go to their configured fault action. The test will run for approximately 140 seconds.</td>
</tr>
</tbody>
</table>

Test progress is displayed on the screen.

**Postrequisites**

View the test results and take any appropriate actions.
11.2.5 View test data

You can view the results of the current test. You can also view results from previous tests.

**Important**
You can view previous test results and see detailed test reports only if SMV is licensed.

The transmitter stores the following information about the previous twenty SMV tests:

- Powered-on hours at the time of the test.
- Test result (Pass, Fail, Abort).
- Abort code, if applicable.

In addition, ProLink III provides a detailed test reporting and analysis framework. This information is stored on the PC where ProLink III is installed for tests that were run only on that PC. It includes:

- Timestamp from the PC clock
- Current flowmeter identification data
- Current flow and density configuration parameters
- Current zero values
- Current process values for mass flow rate, volume flow rate, density, temperature, and external pressure
- Customer and test descriptions (if entered by the user)

You can use ProLink III to run a test that displays a test result chart and a test report at the completion of the test. On-screen directions are provided to manipulate the test data or export the data to a CSV file for offline analysis.

**View test result data using the display**

**Procedure**

1. If you have just run a test, results are displayed automatically at the end of the test.
2. If SMV is licensed, and you want to view results from previous tests:
   a) Navigate to the *Smart Meter Verification* menu.

   ![Figure 11-3: SMV – Top-level menu](image)

   b) Scroll to **Results Read** and press **Select**.

   The runcount of the most recent test is displayed.
c) To view data for this test, press **Select**, then press **Scroll** to scroll through test data.

d) To select a different test, press **Scroll**, then press **Select** when the transmitter displays **Results More?**. When the desired test appears, as identified by runcount, press **Select**.

**SMV flowchart: Viewing test results using the display**

![SMV flowchart](image)

**Note**
If you have a basic (unlicensed version) of SMV, you will not be prompted for **RESULTS MORE?**.

**View test result data using ProLink III**

**Prerequisites**
You can view test result data only if your SMV is licensed and only for tests that were run on the PC you are currently using.
**Procedure**

1. Choose **Device Tools** → **Diagnostics** → **Meter Verification** and click **Previous Test Results**. The chart shows test results for all tests stored in the ProLink III database.
2. (Optional) Click **Next** to view and print a test report.
3. (Optional) Click **Export Data to CSV File** to save the data to a file on your PC.

**View test result data using the Field Communicator**

**Prerequisites**
You can view test result data only if your SMV is licensed.

**Procedure**

1. Navigate to the **Smart Meter Verification** menu:
   - **Overview** → **Shortcuts** → **Meter Verification**
   - **Service Tools** → **Maintenance** → **Routine Maintenance** → **Meter Verification**
2. (Optional) If the Field Communicator database is out of date, choose **Upload Results Data from Device**.
3. To view data from the most recent test, choose **Most Recent Test Results**.
4. To view data for all tests in the Field Communicator database:
   a) Press **Show Results Table**. Data from the most recent test is displayed.
   b) Press **OK** to scroll through data from previous tests.
   c) To exit the results table, press **Abort**.

**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.
11.2.6 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
3. Contact the factory for further evaluation and instructions.

11.2.7 Schedule automatic execution of the SMV test

You can set up and run a single test at a user-defined future time. You can also set up and run tests on a regular schedule.

**Manage scheduled test execution using the display**

**Procedure**

1. Navigate to the *Smart Meter Verification* menu.

   ![Figure 11-5: SMV – Top-level menu](image)

2. Scroll to *Schedule Verfy* and press *Select*.
3. To schedule a single test or the first test in recurring execution:
   a) Scroll to *Set Next* and press *Select*.
   b) Enter the number of hours that the transmitter will wait before beginning the test.
4. To schedule recurring execution:
   a) Scroll to *Set Recur* and press *Select*.
   b) Enter the number of hours that will elapse between tests.
5. To disable scheduled execution:
- To disable execution of a single scheduled test, set **Set Next** to 0.
- To disable recurring execution, set **Set Recur** to 0.
- To disable all scheduled execution, choose **Turn Off Sched** when you enter the **Smart Meter Verification** menu.

**SMV flowchart: Scheduling test execution using the display**

*Figure 11-6: Scheduling SMV test execution using the display*
Manage scheduled test execution using ProLink III

Procedure
1. Choose Device Tools → Diagnostics → Meter Verification → Schedule Meter Verification.
2. To schedule a single test or the first test in recurring execution, specify a value for Hours Until Next Run.
3. To schedule recurring execution, specify a value for Hours Between Recurring Runs.
4. To disable scheduled execution:
   • To disable execution of a single scheduled test, set Hours Until Next Run to 0.
   • To disable recurring execution, set Hours Between Recurring Runs to 0.
   • To disable all scheduled execution, click Disable Scheduled Execution.

Manage scheduled test execution using the Field Communicator

Procedure
1. Navigate to the Smart Meter Verification menu:
   • Overview → Shortcuts → Meter Verification
   • Service Tools → Maintenance → Routine Maintenance → Meter Verification
2. Choose Automatic Verification.
3. To schedule a single test or the first test in recurring execution, specify a value for Hrs Until Next Run.
4. To schedule recurring execution, specify a value for Set Recurring Hours.
5. To disable scheduled execution:
   • To disable execution of a single scheduled test, set Hrs Until Next Run to 0.
   • To disable recurring execution, set Set Recurring Hours to 0.
   • To disable all scheduled execution, choose Turn Off Schedule.

11.3 Use Production Volume Reconciliation, Transient Mist Remediation, and Transient Bubble Remediation

For detailed information about Production Volume Reconciliation (PVR), Transient Mist Remediation (TMR), and Transient Bubble Remediation (TBR), see the Micro Motion Oil and Gas Production Supplement.

Restriction
PVR, TBR, and TMR are available only with a transmitter that is ordered with one of these software options:
• An 800 Enhanced Core Processor version 4.4 and later
• HART with HART 7 enabled in order to view process variables over HART (default)
11.3.1 PVR, TBR, and TMR applications

PVR, TBR, and TMR are applications designed to provide more accurate process data in the presence of multiple phases. For example, if bubbles are present in the process fluid, or the process fluid is flashing, the volume measurements are often incorrect.

**Production Volume Reconciliation (PVR)**
- Provides oil and water volumes through density-based calculations for both line and reference conditions
- Detects bubble entrainment or flashing in the sensor, and can correct volumes accordingly
- Best for undersized three-phase separators that frequently have intermittent gas or water contamination in the oil leg
- Offers a simple, low-cost solution for net oil and net water measurement for two-phase separators

**Transient Bubble Remediation (TBR)**
- Used with single-component liquid streams that may experience intermittent low levels of gas entrainment, that is, gas carryunder
- Enables accurate measurement of a single fluid during periods of entrained gas by providing a substitute density value based on the immediately preceding process density (standard configuration)
- Tracks total time of aerated flow to assist in diagnosing process issues that may cause aeration

**Transient Mist Remediation (TMR)**
- Used with gas streams that may experience intermittent low levels of liquid entrainment, i.e., liquid carryover
- Allows gas measurement to continue during periods of entrained liquid (mist) by providing a substitute flow rate value based on the immediately preceding process flow rate
- Returns to reporting the measured flow rate when the mist interval is over, increased or decreased by a maximum of 10%, until flow totals are appropriately adjusted for the unmeasured flow
- Provides an indication of the amount of time that liquid was present in the stream — identifying process improvements to reduce gas stream contamination

11.4 Piecewise linearization (PWL) for calibrating gas meters

Piecewise linearization (PWL) can linearize the measurements of flow meters for greater accuracy in order to measure gas over a wide range of flow rates. PWL does not apply when measuring liquid flow. When better accuracy is required over the published gas measurement specifications, an Emerson-approved independent gas laboratory can calibrate gas up to 10 PWL adjustment points.

**Restriction**
You cannot use a field communicator to configure PWL.

For more information, see the white paper, *The Practical Application of Multi-Point Piecewise Linear Interpolation (PWL) and Other Developing Trends with Coriolis Meters for Natural Gas Custody Transfer Applications*, available at Emerson.com.
11.4.1 Configure PWL

<table>
<thead>
<tr>
<th>Display</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProLink III</td>
<td>Device Tools → Configuration → Process Measurement → Piecewise Linearization for Gas (PWL)</td>
</tr>
<tr>
<td>Field communicator</td>
<td>Not available</td>
</tr>
</tbody>
</table>

11.5 Use the fuel consumption application

For detailed information about fuel consumption, see the Micro Motion™ Fuel Consumption Application for Transmitters Installation and Operation Guide.

Restriction
Fuel consumption process variables are available only over HART with HART 7 enabled (default). Fuel consumption parameters cannot be configured with HART.

11.5.1 Fuel consumption application architecture

The Fuel consumption application is designed to support fuel efficiency and fuel management projects and practices by providing accurate real-time fuel consumption data.

- Automatically calculates the fluid consumption between two Coriolis flow sensors, typically for recirculating fuel consumption loops
- Eliminates the need to program an external calculation system and minimizes common inaccuracies related to time lag, sampling issues and cumulative errors
- Uses a proprietary algorithm that adapts to the unique calibration of each pair of Coriolis flow sensors
11.6 Zero the meter

Zeroing the meter establishes a baseline for process measurement by analyzing the sensor's output when there is no flow through the sensor tubes.

**Prerequisites**
Verify the zero and prepare the meter using the procedures in Verify the zero.

**Procedure**
Zero the meter.

If necessary, modify **Zero Time**. **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.
**Postrequisites**

Restore normal flow through the sensor by opening the valves. Verify that the sensor tubes are full.

**Need help?**

If the zero fails:

- Verify 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.

### 11.7 Validate the meter

<table>
<thead>
<tr>
<th>Display</th>
<th>OFF-LINE MAINT → Config MTR F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolink III</td>
<td>Device Tools → Configuration → Process Measurement → Flow</td>
</tr>
<tr>
<td></td>
<td>Device Tools → Configuration → Process Measurement → Density</td>
</tr>
<tr>
<td>Field Communicator</td>
<td>Configure → Manual Setup → Measurements → Flow</td>
</tr>
<tr>
<td></td>
<td>Configure → Manual Setup → Measurements → Density</td>
</tr>
</tbody>
</table>

Meter validation compares flowmeter 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 flowmeter’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. See **Alternate method for calculating the meter factor for volume flow** for instructions on this method.

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) Set the meter factor to 1 to take a sample measurement.
   b) Measure the same sample using the reference device.
   c) Calculate the meter factor using the following formula:

   \[
   \text{New Meter Factor} = \frac{\text{Configured Meter Factor} \times \left( \frac{\text{Reference Measurement}}{\text{Flowmeter Measurement}} \right)}{
   \]

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 flowmeter 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:

\[
\text{Meter Factor}_{\text{Mass Flow}} = 1 \times \left( \frac{250}{250.27} \right) = 0.9989
\]

The first meter factor for mass flow is 0.9989.

One year later, the flowmeter 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:

\[
\text{Meter Factor}_{\text{Mass Flow}} = 0.9989 \times \left( \frac{250.25}{250.07} \right) = 0.9996
\]

The new meter factor for mass flow is 0.9996.

11.7.1 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:

\[
\text{Meter Factor}_{\text{Volume}} = \left( \frac{1}{\text{Meter Factor}_{\text{Density}}} \right)
\]
The following equation is mathematically equivalent to the first equation. You may use whichever version you prefer.

\[ \text{Meter Factor}_{\text{Volume}} = \text{Configured Meter Factor}_{\text{Density}} \times \left( \frac{\text{Density Flowmeter}}{\text{Density Reference Device}} \right) \]

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.

**11.8 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, choose Configure → Manual Setup → Measurements → LD Optimization. LD Optimization is used only with large sensors in hydrocarbon applications. In some installations, only customer service has access to this parameter. If this is the case, contact customer service before continuing.
- 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 Emerson 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.
11.8.1 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.

### D1 Calibration
- Close shutoff valve downstream from sensor
- Fill sensor with D1 fluid
- Device Tools > Calibration > Density Calibration > Density Calibration – Point 1 (Air)
- Enter density of D1 fluid
- Start calibration
- Close

### D2 Calibration
- Fill sensor with D2 fluid
- Device Tools > Calibration > Density Calibration > Density Calibration – Point 2 (Water)
- Enter density of D2 fluid
- Start calibration
- Close

**Postrequisites**

If you disabled LD Optimization before the calibration procedure, re-enable it.

11.8.2 Perform a D1 and D2 density calibration using a field communicator

**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.

![Calibration Diagram]

**Postrequisites**

If you disabled **LD Optimization** before the calibration procedure, re-enable it.

### 11.9 Perform a D3 and D4 density calibration (T-Series sensors only)

For T-Series sensors, the optional D3 and D4 calibration could improve the accuracy of the density measurement if the density of your process fluid is less than 0.8 g/cm³ or greater than 1.2 g/cm³.

If you perform the D3 and D4 calibration, note the following:

- Do not perform the D1 and D2 calibration.
- Perform the D3 calibration if you have one calibrated fluid.
- Perform both the D3 and D4 calibrations if you have two calibrated fluids (other than air and water). The calibrations must be performed without interruption, in the order shown. Make sure that you are prepared to complete the process without interruption.
**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.

- For D3 density calibration, the D3 fluid must meet the following requirements:
  - Minimum density of 0.6 g/cm³
  - Minimum difference of 0.1 g/cm³ between the density of the D3 fluid and the density of water. The density of the D3 fluid may be either greater or less than the density of water.

- For D4 density calibration, the D4 fluid must meet the following requirements:
  - Minimum density of 0.6 g/cm³
  - Minimum difference of 0.1 g/cm³ between the density of the D4 fluid and the density of the D3 fluid. The density of the D4 fluid must be greater than the density of the D3 fluid.
  - Minimum difference of 0.1 g/cm³ between the density of the D4 fluid and the density of water. The density of the D4 fluid may be either greater or less than the density of water.

- 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.

### 11.9.1 Perform a D3 or D3 and D4 density calibration using ProLink III

**Procedure**

See Figure 11-7.
11.9.2 Perform a D3 or D3 and D4 density calibration using the Field Communicator

Procedure

See the following flowchart.
11.10 Perform temperature calibration

Temperature calibration establishes the relationship between the temperature of the calibration fluids and the signal produced by the sensor.

Prerequisites

The temperature calibration is a two-part procedure: temperature offset calibration and temperature slope calibration. The two parts must be performed without interruption, in the order shown. Ensure that you are
prepared to complete the process without interruption. You will need a low-temperature calibration fluid and a high-temperature calibration fluid. You will not see the effect of the calibration until both the temperature offset calibration and the temperature slope calibration are complete.

**Important**
Consult customer support before performing a temperature calibration. Under normal circumstances, the temperature circuit is stable and should not need an adjustment.

### 11.10.1 Perform temperature calibration using the display

**Procedure**
1. Fill the sensor with the low-temperature fluid.
2. Wait until the sensor achieves thermal equilibrium.
3. Navigate to the calibration menu and enter it.
   a) Activate **Scroll** and **Select** simultaneously.
   b) Scroll to **OFF-LINE MAINT** and activate **Select**.
   c) Scroll to **OFF-LINE CAL** and activate **Select**.
   d) Scroll to **CAL TEMP** and activate **Select**.
4. Enter the temperature of the low-temperature fluid.
   a) When **CAL OFFSET TEMP** is flashing, activate **Select**.
   b) Enter the temperature value and save it.
5. Fill the sensor with the high-temperature fluid.
6. Wait until the sensor achieves thermal equilibrium.
7. Enter the temperature of the high-temperature fluid.
   a) When **CAL SLOPE TEMP** is flashing, activate **Select**.
   b) Enter the temperature value and save it.
8. Activate **Scroll** to view the new offset and slope values.
9. Activate **Select** to exit.

### 11.10.2 Perform temperature calibration using ProLink III

**Procedure**
See the following figure.
Temperature Offset Calibration

- Fill sensor with low-temperature fluid
- Wait until sensor achieves thermal equilibrium
- Device Tools > Calibration > Temperature Calibration > Temperature Calibration - Offset
- Enter temperature of low-temperature fluid
- Start Calibration

Temperature Slope Calibration

- Fill sensor with high-temperature fluid
- Wait until sensor achieves thermal equilibrium
- Device Tools > Calibration > Temperature Calibration > Temperature Calibration - Slope
- Enter temperature of high-temperature fluid
- Start Calibration

Done
11.10.3 Perform temperature calibration using the Field Communicator

Procedure

**Temperature Offset calibration**
- Fill sensor with low-temperature fluid
- Wait until sensor achieves thermal equilibrium
- Service Tools > Maintenance > Calibration >
- Enter temperature of low-temperature fluid
- Calibration in Progress
- Calibration Complete

**Temperature Slope calibration**
- Fill sensor with high-temperature fluid
- Wait until sensor achieves thermal equilibrium
- Service Tools > Maintenance > Calibration >
- Enter temperature of high-temperature fluid
- Calibration in Progress
- Calibration Complete
12 Troubleshooting

12.1 Status LED states

The status LED on the transmitter indicates whether or not alerts are active. If alerts are active, view the alert list to identify the alerts, then take appropriate action to correct the alert condition.

Your transmitter has a status LED only if it has a display.

If the transmitter has a display and LED Blinking is disabled, the status LED does not flash to indicate an unacknowledged alert.

<table>
<thead>
<tr>
<th>LED state</th>
<th>Description</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid green</td>
<td>No alerts are active.</td>
<td>Continue with configuration or process measurement.</td>
</tr>
<tr>
<td>Flashing green (if enabled)</td>
<td>Unacknowledged corrected condition (no alert)</td>
<td>Continue with configuration or process measurement. Acknowledge the alert if you choose.</td>
</tr>
<tr>
<td>Solid yellow</td>
<td>One or more low-severity alerts are active. A low severity alarm can mean one or more process variables is at a set output level (i.e. simulation or two phase timeout).</td>
<td>A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement, but Micro Motion still recommends identifying and resolving the alert condition.</td>
</tr>
<tr>
<td>Flashing yellow (if enabled)</td>
<td>Calibration in progress, or Known Density Verification in progress. One or more low-severity alerts are active and have not been acknowledged.</td>
<td>A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement, but Micro Motion still recommends identifying and resolving the alert condition.</td>
</tr>
<tr>
<td>Solid red</td>
<td>One or more high-severity alerts are active.</td>
<td>A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing.</td>
</tr>
<tr>
<td>Flashing red (if enabled)</td>
<td>One or more high-severity alerts are active and have not been acknowledged.</td>
<td>A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing. Acknowledge the alert if you choose.</td>
</tr>
</tbody>
</table>

12.2 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.

There are separate cutoff parameters for mass flow rate, volume flow rate, gas standard volume flow rate (if applicable), and density. There is an independent cutoff for the mA Output on your transmitter. The interaction between cutoffs sometimes produces unexpected results.

**Procedure**

Verify the configuration of all cutoffs.
Tip
For typical applications, set Mass Flow Cutoff between 0.1% of the nominal flow rate of the attached sensor. See the sensor specifications for nominal flow rate data.

12.3 Check the core processor LED
The core processor has an LED that indicates different meter conditions.

Procedure
1. Maintain power to the transmitter.
2. If you have a 4-wire remote installation or a remote core processor with remote transmitter installation:
   a) Remove the core processor lid. The core processor is intrinsically safe and can be opened in all environments.
   b) Check the state of the core processor LED.
3. If you have an integral installation:
   a) Loosen the four cap screws that fasten the transmitter to the base.

Figure 12-1: Integral installation components

b) Rotate the transmitter counter-clockwise so that the cap screws are in the unlocked position.

c) Gently lift the transmitter straight up, disengaging it from the cap screws.
**Important**
Do not disconnect or damage the wires that connect the transmitter to the core processor.

d) Check the state of the core processor LED.

4. If you have a 9-wire remote installation:
   a) Remove the end-cap.

**Figure 12-2: 9-wire remote installation components**

A. Transmitter  
B. Core processor  
C. 4 x cap screws (4 mm)  
D. End cap

b) Inside the core processor housing, loosen the three screws that hold the core processor mounting plate in place.  
   Do not remove the screws.

c) Rotate the mounting plate so that the screws are in the unlocked position.

d) Holding the tab on the mounting plate, slowly lower the mounting plate so that the top of the core processor is visible.
**Important**
Do not disconnect or damage the wires that connect the transmitter to the core processor.

e) Check the state of the core processor LED.

**Postrequisites**

To return to normal operation:

- For a 4-wire remote installation or a remote core processor with remote transmitter installation, replace the core processor lid.

- For an integral installation:
  1. Without pinching or stretching the wires, lower the transmitter onto the base, inserting the cap screws into the slots.
  2. Rotate the transmitter clockwise so that the cap screws are in the locked position.
  3. Tighten the cap screws, torquing to 20 to 30 in-lbs (2.3 to 3.4 N-m).

- For a 9-wire remote installation:
  1. Without pinching or stressing the wires, slide the mounting plate into place.
  2. Rotate the mounting plate so that the screws are in the locked position.
  3. Tighten the screws, torquing to 6 to 8 in-lbs (0.7 to 0.9 N-m).
  4. Replace the end-cap.

**Important**
When reassembling the meter components, be sure to grease all O-rings.

### 12.3.1 Core processor LED states

**Table 12-1: Standard core processor LED states**

<table>
<thead>
<tr>
<th>LED state</th>
<th>Description</th>
<th>Recommended actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash per second (ON 25%, OFF 75%)</td>
<td>Normal operation</td>
<td>No action required.</td>
</tr>
<tr>
<td>1 flash per second (ON 75%, OFF 25%)</td>
<td>Slug flow (two-phase flow)</td>
<td>See Check for two-phase flow (slug flow).</td>
</tr>
<tr>
<td>Solid ON</td>
<td>Zero or calibration in progress</td>
<td>No action required.</td>
</tr>
<tr>
<td></td>
<td>Core processor receiving between 11.5 and 5 volts</td>
<td>Check power supply to transmitter.</td>
</tr>
<tr>
<td>3 rapid flashes, followed by pause</td>
<td>Sensor not recognized</td>
<td>Check wiring between transmitter and sensor.</td>
</tr>
<tr>
<td></td>
<td>Improper configuration</td>
<td>Check sensor characterization parameters.</td>
</tr>
<tr>
<td></td>
<td>Broken pin between sensor and core processor</td>
<td>The meter requires factory service.</td>
</tr>
<tr>
<td>4 flashes per second</td>
<td>Fault condition</td>
<td>Check alert status.</td>
</tr>
</tbody>
</table>
### Table 12-1: Standard core processor LED states (continued)

<table>
<thead>
<tr>
<th>LED state</th>
<th>Description</th>
<th>Recommended actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Core processor receiving less than 5 volts</td>
<td>• Verify power supply wiring to core processor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If transmitter status LED is lit, transmitter is receiving power. Check voltage across terminals 1 (VDC+) and 2 (VDC-) in core processor. If reading is less than 1 VDC, verify power supply wiring to core processor. Wires may be switched.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If transmitter status LED is not lit, transmitter is not receiving power. Check power supply. If power supply is operational, internal transmitter, display, or LED failure is possible – the meter may require factory service.</td>
</tr>
<tr>
<td>Core processor internal failure</td>
<td>The meter requires factory service.</td>
<td></td>
</tr>
</tbody>
</table>

### Table 12-2: Enhanced core processor LED states

<table>
<thead>
<tr>
<th>LED state</th>
<th>Description</th>
<th>Recommended action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid green</td>
<td>Normal operation</td>
<td>No action required.</td>
</tr>
<tr>
<td>Flashing yellow</td>
<td>Zero in progress</td>
<td>No action required.</td>
</tr>
<tr>
<td>Solid yellow</td>
<td>Low-severity alert</td>
<td>Check alert status.</td>
</tr>
<tr>
<td>Solid red</td>
<td>High-severity alert</td>
<td>Check alert status.</td>
</tr>
<tr>
<td>Flashing red (80% on, 20% off)</td>
<td>Tubes not full</td>
<td>• If alert A105 (slug flow) is active, refer to the recommended actions for that alert.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If alert A033 (tubes not full) is active, verify process. Check for air in the flow tubes, tubes not filled, foreign material in tubes, or coating in tubes.</td>
</tr>
<tr>
<td>Flashing red (50% on, 50% off, skips every 4th)</td>
<td>Electronics failed</td>
<td>The meter requires factory service.</td>
</tr>
<tr>
<td>Flashing red (50% on, 50% off, skips every 4th)</td>
<td>Sensor failed</td>
<td>The meter requires factory service.</td>
</tr>
<tr>
<td>OFF</td>
<td>Core processor receiving less than 5 volts</td>
<td>• Verify power supply wiring to core processor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If transmitter status LED is lit, transmitter is receiving power. Check voltage across terminals 1 (VDC+) and 2 (VDC-) in core processor. If reading is less than 1 VDC, verify power supply wiring to core processor. Wires may be switched.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If transmitter status LED is not lit, transmitter is not receiving power. Check power supply. If power supply is operational, internal transmitter, display, or LED failure is possible – the meter may require factory service.</td>
</tr>
<tr>
<td>Core processor internal failure</td>
<td>The meter requires factory service.</td>
<td></td>
</tr>
</tbody>
</table>
12.4 Perform a 700 core processor resistance test

**Note**
You can perform a resistance test only on a 700 core processor.

**Procedure**

1. Power down the transmitter.
2. If you have a 4-wire remote installation or a remote core processor with remote transmitter installation, remove the core processor lid.
3. If you have an integral installation:
   a) Loosen the four cap screws that fasten the transmitter to the base.
   b) Rotate the transmitter counter-clockwise so that the cap screws are in the unlocked position.
   c) Gently lift the transmitter straight up, disengaging it from the cap screws.
4. If you have a 9-wire remote installation:
   a) Remove the end-cap.
Figure 12-3: 9-wire remote installation components

A. Transmitter
B. Core processor
C. 4 x cap screws (4 mm)
D. End-cap

b) Inside the core processor housing, loosen the three screws that hold the core processor mounting plate in place. Do not remove the screws.

c) Rotate the mounting plate so that the screws are in the unlocked position.

d) Holding the tab on the mounting plate, slowly lower the mounting plate so that the top of the core processor is visible.

5. At the core processor, disconnect the 4-wire cable between the core processor and the transmitter.


<table>
<thead>
<tr>
<th>Terminal pair</th>
<th>Function</th>
<th>Expected resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3–4</td>
<td>RS-485/A and RS-485/B</td>
<td>40 kΩ to 50 kΩ</td>
</tr>
<tr>
<td>2–3</td>
<td>VDC – and RS-485/A</td>
<td>20 kΩ to 25 kΩ</td>
</tr>
<tr>
<td>Terminal pair</td>
<td>Function</td>
<td>Expected resistance</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>2–4</td>
<td>VDC– and RS-485/B</td>
<td>20 kΩ to 25 kΩ</td>
</tr>
</tbody>
</table>

7. If any resistance measurements are lower than specified, the core processor may not be able to communicate with a transmitter or a remote host. The meter may need factory service.

**Postrequisites**

To return to normal operation:

- For a 4-wire remote installation or a remote core processor with remote transmitter installation:
  1. Reconnect the 4-wire cable between the core processor and the transmitter.
  2. Replace the core processor lid.
  3. Restore power to the transmitter.

- For an integral installation:
  1. Reconnect the 4-wire cable between the core processor and the transmitter.
  2. Without pinching or stretching the wires, lower the transmitter onto the base, inserting the cap screws into the slots.
  3. Rotate the transmitter clockwise so that the cap screws are in the locked position.
  4. Tighten the cap screws, torquing to 20 to 30 in-lbs (2.3 to 3.4 N-m).
  5. Restore power to the transmitter.

- For a 9-wire remote installation:
  1. Reconnect the 4-wire cable between the core processor and the transmitter.
  2. Without pinching or stressing the wires, slide the mounting plate into place.
  3. Rotate the mounting plate so that the screws are in the locked position.
  4. Tighten the screws, torquing to 6 to 8 in-lbs (0.7 to 0.9 N-m).
  5. Replace the end-cap.
  6. Restore power to the transmitter.

**Important**

When reassembling the meter components, be sure to grease all O-rings.
### 12.5 Density measurement problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible causes</th>
<th>Recommended actions</th>
</tr>
</thead>
</table>
| Inaccurate density reading    | • 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 | • Check your process conditions against the values reported by the device.  
     • Ensure that all of the calibration parameters have been entered correctly. See the sensor tag or the calibration sheet for your meter.  
     • Check the wiring between the sensor and the transmitter.  
     • Check the grounding of all components.  
     • Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.  
     • Check for two-phase flow.  
     • If two sensors with similar frequency are too near each other, separate them.  
     • Purge the sensor tubes. |
| Unusually high density reading| • Plugged or coated sensor tube  
     • Incorrect density calibration factors  
     • Incorrect temperature measurement  
     • RTD problem  
     • In high-frequency meters, this can indicate erosion or corrosion  
     • In low-frequency meters, this can indicate tube fouling | • Ensure that all of the calibration parameters have been entered correctly. See the sensor tag or the calibration sheet for your meter.  
     • Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.  
     • Purge the sensor tubes.  
     • Check for coating in the flow tubes. |
| Unusually low density reading | • Two-phase flow  
     • Ensure that all of the calibration parameters have been entered correctly. See the sensor tag or the calibration sheet for your meter.  
     • In low-frequency meters, this can indicate erosion or corrosion | • Check your process conditions against the values reported by the device.  
     • Check for two-phase flow.  
     • Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.  
     • Check the wiring between the sensor and the transmitter.  
     • Check for tube erosion, especially if the process fluid is abrasive. |
12.6 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 12-3: Possible causes and recommended actions for excessive (saturated) drive gain

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Recommended actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bent sensor tube</td>
<td>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.</td>
</tr>
</tbody>
</table>
| Cavitation or flashing; settling of two-phase or three-phase fluids | • Increase the inlet or back pressure at the sensor.  
  • If a pump is located upstream from the sensor, increase the distance between the pump and sensor.  
  • The sensor may need to be reoriented or repositioned. Consult the installation manual for your sensor. |
| 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.                                                                                                 |
| Incorrect sensor characterization                    | Verify the characterization or calibration parameters.                                                                                               |
| 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 12-4: Possible causes and recommended actions for erratic drive gain

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Recommended actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-phase flow</td>
<td>Check for two-phase flow. See Check for two-phase flow (slug flow).</td>
</tr>
<tr>
<td>Polarity of pick-off reversed or polarity of drive reversed</td>
<td>Applicable for a 9-wire sensor. Check the wiring between the sensor and the transmitter.</td>
</tr>
<tr>
<td>Foreign material caught in sensor tubes</td>
<td>• Purge the sensor tubes.</td>
</tr>
<tr>
<td></td>
<td>• Replace the sensor.</td>
</tr>
</tbody>
</table>

12.6.1 Collect drive gain data

Drive gain data can be used to diagnose a variety of process and equipment conditions. Collect drive gain data from a period of normal operation, and use this data as a baseline for troubleshooting.

Procedure

1. Navigate to the drive gain data.
2. Observe and record drive gain data over an appropriate period of time, under a variety of process conditions.

12.7 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.

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Recommended action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture inside the sensor junction box</td>
<td>Ensure that the junction box is dry and no corrosion is present.</td>
</tr>
<tr>
<td>Liquid or moisture inside the sensor case</td>
<td>Contact customer support.</td>
</tr>
<tr>
<td>Internally shorted feedthrough</td>
<td>Contact customer support.</td>
</tr>
<tr>
<td>Faulty cable</td>
<td>Replace the cable.</td>
</tr>
<tr>
<td>Improper wire termination</td>
<td>Verify wire terminations inside the sensor junction box. See <em>Micro Motion 9-Wire Flow Meter Cable Preparation and Installation Guide</em>.</td>
</tr>
<tr>
<td>Shorts to the housing created by trapped or damaged wires</td>
<td>Contact customer support.</td>
</tr>
<tr>
<td>Loose wires or connectors</td>
<td>Contact customer support.</td>
</tr>
<tr>
<td>Liquid or moisture inside the housing</td>
<td>Contact customer support.</td>
</tr>
</tbody>
</table>
12.7.1 Check the sensor coils

Checking the sensor coils can identify a cause for a no sensor response alert.

**Restriction**
This procedure applies only to 9-wire remote-mount transmitters and remote transmitters with remote core processors.

**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. Remove the end-cap from the core processor housing.

3. Unplug the terminal blocks from the terminal board on the core processor.

4. Using a digital multimeter (DMM), check the pickoff coils by placing the DMM leads on the unplugged terminal blocks for each terminal pair. See the following table for a list of the coils. Record the values.

   **Table 12-5: Coils and test terminal pairs**

<table>
<thead>
<tr>
<th>Coil</th>
<th>Sensor model</th>
<th>Terminal colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive coil</td>
<td>All</td>
<td>Brown to red</td>
</tr>
<tr>
<td>Left pickoff coil (LPO)</td>
<td>All</td>
<td>Green to white</td>
</tr>
<tr>
<td>Right pickoff coil (RPO)</td>
<td>All</td>
<td>Blue to gray</td>
</tr>
<tr>
<td>Resistance temperature detector (RTD)</td>
<td>All</td>
<td>Yellow to violet</td>
</tr>
<tr>
<td>Lead length compensator (LLC)</td>
<td>All except T-Series and CMF400 (see note)</td>
<td>Yellow to orange</td>
</tr>
<tr>
<td>Composite RTD</td>
<td>All CMFSs, T-Series, H300, and F300</td>
<td>Yellow to orange</td>
</tr>
<tr>
<td>Fixed resistor (see note)</td>
<td>CMFS007, CMFS010, CMFS015, CMF400, and F300</td>
<td>Yellow to orange</td>
</tr>
</tbody>
</table>

**Note**
The fixed resistor on F300/H300/CMF400 sensors adds ~ 40 ohms to the reading between the yellow and orange leads and applies to only specific sensor 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.

5. Test the terminals in the sensor junction box for shorts to case.

   Test results will be inconclusive with nonconductive process fluids such as hydrocarbons.
   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.

6. 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 end-cap on the core processor housing.
3. Replace the lid on the sensor junction box.

Important

When reassembling the meter components, be sure to grease all O-rings.

12.8 Check Flow Direction

If Flow Direction is set inappropriately for your process, the transmitter may report flow data that is not appropriate for your requirements.

The Flow Direction parameter interacts with actual flow direction to affect flow values, flow totals and inventories, and output behavior. For the simplest operation, actual process flow should match the flow arrow that is on the side of the sensor case.

Procedure

1. Verify the actual direction of process flow through the sensor.
2. Verify the configuration of Flow Direction.
# 12.9 Flow measurement problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible causes</th>
<th>Recommended actions</th>
</tr>
</thead>
</table>
| Non-zero flow reading at no-flow conditions or at zero offset | • Misaligned piping (especially in new installations)  
• Open or leaking valve  
• Incorrect sensor zero | • If the reading is not excessively high, review the live zero. You may need to restore the factory zero.  
• Check for open or leaking valves or seals.  
• Check for mounting stress on the sensor (e.g., sensor being used to support piping, misaligned piping).  
• Contact customer support. |
| Erratic non-zero flow rate at no-flow conditions | • Leaking valve or seal  
• Two-phase flow  
• Incorrect sensor orientation  
• Wiring problem  
• Vibration in pipeline at rate close to sensor tube frequency  
• Damping value too low  
• Mounting stress on sensor  
• Empty sensor when reading liquid volume flow | • Verify that the sensor orientation is appropriate for your application (refer to the sensor installation manual).  
• Check the drive gain and the pickoff voltage.  
• If the wiring between the sensor and the transmitter includes a 9-wire segment, verify that the 9-wire cable shields are correctly grounded.  
• Check the wiring between the sensor and the transmitter.  
• For sensors with a junction box, check for moisture in the junction box.  
• 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 support. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible causes</th>
<th>Recommended actions</th>
</tr>
</thead>
</table>
| Erratic non-zero flow rate when flow 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 (refer to the sensor installation manual).  
• Check the drive gain and the pickoff voltage.  
• If the wiring between the sensor and the transmitter includes a 9-wire segment, verify that the 9-wire cable shields are correctly grounded.  
• Check for air entrainment, tube fouling, flashing, or tube damage.  
• Check the wiring between the sensor and the transmitter.  
• For sensors with a junction box, check for moisture in the junction box.  
• 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 support. |
| Inaccurate flow rate or batch total | • 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  
• Incorrect measurement unit configured for a process variable - for example, selecting g/min instead of USGPM | • Check the wiring between the sensor and the transmitter.  
• Verify that the measurement units are configured correctly for your application.  
• Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.  
• Perform a bucket test to verify batch totals.  
• 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.  
• Check sensor coil resistance and for shorts to case.  
• Replace the core processor or transmitter. |
12.10 Frequency Output problems

Table 12-6: Frequency Output problems and recommended actions

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible causes</th>
<th>Recommended actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Frequency Output</td>
<td>• Stopped totalizer</td>
<td>• Verify that the process conditions are below the low-flow cutoff. Reconfigure the low-flow cutoff if necessary.</td>
</tr>
<tr>
<td></td>
<td>• Process condition below cutoff</td>
<td>• Check the Fault Action settings.</td>
</tr>
<tr>
<td></td>
<td>• Fault condition if Fault Action is set to Internal Zero or Downscale</td>
<td>• Verify that the totalizers are not stopped. A stopped totalizer will cause the Frequency Output to be locked.</td>
</tr>
<tr>
<td></td>
<td>• Two-phase flow</td>
<td>• Check for two-phase flow.</td>
</tr>
<tr>
<td></td>
<td>• Flow in reverse direction from configured flow direction parameter</td>
<td>• Check flow direction.</td>
</tr>
<tr>
<td></td>
<td>• Bad frequency receiving device</td>
<td>• Verify the receiving device, and the wiring between the transmitter and the receiving device.</td>
</tr>
<tr>
<td></td>
<td>• Output level not compatible with receiving device</td>
<td>• Verify that the channel is wired and configured as a Frequency Output.</td>
</tr>
<tr>
<td></td>
<td>• Bad output circuit (rarely occurs)</td>
<td>• Perform a loop test.</td>
</tr>
<tr>
<td></td>
<td>• Wiring problem</td>
<td></td>
</tr>
<tr>
<td>Consistently incorrect</td>
<td>• Output not scaled correctly</td>
<td>• Check the Frequency Output scaling.</td>
</tr>
<tr>
<td>frequency measurement</td>
<td>• Incorrect measurement unit configured for process variable</td>
<td>• Verify that the measurement units are configured correctly for your application.</td>
</tr>
<tr>
<td>Erratic Frequency</td>
<td>• Radio frequency interference (RFI) from environment</td>
<td>• Check for radio frequency interference.</td>
</tr>
<tr>
<td>Output</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12.11 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, consider the following options:
   • Change the setting of Frequency Output Fault Action.
   • For the relevant status alerts, change the setting of Alert Severity to Ignore.

Restriction
For some status alerts, Alert Severity is not configurable.

3. If there are no active fault conditions, continue troubleshooting.
12.12 Check Frequency Output Scaling Method

If Frequency Output Scaling Method is set incorrectly, the Frequency Output may report an incorrect value.

Procedure

1. Verify the configuration of the Frequency Output.
2. If you changed the setting of Frequency Output Scaling Method, check the settings of all other Frequency Output parameters.

12.13 Check grounding

The sensor and the transmitter must be grounded. If the core processor is installed as part of the transmitter or the sensor, it is grounded automatically. If the core processor is installed separately, it must be grounded separately.

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.

12.14 Locate a device using the HART 7 Squawk feature

The Squawk feature causes the device to show a specific pattern on its display. You can use this to locate or identify a device.

Restriction

The Squawk feature is available only with HART 7 connections from a field communicator. It is not available with ProLink III.

Procedure

A 0-0-0-0 pattern is shown on the display.

12.15 Check HART Address and mA Output Action

If the transmitter is producing a fixed current from the mA Output, the mA Output Action parameter may be set incorrectly.

When the mA Output Action parameter is set to Fixed, the mA Output produces a fixed value, and does not report process data or implement its fault action.

When HART Address is changed, some configuration tools will automatically change mA Output Action.

Tip

Always verify mA Output Action after setting or changing HART Address.
Procedure

1. Set [HART Address] as appropriate for your HART network.
   The default address is 0. This is the recommended value unless the transmitter is in a multidrop network.

2. Set [mA Output Action] to Live.

12.16 Check HART burst mode

HART burst mode is normally disabled, and should be enabled only if a HART Triloop is being used.

Procedure

1. Check to see if burst mode is enabled or disabled.
2. If burst mode is enabled, disable it.

12.17 Check the HART communication loop

If you cannot establish or maintain HART communications, the HART loop may be wired incorrectly.

Prerequisites

You will need:
- A copy of your transmitter installation manual
- A 250–600 Ω resistor
- A Field Communicator

Procedure

1. Verify that the loop wires are connected as shown in the wiring diagrams in the transmitter installation manual.
   If your HART network is more complex than the wiring diagrams in the transmitter installation manual, contact either customer service or the HART Communication Foundation.

2. Disconnect the primary mA Output wiring from the transmitter.

3. Install a 250–600 Ω resistor across the transmitter’s primary mA Output terminals.

4. Check the voltage drop across the resistor (4–20 mA = 1–5 VDC for a 250 Ω resistor).
   If voltage drop is less than 1 VDC, add resistance to achieve a voltage drop of greater than 1 VDC.

5. Connect a Field Communicator directly across the resistor and attempt to communicate (poll).
   If communication with the transmitter cannot be established, the transmitter may need service.
   Contact customer service.
12.18 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.

12.18.1 Perform loop tests using the display

Prerequisites
Before performing a loop test, configure the channels for the transmitter inputs and outputs that will be used in your application.

Follow appropriate procedures to ensure that loop testing will not interfere with existing measurement and control loops.

Procedure
1. Test the mA Output(s).
   a) Choose **OFFLINE MAINT → SIM → AO1 SIM** and select a low value, e.g., 4 mA.
      Dots traverse the display while the output is fixed.
   b) 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.
   c) At the transmitter, activate **Select**.
   d) Scroll to and select a high value, e.g., 20 mA.
      Dots traverse the display while the output is fixed.
   e) 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.
   f) At the transmitter, activate **Select**.

2. Test the Frequency Output(s).
   a) Choose **OFFLINE MAINT → SIM → FO SIM**, and select the Frequency Output value.
      The Frequency Output can be set to 1, 10, or 15 kHz.

Note
If the Weights & Measures application with NTEP approval is enabled on the transmitter, it is not possible to perform a loop test of the Frequency Output, even when the transmitter is unsecured.
Dots traverse the display while the output is fixed.

b) Read the frequency signal at the receiving device and compare it to the transmitter output.

c) At the transmitter, activate Select.

3. Test the Discrete Output(s).
   a) Choose OFFLINE MAINT → SIM → DO SIM, and select SET ON.
      Dots traverse the display while the output is fixed.
   
      b) Verify the signal at the receiving device.
   
      c) At the transmitter, activate Select.
   
      d) Scroll to and select SET OFF.
   
      e) Verify the signal at the receiving device.
   
      f) At the transmitter, activate Select.

4. Test the Discrete Input.
   a) Set the remote input device to generate a known fixed current.
   
   b) At the transmitter, choose OFFLINE MAINT → SIM, and select READ DI.
   
   c) At the transmitter, activate Select.
   
   d) Verify the signal at the transmitter.
   
   e) Repeat the procedure for the other signal state.

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.

12.18.2 Perform loop tests using ProLink III

Prerequisites

Before performing a loop test, configure the channels for the transmitter inputs and outputs that will be used in your application.

Follow appropriate procedures to ensure that loop testing will not interfere with existing measurement and control loops.

Procedure

1. Test the mA Output(s).
   a) Choose Device Tools → Diagnostics → Testing → mA Output 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).

   Note
   If the Weights & Measures application with NTEP approval is enabled on the transmitter, it is not
   possible to perform a loop test of the Frequency Output, even when the transmitter is unsecured.

   a) Choose Device Tools → Diagnostics → Testing → Frequency Output 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).


   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.
12.18.3 Perform loop tests using the Field Communicator

**Prerequisites**

Before performing a loop test, configure the channels for the transmitter inputs and outputs that will be used in your application.

Follow appropriate procedures to ensure that loop testing will not interfere with existing measurement and control loops.

**Procedure**

1. Test the mA Output(s).
   - a) Choose Service Tools → Simulate → Simulate Outputs → mA Output Loop Test and select 4 mA.
   - b) 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.
   - c) Press OK.
   - d) Select 20 mA.
   - e) 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.
   - f) Press OK.
   - g) Choose End.

2. Test the Frequency Output(s).
   - Note: If the Weights & Measures application with NTEP approval is enabled on the transmitter, it is not possible to perform a loop test of the Frequency Output, even when the transmitter is unsecured.
   - a) Press Service Tools → Simulate → Simulate Outputs → Frequency Output Test, and choose the Frequency Output level.
   - b) Read the frequency signal at the receiving device and compare it to the transmitter output.
   - c) Choose End.

3. Test the Discrete Output(s).
   - a) Press Service Tools → Simulate → Simulate Outputs → Discrete Output 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.

12.19 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 a saturation alert (A100), then perform the configured fault action. 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.

12.20 Milliamp output problems

Table 12-7: Milliamp output problems and recommended actions

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible causes</th>
<th>Recommended actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>No mA Output</td>
<td>• Wiring problem</td>
<td>• Check the power supply and power supply wiring.</td>
</tr>
<tr>
<td></td>
<td>• Circuit failure (rarely occurs)</td>
<td>• Verify the output wiring.</td>
</tr>
<tr>
<td></td>
<td>• Channel not configured for desired output</td>
<td>• Check the Fault Action settings.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Contact customer support.</td>
</tr>
<tr>
<td>Loop test failed</td>
<td>• Power supply problem</td>
<td>• Check the power supply and power supply wiring.</td>
</tr>
<tr>
<td></td>
<td>• Wiring problem</td>
<td>• Verify the output wiring.</td>
</tr>
<tr>
<td></td>
<td>• Circuit failure (rarely occurs)</td>
<td>• Check the Fault Action settings.</td>
</tr>
<tr>
<td></td>
<td>• Channel not configured for desired output</td>
<td>• Verify channel configuration for the affected mA Output.</td>
</tr>
<tr>
<td></td>
<td>• Incorrect internal/external power configuration</td>
<td>• Contact customer support.</td>
</tr>
</tbody>
</table>
### Table 12-7: Milliamp output problems and recommended actions (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible causes</th>
<th>Recommended actions</th>
</tr>
</thead>
</table>
| mA Output below 4 mA | • Open in wiring  
• Bad output circuit (rarely occurs)  
• 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 | • Check your process conditions against the values reported by the device.  
• Verify the receiving device, and the wiring between the transmitter and the receiving device.  
• Check the settings of **Upper Range Value** and **Lower Range Value**.  
• Check the **Fault Action** settings. |
| Constant mA Output | • Incorrect process variable assigned to the output  
• Fault condition exists  
• Non-zero HART address (mA Output 1)  
• Output is configured for loop test mode  
• Zero calibration failure  
• Output is configured for a range that is far in excess of intended range. Reconfigure output.  
• The process condition is below cutoff. | • Verify the output variable assignments.  
• View and resolve any existing alert conditions.  
• Check the HART address. If the HART address is non-zero, you may need to change the setting of **mA Output Action**.  
• Check to see if a loop test is in process (the output is fixed).  
• Check HART burst mode configuration.  
• If related to a zero calibration failure, cycle power to the meter and retry the zeroing procedure.  
• Process condition is below cutoff. Check and adjust the cutoff setting. |
| mA Output consistently out of range | • 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 | • Verify the output variable assignments.  
• Verify the measurement units configured for the output.  
• Check the **Fault Action** settings.  
• Check the settings of **Upper Range Value** and **Lower Range Value**.  
• Check the mA Output trim. |
| Consistently incorrect mA measurement | • Loop problem  
• Output not trimmed correctly  
• Incorrect measurement unit configured for process variable  
• Incorrect process variable configured  
• LRV and URV are not set correctly | • Check the mA Output trim.  
• Verify that the measurement units are configured correctly for your application.  
• Verify the process variable assigned to the mA Output.  
• Check the settings of **Upper Range Value** and **Lower Range Value**. |
| mA Output correct at lower current, but incorrect at higher current | • mA loop resistance may be too high | • Verify that the mA Output load resistance is below the maximum supported load (see the installation manual for your transmitter). |
12.21 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, consider the following options:
   - Change the setting of mA Output Fault Action.
   - For the relevant status alerts, change the setting of Alert Severity to Ignore.

Restriction
For some status alerts, Alert Severity is not configurable.

3. If there are no active fault conditions, continue troubleshooting.

12.22 Trim mA Output

Trimming an mA Output calibrates the transmitter mA Output to the receiving device. If the current trim value is inaccurate, the transmitter will under-compensate or over-compensate the output.

12.22.1 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.

Important
You must trim the output at both ends (4 mA and 20 mA to ensure that it is compensated accurately across the entire output range.

Procedure

1. Choose Device Tools → Calibration → MA Output Trim → mA Output 1 Trim.
2. Choose Device Tools → Calibration → MA Output Trim → mA Output 1 Trim or Device Tools → Calibration → MA Output Trim → mA Output 2 Trim.
3. Follow the instructions in the guided method.
4. Check the trim results. If any trim result is less than −20 microamps or greater than +20 microamps, contact customer service.
12.22.2 Trim mA Outputs using a field communicator

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.

**Important**

You must trim the output at both ends (4 mA and 20 mA to ensure that it is compensated accurately across the entire output range.

**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.

12.23 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 12-8: Possible causes and recommended actions for low pickoff voltage**

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Recommended actions</th>
</tr>
</thead>
</table>
| Cavitation or flashing; settling of two-phase or three-phase fluids | • Increase the inlet or back pressure at the sensor. Increasing back pressure is recommended. Applying back pressure downstream from the sensor can prevent flashing inside the sensor tubes. That way, if the process fluid is going to flash, it will do so downstream from the sensor after it has been measured.  
  • If a pump is located upstream from the sensor, increase the distance between the pump and sensor.  
  • The sensor may need to be reoriented or repositioned. Consult the installation manual for your sensor. |
| 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.                |
| Two-phase flow                                       | Check for two-phase flow. See Check for two-phase flow (slug flow).                 |
Table 12-8: Possible causes and recommended actions for low pickoff voltage (continued)

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Recommended actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor tubes are not vibrating</td>
<td>• Check for plugging or deposition.</td>
</tr>
<tr>
<td></td>
<td>• Ensure that the vibrating element is free to vibrate (no mechanical binding).</td>
</tr>
<tr>
<td></td>
<td>• Verify wiring.</td>
</tr>
<tr>
<td></td>
<td>• Test coils at sensor. See Check the sensor coils.</td>
</tr>
<tr>
<td>Moisture in the sensor electronics</td>
<td>Eliminate the moisture in the sensor electronics.</td>
</tr>
<tr>
<td>The sensor is damaged, or sensor magnets may have become demagnetized</td>
<td>Replace the sensor.</td>
</tr>
</tbody>
</table>

12.23.1 Collect pickoff voltage data

Pickoff voltage data can be used to diagnose a variety of process and equipment conditions. Collect pickoff voltage data from a period of normal operation, and use this data as a baseline for troubleshooting.

Procedure

1. Navigate to the pickoff voltage data.
2. Observe and record data for both the left pickoff and the right pickoff, over an appropriate period of time, under a variety of process conditions.

12.24 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.
• When using DC power, a minimum of 1.5 amps of startup current is required.

Procedure

1. Use a voltmeter to test the voltage at the transmitter 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. Inspect the voltage label inside the wiring compartment.
The voltage supplied to the transmitter should match the voltage specified on the label.
7. **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.
8. Test the voltage at the terminals.
   If there is no power, contact customer service.

### 12.25 Check for radio frequency interference (RFI)

The transmitter 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.

### 12.26 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.

12.27 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.

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.

12.28 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. Micro Motion recommends leaving the Two-Phase Flow High Limit at the default value.
12.29 Status alerts, causes, and recommendations

Not all of these alerts may apply to your type of transmitter.

12.29.1 A001

Alert
EEPROM Error (Core Processor)

Cause
The transmitter has detected a problem communicating with the sensor.

Recommended actions
1. Cycle power to the meter.
2. Replace the core processor.
3. Contact customer support.

12.29.2 A002

Alert
RAM Error (Core Processor)

Cause
The transmitter has detected a problem communicating with the sensor.

Recommended actions
1. Cycle power to the meter.
2. Replace the core processor.
3. Contact customer support.

12.29.3 A003

Alert
No Sensor Response

Cause
The transmitter is not receiving one or more basic electrical signals from the sensor.
This alert often occurs in conjunction with Alert 102.

Recommended actions
1. Check the drive gain and the pickoff voltage.
2. Check the wiring between the sensor and the transmitter.
3. Verify that internal wiring is secure and that there are no internal electrical problems.
4. Check the integrity of the sensor tubes.
5. Perform sensor coil resistance checks.

12.29.4 A004

Alert
Temperature Overrange

Cause
The RTD resistance is out of range for the sensor. The tube RTD resistance is out of range for the sensor.

Recommended actions
1. Check your process conditions against the values reported by the device.
2. Verify temperature characterization or calibration parameters.
3. Verify that internal wiring is secure and that there are no internal electrical problems.
4. Check the wiring between the sensor and the transmitter.
5. Contact customer support.

12.29.5 A005

Alert
Mass Flow Rate Overrange

Cause
The measured flow rate is greater than the maximum flow rate of the sensor (ΔT greater than 200 µs).

Recommended actions
1. If other alerts are present, resolve those alert conditions first. If the current alert persists, continue with the recommended actions.
2. Check your process conditions against the values reported by the device.
3. Check for two-phase flow.

12.29.6 A006

Alert
Characterization Required

Cause
• Calibration factors have not been entered
• The sensor type is incorrect
• The calibration factors are incorrect for the sensor type

Recommended actions
1. Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.
2. Verify the setting of the Sensor Type parameter.
3. If Sensor Type = Curved Tube, ensure that no parameters specific to Straight Tube have been set.
4. Verify that internal wiring is secure and that there are no internal electrical problems.
5. Replace the core processor.
6. Contact customer support.

12.29.7 A008

Alert
Density Overrange

Cause
The line density is greater than 10 g/cm$^3$ (10000 kg/m$^3$).

Recommended actions
1. If other alerts are present, resolve those alert conditions first. If the current alert persists, continue with the following steps.
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. Check for two-phase flow.
4. Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.
5. Check the drive gain and the pickoff voltage.
6. Perform Smart Meter Verification.
7. Perform density calibration.
8. Contact customer support.

12.29.8 A009

Alert
Transmitter Initializing/Warming Up

Cause
Transmitter is in power-up mode.
This alert often occurs in conjunction with Alert 14.

Recommended actions
1. Allow the meter to complete its power-up sequence. The alert should clear automatically.
2. If other alerts are present, resolve those alert conditions first. If the current alert persists, continue with the following steps.
3. Verify that the tubes are full of process fluid.
4. Check the wiring between the sensor and the transmitter.
5. Verify that the transmitter is receiving sufficient power. If using DC power, verify that there is a minimum of 1.5 amps of startup current available.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>If no</td>
<td>Correct the problem and cycle power to the meter.</td>
</tr>
<tr>
<td>If yes</td>
<td>The transmitter probably has an internal power issue. Replace the transmitter.</td>
</tr>
</tbody>
</table>

6. Ensure that the process fluid is stable.
   - Check for two-phase flow, high process noise, or a fast transition between two fluids of different densities.

12.29.9 A010
Alert
Calibration Failure

**Cause**
There are many possible causes. This alert will not clear until you cycle power to the meter.

**Recommended actions**
1. Ensure that your calibration procedure meets the documented requirements, cycle power to the meter, then retry the procedure.
2. If this alert appears during zeroing:
   a) Verify that there is no flow through the sensor.
   b) Cycle power to the meter.
   c) Retry the procedure.

12.29.10 A011
Alert
Zero Calibration Failed: Low

**Cause**
There are many possible causes, such as:
- Too much flow, especially reverse flow through the sensor during a calibration procedure
- A zero result occurred that is too low.

This alert is accompanied by A010, and will not clear until you cycle power to the meter.

**Recommended actions**
1. Verify that there is no flow through the sensor.
2. Cycle power to the meter.
3. Retry the procedure.
12.29.11 A012

Alert
Zero Calibration Failed: High

Cause
There are many possible causes, such as:
• Too much flow, especially forward flow through the sensor during a calibration procedure
• A zero result occurred that is too high.

This alert is accompanied by A010, and will not clear until you cycle power to the meter.

Recommended actions
1. Verify that there is no flow through the sensor.
2. Cycle power to the meter.
3. Retry the procedure.

12.29.12 A013

Alert
Zero Calibration Failed: Unstable

Cause
There was too much process instability during the calibration procedure.

This alert will not clear until you cycle power to the meter.

Recommended actions
1. Remove or reduce sources of electromechanical noise.

   Example
   Pumps, vibration, or pipe stress
2. Cycle power to the meter.
3. Retry the procedure.

12.29.13 A014

Alert
Transmitter Failure

Cause
There are many possible causes.

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 grounding of all components.
4. Evaluate the environment for sources of high electromagnetic interference (EMI) and relocate the transmitter or wiring as necessary.
5. Contact customer support.

12.29.14 A016

Alert
Sensor Temperature (RTD) Failure

Cause
The value computed for the resistance of the line RTD is outside limits.

Recommended actions
1. Check your process conditions against the values reported by the device.
2. Check the wiring between the sensor and the transmitter.
3. Verify that internal wiring is secure and that there are no internal electrical problems.
4. Contact customer support.

12.29.15 A017

Alert
Sensor Case Temperature (RTD) Failure

Cause
The values computed for the resistance of the meter and case RTDs are outside limits.

Recommended actions
1. Check your process conditions against the values reported by the device.
   Temperature should be between -200 °F (-129 °C) and +400 °F (+204 °C).
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. Verify that internal wiring is secure and that there are no internal electrical problems.
5. Contact customer support.

12.29.16 A018

Alert
EEPROM Error (Transmitter)
Cause

The transmitter has experienced a memory error. This alert will not clear until you cycle power to the meter.

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. Power-cycle the transmitter to see if the alert clears.

Important

This alert will not clear until you cycle power to the meter.

7. If the alert persists, replace the transmitter.

12.29.17 A019

Alert

RAM Error (Transmitter)

Cause

The transmitter has experienced a memory error. This alert will not clear until you 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. Power-cycle the transmitter to see if the alert clears.
7. If the alert persists, replace the transmitter.
8. Contact customer support.

12.29.18 A020

Alert
Calibration Factors Missing

Cause
Some calibration factors have not been entered or are incorrect.

Recommended actions
1. Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.
2. Verify the setting of the Sensor Type parameter.
3. If Sensor Type = Curved Tube, ensure that no parameters specific to Straight Tube have been set.

12.29.19 A021

Alert
Transmitter/Sensor/Software Mismatch

Cause
The configured board type does not match the physical board, or the configured sensor type does not match the physical sensor.

Recommended actions
1. Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.
2. Ensure that the correct board is installed.
3. Verify the setting of the Sensor Type parameter.
4. If Sensor Type = Curved Tube, ensure that no parameters specific to Straight Tube have been set.

12.29.20 A022

Alert
Configuration Database Corrupt (Core Processor)

Cause
There has been an internal electronics failure.
12.29.21 A023

Alert
Internal Totals Corrupt (Core Processor)

Cause
There has been an internal electronics failure.

Recommended actions
1. Cycle power to the meter.
2. Contact customer support.

12.29.22 A024

Alert
Program Corrupt (Core Processor)

Cause
There has been an internal electronics failure.

Recommended actions
1. Cycle power to the meter.
2. Contact customer support.

12.29.23 A025

Alert
Boot Sector Fault (Core Processor)

Cause
There has been an internal electronics failure.

Recommended actions
1. Cycle power to the meter.
2. Contact customer support.

12.29.24 A026

Alert
Sensor/Transmitter Communications Failure


**Cause**

The transmitter has lost communication with the core processor. There may be a problem with the wiring or with either component.

This alert often occurs in conjunction with alerts A009 and A014.

**Recommended actions**

1. Check the wiring between the sensor and the transmitter.
2. Check for noise in the wiring or in the transmitter environment.
3. Verify that internal wiring is secure and that there are no internal electrical problems.
4. Check the status LED on the core processor.
5. Check the resistance across core processor terminals.
6. 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.

12.29.25 A027

**Alert**

Security Breach

**Cause**

- The transmitter has been switched from secure mode to unsecure mode. Only in unsecured mode can the transmitter configuration be changed.
- The HART device ID is set to zero.

**Recommended actions**

1. Return the transmitter to secure mode if changing the configuration is not needed.
2. Check the HART device ID.
   For custody transfer or MID applications, it must be non-zero. If it is set to 0, contact the factory or customer support.

12.29.26 A028

**Alert**

Core Processor Write Failure

**Cause**

There is an internal electronics failure.

**Recommended actions**

1. Cycle power to the meter.
2. Contact customer support.

12.29.27 A029
Alert
Internal Electronics Failure

Cause
This can indicate a loss of communication between the transmitter and the display module.

Recommended actions
1. Cycle power to the meter.
2. Replace the display module.
3. Contact customer support.

12.29.28 A030
Alert
Incorrect Board Type

Cause
The loaded software is not compatible with the programmed board type.

Recommended actions
Contact customer support.

12.29.29 A031
Alert
Low Power

Cause
The core processor or transmitter is not receiving enough power.
This alert will not clear until you cycle power to the meter.

Recommended actions
1. Check the wiring between the transmitter and the core processor.
2. Cycle power to the meter.
3. Check the wiring of the transmitter.
4. Cycle power to the meter.
5. Verify that the transmitter is receiving sufficient power.
<table>
<thead>
<tr>
<th>Option</th>
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</tr>
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<tbody>
<tr>
<td>If it is not</td>
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<td></td>
<td>b. Cycle power to the meter.</td>
</tr>
<tr>
<td>If it is</td>
<td>The transmitter probably has an internal power issue. Replace the transmitter.</td>
</tr>
</tbody>
</table>

**12.29.30 A032**

**Alert**

Meter Verification in Progress: Outputs to Fault

**Cause**

A meter verification test is in progress, with outputs set to Fault.

**Recommended actions**

- Allow the procedure to complete.

**12.29.31 A033**

**Alert**

Insufficient Pickoff Signal

**Cause**

The signal from the sensor pickoff(s) is insufficient. This suggests that the sensor tubes or vibrating elements are not vibrating. This alert often occurs in conjunction with Alert 102.

**Recommended actions**

1. Check for air in the flow tubes, tubes not filled, foreign material in the tubes, coating in the tubes, or other process problems.
2. Check for foreign material in the process gas or fluid, coating, or other process problems.
3. Check for fluid separation by monitoring the density value and comparing the results against expected density values.
4. 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.

**12.29.32 A035**

**Alert**

Meter Verification Aborted

**Cause**

The meter verification test did not complete, possibly because of a manual abort.
Recommended actions
1. Verify that process conditions are stable, then retry the test.
2. Contact customer support.

12.29.33 A100

Alert
mA Output 1 Saturated

Cause
The calculated mA Output value is outside the configured range.

Recommended actions
1. Check the settings of **Upper Range Value** and **Lower Range Value**.
2. Check process conditions.
   Actual conditions may be outside the normal conditions for which the output is configured.
3. Check for air in the flow tubes, tubes not filled, foreign material in the tubes, coating in the tubes, or other process problems.
4. Verify that the measurement units are configured correctly for your application.
5. Purge the sensor tubes.

12.29.34 A101

Alert
mA Output 1 Fixed

Cause
The HART address is set to a non-zero value, or the mA Output is configured to send a constant value.

Recommended actions
1. Check whether the output is in loop test mode. If it is, unfix the output.
2. Exit mA Output trim, if applicable.
3. Check the HART address. If the HART address is non-zero, you may need to change the setting of **mA Output Action**.
4. Check whether the output has been set to a constant value via digital communication.

12.29.35 A102

Alert
Drive Overrange

Cause
The drive power (current/voltage) is at its maximum.
**Recommended actions**

1. Check the drive gain and the pickoff voltage.
2. Check the wiring between the sensor and the transmitter.
3. Verify that internal wiring is secure and that there are no internal electrical problems.
4. Check for air in the flow tubes, tubes not filled, foreign material in the tubes, coating in the tubes, or other process problems.
5. Check for fluid separation by monitoring the density value and comparing the results against expected density values.
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.

**12.29.36 A103**

**Alert**
Data Loss Possible (Totals and Inventories)

**Cause**
Totalizers are not properly saved. The device was unable to store the totalizers during 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. Check the wiring between the transmitter and the core processor, then cycle power to the meter.
2. Verify that the transmitter is receiving sufficient power.

<table>
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<tbody>
<tr>
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<td>a. Correct the problem.</td>
</tr>
<tr>
<td></td>
<td>b. Cycle power to the meter.</td>
</tr>
<tr>
<td>If it is</td>
<td>The transmitter probably has an internal power issue. Replace the transmitter.</td>
</tr>
</tbody>
</table>

**12.29.37 A104**

**Alert**
Calibration in Progress

**Cause**
A calibration procedure is in process.

**Recommended actions**

1. Allow the procedure to complete.
2. For zero calibration:
   a) Abort the calibration.
   b) Set **Zero Time** to a lower value.
c) Restart the calibration.

12.29.38  A105

Alert
Two-Phase Flow

Cause
The line density is outside the user-defined two-phase flow limits.

Recommended actions
1. Check for two-phase flow.
2. Check the live density reading against the upper and lower two-phase flow limit settings.

12.29.39  A106

Alert
Burst Mode Enabled

Cause
HART burst mode is enabled.

Recommended actions
1. No action required.
2. If desired, you can set Alert Severity Level to Ignore.

12.29.40  A107

Alert
Power Reset Occurred

Cause
The transmitter has been restarted.

Recommended actions
No action is required.
If desired, you can set Alert Severity Level to Ignore.

12.29.41  A108

Alert
Basic Event 1 On
Cause
The process has triggered Basic Event 1.

**Recommended actions**
1. No action is required.
2. Review event configuration if you believe the event was triggered erroneously.

**12.29.42 A109**

**Alert**
Basic Event 2 On

**Cause**
The process has triggered Basic Event 2.

**Recommended actions**
1. No action is required.
2. Review event configuration if you believe the event was triggered erroneously.

**12.29.43 A110**

**Alert**
Frequency Output Saturated

**Cause**
The calculated Frequency Output is outside the configured range.

**Recommended actions**
1. Check the Frequency Output scaling.
2. Check process conditions.
   Actual conditions may be outside the normal conditions for which the output is configured.
3. Check for air in the flow tubes, tubes not filled, foreign material in the tubes, coating in the tubes, or other process problems.
4. Verify that the measurement units are configured correctly for your application.
5. Purge the sensor tubes.

**12.29.44 A111**

**Alert**
Frequency Output Fixed

**Cause**
The Frequency Output has been configured to send a constant value.
**Recommended actions**

1. Cycling power to the meter or restarting totalizers will restore the Frequency Output to normal operation.
2. Check whether the output is in loop test mode. If it is, unfix the output.
3. Check whether the output has been set to a constant value via digital communication.

---

**12.29.45 A112**

**Alert**
Upgraded Transmitter Software

**Cause**
The transmitter software is down-level from the core processor software.

**Recommended actions**
Contact customer support.

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**12.29.46 A115**

**Alert**
No External Input or Polled Data

**Cause**
The connection to an external measurement device has failed. No external data is available.

**Recommended actions**
1. Verify that the external device is operating correctly.
2. Verify the wiring between the transmitter and the external device.
3. Verify the HART polling configuration.

---

**12.29.47 A116**

**Alert**
Temperature Overrange (Petroleum)

**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 petroleum measurement application and related parameters.
3. Verify the configuration of the API referral application and related parameters.
12.29.48 A117

Alert
Density Overrange (Petroleum)

Cause
The measured density 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 petroleum measurement application and related parameters.
3. Verify the configuration of the API referral application and related parameters.

12.29.49 ts_A117

Alert
Density Overrange (Petroleum)

Cause
The measured density 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 petroleum measurement application and related parameters.
3. Verify the configuration of the API referral application and related parameters.

12.29.50 A120

Alert
Curve Fit Failure (Concentration)

Cause
The transmitter was unable to calculate a valid concentration matrix from the current data.

Recommended actions
Verify the configuration of the concentration measurement application.

12.29.51 A121

Alert
Extrapolation Alert (Concentration)

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.

**12.29.52  A131**

**Alert**

Meter Verification in Progress: Outputs to Last Measured Value

**Cause**

A meter verification test is in progress, with outputs set to Last Measured Value.

**Recommended actions**

Allow the procedure to complete.

**12.29.53  A132**

**Alert**

Sensor Simulation Active

**Cause**

Sensor simulation is enabled.

**Recommended actions**

Disable sensor simulation.

**12.29.54  Density D[1 - 4] Calibration in Progress**

**Cause**

A D[1 - 4] density calibration is in progress.

**Recommended actions**

No action required.

**12.29.55  Reverse Flow**

**Cause**

Flow through the device is in the reverse direction (against the flow arrow).

**Recommended actions**

No action is required.
12.29.56 Zero Calibration in Progress

**Cause**
A zero calibration is in progress.

**Recommended actions**
No action required.

12.30 Temperature measurement problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible causes</th>
<th>Recommended actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature reading significantly different</td>
<td>• RTD failure</td>
<td>• Check junction box for moisture or verdigris.</td>
</tr>
<tr>
<td>from process temperature</td>
<td>• Incorrect compensation factors</td>
<td>• Perform RTD resistance checks and check for shorts to case (see Check the sensor</td>
</tr>
<tr>
<td></td>
<td>• Line temperature in bypass does not match</td>
<td>coils).</td>
</tr>
<tr>
<td></td>
<td>temperature in main line</td>
<td>• Verify that the temperature compensation factors match the value on the sensor tag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or calibration sheet.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If Alert A004, A016, or A017 is active, perform the actions recommended for that</td>
</tr>
<tr>
<td></td>
<td></td>
<td>alert.</td>
</tr>
<tr>
<td>Temperature reading</td>
<td>• Sensor temperature not yet equalized</td>
<td>• If the error is within the temperature specification for the sensor, there is no</td>
</tr>
<tr>
<td>slightly different from</td>
<td>• Sensor leaking heat</td>
<td>problem. If the temperature measurement is outside the specification, contact</td>
</tr>
<tr>
<td>process temperature</td>
<td></td>
<td>customer support.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The temperature of the fluid may be changing rapidly. Allow sufficient time for the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sensor to equalize with the process fluid.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Perform RTD resistance checks and check for shorts to case (see Check the sensor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>coils).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The electrical connection between the RTD and the sensor may be damaged. This may</td>
</tr>
<tr>
<td></td>
<td></td>
<td>require replacing the sensor.</td>
</tr>
<tr>
<td>Inaccurate temperature data</td>
<td>• Wiring problem</td>
<td>• Verify the wiring between the transmitter and the external device.</td>
</tr>
<tr>
<td>from external device</td>
<td>• Problem with input configuration</td>
<td>• Verify that the external device is operating correctly.</td>
</tr>
<tr>
<td></td>
<td>• Problem with external device</td>
<td>• Verify the configuration of the temperature input.</td>
</tr>
<tr>
<td></td>
<td>• Problem with input configuration</td>
<td>• Ensure that both devices are using the same measurement unit.</td>
</tr>
</tbody>
</table>
A Using the transmitter display

This section explains how to use the 2700 display. Using the display, you can move through the menus, configure the application, monitor and control the application, and perform maintenance and diagnostic tasks.

A.1 Components of the transmitter interface

The transmitter interface includes the status LED, the display (LCD panel), and two optical switches.

Figure A-1: Transmitter interface

A. Status LED
B. Display (LCD panel)
C. Process variable
D. Scroll optical switch
E. Optical switch indicator
F. Select optical switch
G. Unit of measure for process variable
H. Current value of process variable

A.2 Use the optical switches

Use the optical switches on the transmitter interface to control the transmitter display. The transmitter has two optical switches: Scroll and Select.
Procedure
To activate an optical switch, block the light by holding your thumb or finger in front of the opening.

Tip
You can activate the optical switch through the lens. Do not remove the transmitter housing cover.

The optical switch indicator lights up when the transmitter senses that an optical switch has been activated.

<table>
<thead>
<tr>
<th>Optical switch indicator</th>
<th>State of optical switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid red</td>
<td>One optical switch is activated.</td>
</tr>
<tr>
<td>Flickering red</td>
<td>Both optical switches are activated.</td>
</tr>
</tbody>
</table>

**A.3 Access and use the display menu system**

The display menu system is used to perform various configuration, administrative, and maintenance tasks.

**Prerequisites**

To access the display menu system, operator access to either the **Off-Line** menu or the **Alert** menu must be enabled. To access the complete menu system, operator access must be enabled for both the **Off-Line** menu and the **Alert** menu.

**Tip**

The display menu system does not provide complete configuration, administrative, or maintenance functions. For complete transmitter management, you must use another communications tool.

**Procedure**

1. At the transmitter display, activate the **Scroll** and **Select** optical switches simultaneously until the display changes.
   You will enter the **Off-Line** menu at any of several locations, depending on several factors.
   - If an alert is active and access to the **Alert** menu is enabled, you will see **SEE ALERT**.
   - If no alert is active and Smart Meter Verification is enabled on the transmitter, you will see **ENTER METER VERFY**.
   - If no alert is active and Smart Meter Verification is not enabled on the transmitter, you will see **OFF-LINE MAINT**.

2. If **CODE?** appears on the display when you make a choice, enter the value that is configured for **Off-Line Password**.
   a) With the cursor flashing on the first digit, activate **Scroll** until the correct digit is displayed, then activate **Select**.
   b) Repeat this process for the second, third, and fourth digits.

**Tip**

If you do not know the correct value for **Off-Line Password**, wait 30 seconds. The password screen will time out automatically and you will be returned to the previous screen.

3. Use the **Scroll** and **Select** optical switches to navigate to your destination in the display menu system.
• Use Scroll to move through a list of options.
• Use Select to choose the current option.

4. If Scroll flashes on the display, activate the Scroll optical switch, then the Select optical switch, and then the Scroll optical switch again.

The display will prompt you through this sequence. The Scroll-Select-Scroll sequence is designed to guard against accidental activation of the off-line menu. It is not designed as a security measure.

5. To exit a display menu and return to a higher-level menu:
   • Activate Scroll until the EXIT option is displayed, then activate Select.
   • If the EXIT option is not available, activate Scroll and Select simultaneously and hold until the screen returns to the previous display.

6. To exit the display menu system, you can use either of the following methods:
   • Exit each menu separately, working your way back to the top of the menu system.
   • Wait two minutes until the display times out and returns to displaying process variable data.

A.3.1 Enter a floating-point value using the display

Certain configuration values (for example, Lower Range Value and Upper Range Value) are entered as floating-point values. The display supports both decimal notation and exponential notation for floating-point values.

The display allows you to enter a maximum of 8 characters, including the sign. The decimal point is not counted as a character. Exponential notation is used to enter values that require more than 8 characters.

A.3.1 Enter a floating-point value using decimal notation

Decimal notation allows you to enter values between –9999999 and 99999999. You can use the decimal point to enter values with a precision of 0 through 4 (4 characters to the right of the decimal point).

Decimal values entered via the display must meet the following requirements:

• They can contain a maximum of 8 digits, or 7 digits plus a minus sign (−) to indicate a negative number.
• They can contain a decimal point. The decimal point does not count as a digit. The decimal point must be positioned so that the precision of the value does not exceed 4.

When you first enter the configuration screen, the current configuration value is displayed in decimal notation, and the active character is flashing. If the value is positive, no sign is displayed. If the value is negative, a minus sign is displayed.

Procedure

• To change the value:
  a) Activate Select until the digit you want to change is active (flashing).
     Select moves the cursor one position to the left. From the leftmost position, Select moves the cursor to the rightmost digit.
  b) Activate Scroll to change the value of the active digit.
  c) Repeat until all digits are set as desired.
• To change the sign of the value:
  • If the current value is negative, activate Select until the minus sign is flashing, then activate Scroll until the space is blank.
  • If the current value is positive and there is a blank space at the left of the value, activate Select until the cursor is flashing under the blank space, then activate Scroll until the minus sign appears.
  • If the current value is positive and there is no blank space at the left of the value, activate Select until the cursor is flashing under the leftmost digit, then activate Scroll until the minus sign appears.
• To move the decimal point:
  a) Activate Select until the decimal point is flashing.
  b) Activate Scroll.
      The decimal point is removed from its current position.
  c) Activate Select and watch the position of the decimal point.
      As the cursor moves to the left, the decimal point will flash between each pair of digits, up to a maximum precision of four (four digits to the right of the decimal point).

  Tip
  If the position is not valid, the decimal point is not displayed. Continue to activate Select until the decimal point appears at the right of the displayed value.

d) When the decimal point is in the desired position, activate Scroll.
   The decimal point is inserted at its current position.
• To save the displayed value to transmitter memory, activate Scroll and Select simultaneously and hold until the display changes.
  • If the displayed value is the same as the value in transmitter memory, you will be returned to the previous screen.
  • If the displayed value is not the same as the value in transmitter memory, SAVE/YES? flashes on the display. Activate Select.
• To exit the menu without saving the displayed value to transmitter memory, activate Scroll and Select simultaneously and hold until the display changes.
  • If the displayed value is the same as the value in transmitter memory, you will be returned to the previous screen.
  • If the displayed value is not the same as the value in transmitter memory, SAVE/YES? flashes on the display. Activate Scroll.

A.3.1 Enter a floating-point value using exponential notation

Exponential notation is used to enter values that are larger than 99999999 or smaller than −9999999. Exponential values entered via the display must be in the following form: SX.XXXEYY. In this string:

• S = Sign. A minus sign (−) indicates a negative number. A blank indicates a positive number.
• X.XXX = The 4-digit mantissa.
• E = The exponent indicator.
• YY = The 2-digit exponent.
Procedure

1. Switch from decimal notation to exponential notation.
   a) Activate Select as required until the rightmost digit is flashing.
   b) Activate Scroll until \( e \) is displayed.
   c) Activate Select.

   **Tip**
   If you have modified the value in decimal notation without saving the changes to transmitter memory, the changes will be lost when you switch to exponential notation. Save the decimal value before switching to exponential notation.

2. Enter the exponent.
   The first character may be a minus sign or any digit between 0 and 3. The second character may be any digit between 0 and 9.
   a) Activate Select to move the cursor to the rightmost character on the display.
   b) Activate Scroll until the desired character is displayed.
   c) Activate Select to move the cursor one position to the left.
   d) Activate Scroll until the desired character is displayed.

3. Enter the mantissa.
   The mantissa must be a 4-digit value with a precision of 3 (that is, all values between 0.000 and 9.999).
   a) Activate Select to move the cursor to the rightmost digit in the mantissa.
   b) Activate Scroll until the desired character is displayed.
   c) Activate Select to move the cursor one digit to the left.
   d) Activate Scroll until the desired character is displayed.
   e) Activate Select to move the cursor one digit to the left.
   f) Activate Scroll until the desired character is displayed.
   g) Activate Select to move the cursor one digit to the left.
   h) Activate Scroll until the desired character is displayed.

4. Enter the sign.
   a) Activate Select to move the cursor one digit to the left.
   b) Activate Scroll until the desired character is displayed.
      For positive numbers, select a blank space.

5. To save the displayed value to transmitter memory, activate Scroll and Select simultaneously and hold until the display changes.
   • If the displayed value is the same as the value in transmitter memory, you will be returned to the previous screen.
• If the displayed value is not the same as the value in transmitter memory, **SAVE/YES?** flashes on the display. Activate **Select**.

6. Switch back from exponential notation to decimal notation.
   a) Activate **Select** until the \( e \) is flashing.
   b) Activate **Select** until \( a \) is displayed.
   c) Activate **Select**.

### A.4 Display codes for process variables

#### Table A-2: Display codes for process variables

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
<th>Comment or reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVE_D</td>
<td>Average density</td>
<td>Petroleum measurement application only</td>
</tr>
<tr>
<td>AVE_T</td>
<td>Average temperature</td>
<td>Petroleum measurement application only</td>
</tr>
<tr>
<td>BRD_T</td>
<td>Board temperature</td>
<td></td>
</tr>
<tr>
<td>CONC</td>
<td>Concentration</td>
<td>Concentration measurement application only</td>
</tr>
<tr>
<td>DRIVE%</td>
<td>Drive gain</td>
<td></td>
</tr>
<tr>
<td>EXT_P</td>
<td>External pressure</td>
<td></td>
</tr>
<tr>
<td>EXT_T</td>
<td>External temperature</td>
<td></td>
</tr>
<tr>
<td>FVZ</td>
<td>Field verification zero</td>
<td>Weights &amp; Measures application only</td>
</tr>
<tr>
<td>GSV F</td>
<td>Gas standard volume flow</td>
<td></td>
</tr>
<tr>
<td>GSV I</td>
<td>Gas standard volume inventory</td>
<td></td>
</tr>
<tr>
<td>GSV T</td>
<td>Gas standard volume total</td>
<td></td>
</tr>
<tr>
<td>LPO_A</td>
<td>Left pickoff amplitude</td>
<td></td>
</tr>
<tr>
<td>LVOLI</td>
<td>Volume inventory</td>
<td></td>
</tr>
<tr>
<td>LZERO</td>
<td>Live zero flow</td>
<td></td>
</tr>
<tr>
<td>MASSI</td>
<td>Mass inventory</td>
<td></td>
</tr>
<tr>
<td>MTR_T</td>
<td>Case temperature (T-Series sensors only)</td>
<td></td>
</tr>
<tr>
<td>NET M</td>
<td>Net mass flow rate</td>
<td>Concentration measurement application only</td>
</tr>
<tr>
<td>NET V</td>
<td>Net volume flow rate</td>
<td>Concentration measurement application only</td>
</tr>
<tr>
<td>NETMI</td>
<td>Net mass inventory</td>
<td>Concentration measurement application only</td>
</tr>
<tr>
<td>NETVI</td>
<td>Net volume inventory</td>
<td>Concentration measurement application only</td>
</tr>
<tr>
<td>PWRIN</td>
<td>Input voltage</td>
<td>Refers to power input to the core processor</td>
</tr>
<tr>
<td>RDNS</td>
<td>Density at reference temperature</td>
<td></td>
</tr>
<tr>
<td>RPO_A</td>
<td>Right pickoff amplitude</td>
<td></td>
</tr>
<tr>
<td>SGU</td>
<td>Specific gravity units</td>
<td></td>
</tr>
<tr>
<td>STD V</td>
<td>Standard volume flow rate</td>
<td></td>
</tr>
</tbody>
</table>

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February 2022 MMI-20019043

Micro Motion 2700 Transmitters with Analog Outputs
### Table A-2: Display codes for process variables (continued)

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
<th>Comment or reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>STDVI</td>
<td>Standard volume inventory</td>
<td>Concentration measurement application only</td>
</tr>
<tr>
<td>TCDENS</td>
<td>Temperature-corrected density</td>
<td>Petroleum measurement application only</td>
</tr>
<tr>
<td>TCORI</td>
<td>Temperature-corrected inventory</td>
<td>Petroleum measurement application only</td>
</tr>
<tr>
<td>TCORR</td>
<td>Temperature-corrected total</td>
<td>Petroleum measurement application only</td>
</tr>
<tr>
<td>TCVOL</td>
<td>Temperature-corrected volume</td>
<td>Petroleum measurement application only</td>
</tr>
<tr>
<td>TUBEF</td>
<td>Raw tube frequency</td>
<td></td>
</tr>
<tr>
<td>WTAVE</td>
<td>Weighted average</td>
<td></td>
</tr>
</tbody>
</table>

### A.5 Codes and abbreviations used in display menus

### Table A-3: Codes and abbreviations used in display menus

<table>
<thead>
<tr>
<th>Code or abbreviation</th>
<th>Definition</th>
<th>Comment or reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACK ALERT</td>
<td>Acknowledge alert</td>
<td></td>
</tr>
<tr>
<td>ACK ALL</td>
<td>Acknowledge all alerts</td>
<td></td>
</tr>
<tr>
<td>ACT</td>
<td>Action</td>
<td></td>
</tr>
<tr>
<td>ADDR</td>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>AO1</td>
<td>Analog output 1 (primary mA Output)</td>
<td></td>
</tr>
<tr>
<td>AO 1 SRC</td>
<td>Fixed to the process variable assigned to the primary output</td>
<td></td>
</tr>
<tr>
<td>AO2</td>
<td>Analog output 2 (secondary mA Output)</td>
<td></td>
</tr>
<tr>
<td>AUTO SCRLL</td>
<td>Auto Scroll</td>
<td></td>
</tr>
<tr>
<td>BKLT B LIGHT</td>
<td>Backlight</td>
<td></td>
</tr>
<tr>
<td>CAL</td>
<td>Calibrate</td>
<td></td>
</tr>
<tr>
<td>CH A</td>
<td>Channel A</td>
<td></td>
</tr>
<tr>
<td>CHANGE PASSW</td>
<td>Change password or passcode</td>
<td>Change the password or passcode required for access to display functions</td>
</tr>
<tr>
<td>CHANGE CODE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH B</td>
<td>Channel B</td>
<td></td>
</tr>
<tr>
<td>CH C</td>
<td>Channel C</td>
<td></td>
</tr>
<tr>
<td>CONFIG</td>
<td>Configuration</td>
<td></td>
</tr>
<tr>
<td>CORE</td>
<td>Core processor</td>
<td></td>
</tr>
<tr>
<td>CUR Z</td>
<td>Current zero</td>
<td></td>
</tr>
<tr>
<td>CUSTODY XFER</td>
<td>Custody transfer</td>
<td></td>
</tr>
</tbody>
</table>
Table A-3: Codes and abbreviations used in display menus (continued)

<table>
<thead>
<tr>
<th>Code or abbreviation</th>
<th>Definition</th>
<th>Comment or reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>DENS</td>
<td>Density</td>
<td></td>
</tr>
<tr>
<td>D EV</td>
<td>Discrete event</td>
<td>Events configured using the enhanced event model</td>
</tr>
<tr>
<td>DFLOW</td>
<td>Differential mass flow</td>
<td>Fuel consumption applications only</td>
</tr>
<tr>
<td>DGAIN, DRIVE %</td>
<td>Drive gain</td>
<td></td>
</tr>
<tr>
<td>DISBL</td>
<td>Disable</td>
<td>Select to disable</td>
</tr>
<tr>
<td>DO1</td>
<td>Discrete Output 1</td>
<td></td>
</tr>
<tr>
<td>DO2</td>
<td>Discrete Output 2</td>
<td></td>
</tr>
<tr>
<td>DSPLY</td>
<td>Display</td>
<td></td>
</tr>
<tr>
<td>E1OR2</td>
<td>Event 1 or Event 2</td>
<td>Events configured using the basic event model</td>
</tr>
<tr>
<td>ENABL</td>
<td>Enable</td>
<td>Select to enable</td>
</tr>
<tr>
<td>ENABLE ACK</td>
<td>Enable acknowledge all</td>
<td>Enable or disable the ACK ALL function</td>
</tr>
<tr>
<td>ENABLE ALERTS</td>
<td>Enable alert menu</td>
<td>Access to alert menu from display</td>
</tr>
<tr>
<td>ENABLE AUTO</td>
<td>Enable Auto Scroll</td>
<td>Enable or disable the Auto Scroll function</td>
</tr>
<tr>
<td>ENABLE OFFLN</td>
<td>Enable off-line</td>
<td>Access to off-line menu from display</td>
</tr>
<tr>
<td>ENABLE PASSW</td>
<td>Enable password</td>
<td>Enable or disable password protection for display functions</td>
</tr>
<tr>
<td>ENABLE RESET</td>
<td>Enable totalizer reset</td>
<td>Enable or disable totalizer reset from display</td>
</tr>
<tr>
<td>ENABLE START</td>
<td>Enable totalizer start</td>
<td>Enable or disable totalizer start/stop from display</td>
</tr>
<tr>
<td>EVNT1</td>
<td>Event 1</td>
<td>Event configured using the basic event model only</td>
</tr>
<tr>
<td>EVNT2</td>
<td>Event 2</td>
<td>Event configured using the basic event model only</td>
</tr>
<tr>
<td>EXTRN</td>
<td>External</td>
<td></td>
</tr>
<tr>
<td>FAC Z</td>
<td>Factory zero</td>
<td></td>
</tr>
<tr>
<td>FCF</td>
<td>Flow calibration factor</td>
<td></td>
</tr>
<tr>
<td>FLDIR</td>
<td>Flow direction</td>
<td></td>
</tr>
<tr>
<td>FL SW</td>
<td>Flow switch</td>
<td></td>
</tr>
<tr>
<td>FL SWT</td>
<td>Flow switch</td>
<td></td>
</tr>
<tr>
<td>FO</td>
<td>Frequency Output</td>
<td></td>
</tr>
<tr>
<td>FO FREQ</td>
<td>Frequency factor</td>
<td></td>
</tr>
<tr>
<td>FO RATE</td>
<td>Rate factor</td>
<td></td>
</tr>
<tr>
<td>FREQ</td>
<td>Frequency</td>
<td></td>
</tr>
<tr>
<td>FR FL</td>
<td>Frequency=Flow</td>
<td></td>
</tr>
<tr>
<td>Code or abbreviation</td>
<td>Definition</td>
<td>Comment or reference</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>GSV</td>
<td>Gas standard volume</td>
<td></td>
</tr>
<tr>
<td>HYSTRSIS</td>
<td>Hysteresis</td>
<td></td>
</tr>
<tr>
<td>INTERN</td>
<td>Internal</td>
<td></td>
</tr>
<tr>
<td>IO</td>
<td>Input/output</td>
<td></td>
</tr>
<tr>
<td>LANG</td>
<td>Language</td>
<td></td>
</tr>
<tr>
<td>LOCK</td>
<td>Write-protect</td>
<td></td>
</tr>
<tr>
<td>LOOP CUR</td>
<td>Loop current</td>
<td></td>
</tr>
<tr>
<td>M_ASC</td>
<td>Modbus ASCII</td>
<td></td>
</tr>
<tr>
<td>M_RTU</td>
<td>Modbus RTU</td>
<td></td>
</tr>
<tr>
<td>MAO1</td>
<td>mA Output 1 (primary mA Output)</td>
<td></td>
</tr>
<tr>
<td>MAO2</td>
<td>mA Output 2 (secondary mA Output)</td>
<td></td>
</tr>
<tr>
<td>MASS</td>
<td>Mass flow</td>
<td></td>
</tr>
<tr>
<td>MBUS</td>
<td>Modbus</td>
<td></td>
</tr>
<tr>
<td>MFLOW</td>
<td>Mass flow</td>
<td></td>
</tr>
<tr>
<td>MSMT</td>
<td>Measurement</td>
<td></td>
</tr>
<tr>
<td>MTR F</td>
<td>Meter factor</td>
<td></td>
</tr>
<tr>
<td>OFF-LINE MAINT</td>
<td>Off-line maintenance</td>
<td></td>
</tr>
<tr>
<td>OFFLN</td>
<td>Off-line</td>
<td></td>
</tr>
<tr>
<td>OIL</td>
<td>Uncorrected oil flow</td>
<td>PVR applications only</td>
</tr>
<tr>
<td>OIL60</td>
<td>Corrected Net Oil Flow</td>
<td>PVR applications only</td>
</tr>
<tr>
<td>P/UNT</td>
<td>Pulses/unit</td>
<td></td>
</tr>
<tr>
<td>POLAR</td>
<td>Polarity</td>
<td></td>
</tr>
<tr>
<td>PRESS</td>
<td>Pressure</td>
<td></td>
</tr>
<tr>
<td>QUAD</td>
<td>Quadrature</td>
<td></td>
</tr>
<tr>
<td>r.</td>
<td>Revision</td>
<td></td>
</tr>
<tr>
<td>SCALE</td>
<td>Scaling method</td>
<td></td>
</tr>
<tr>
<td>SFM60</td>
<td>Shrinkage factor corrected volume of mix at 60F</td>
<td>PVR applications only</td>
</tr>
<tr>
<td>SFO60</td>
<td>Shrinkage Fac Corr Net Oil Total at Reference</td>
<td>PVR applications only</td>
</tr>
<tr>
<td>SIM</td>
<td>Simulation</td>
<td>Used for loop testing, not simulation mode. Simulation mode is not accessible through the display.</td>
</tr>
<tr>
<td>Code or abbreviation</td>
<td>Definition</td>
<td>Comment or reference</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>SPECL</td>
<td>Special</td>
<td></td>
</tr>
<tr>
<td>SRC</td>
<td>Source</td>
<td>Variable assignment</td>
</tr>
<tr>
<td>TEMP, TEMPR</td>
<td>Temperature</td>
<td></td>
</tr>
<tr>
<td>UNT/P</td>
<td>Units/pulse</td>
<td></td>
</tr>
<tr>
<td>VAR 1</td>
<td>Display Variable 1</td>
<td></td>
</tr>
<tr>
<td>VER</td>
<td>Version</td>
<td></td>
</tr>
<tr>
<td>Verfy</td>
<td>Verify</td>
<td></td>
</tr>
<tr>
<td>VFLOW</td>
<td>Volume flow</td>
<td></td>
</tr>
<tr>
<td>VOL</td>
<td>Volume, volume flow</td>
<td></td>
</tr>
<tr>
<td>WATER</td>
<td>Uncorrected Net Water Flow Rate</td>
<td></td>
</tr>
<tr>
<td>WATER%</td>
<td>Uncorrected Water Cut</td>
<td>PVR applications only</td>
</tr>
<tr>
<td>WCT60%</td>
<td>Water Cut 60F</td>
<td>PVR applications only</td>
</tr>
<tr>
<td>WRPRO</td>
<td>Write protect</td>
<td>PVR applications only</td>
</tr>
<tr>
<td>WTR60</td>
<td>Corrected Net Water Flow</td>
<td>PVR applications only</td>
</tr>
<tr>
<td>XMTR</td>
<td>Transmitter</td>
<td></td>
</tr>
</tbody>
</table>
B Using ProLink III with the transmitter

B.1 Basic information about ProLink III

ProLink III is a configuration and service tool available from Micro Motion. ProLink III runs on a Windows platform and provides complete access to transmitter functions and data.

Version requirements

Use the latest version of ProLink III and the device firmware to support all features. For details about ProLink III device support, refer to the ProLink III ChangeLog.txt file.

ProLink III requirements

To install ProLink III, you must have:

• The ProLink III installation media
• The ProLink III installation kit for your connection type:

To obtain ProLink III and the appropriate installation kit, contact customer support.

ProLink III documentation

Most of the instructions in this manual assume that you are already familiar with ProLink III or that you have a general familiarity with Windows programs. If you need more information than this manual provides, see the Micro Motion ProLink III with ProcessViz Software User Manual.

In most ProLink III installations, the manual is installed with the ProLink III program. Additionally, the ProLink III manual is available on the documentation CD or at Emerson.com.

ProLink III features and functions

ProLink III offers complete transmitter configuration and operation functions. ProLink III also offers a number of additional features and functions, including:

• A Professional version with expanded features not available on the Basic version.
• The ability to save the transmitter configuration set to a file on the PC, and reload it or propagate it to other transmitters
• The ability to log specific types of data to a file on the PC
• The ability to view performance trends for various types of data on the PC
• The ability to connect to and view information for more than one device
• A guided connection wizard

These features are documented in the Micro Motion ProLink III with ProcessViz Software User Manual. ProLink III features are not documented in this manual.

ProLink III messages

As you use ProLink III 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.
B.2 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.

B.2.1 Connection types supported by ProLink III

Different connection types are available for connecting from ProLink III to the transmitter. Choose the connection type appropriate to your network and the tasks you intend to perform.

The transmitter supports the following ProLink III connection types:

- Service port connections
- HART/Bell 202 connections
- HART/RS-485 connections
- Modbus/RS-485 8-bit connections (Modbus RTU)
- Modbus/RS-485 7-bit connections (Modbus ASCII)

When selecting a connection type, consider the following:

- Service port connections are specialized Modbus/RS-485 connections that use standard connection parameters and a standard address that are already defined in ProLink III. Service port connections are typically used by field service personnel for specific maintenance and diagnostic functions. Use a service port connection only when another connection type does not provide the functionality you need.
- HART/Bell 202 connections use standard HART connection parameters that are already defined in ProLink III. The only parameter you must configure is the transmitter address.
- Some connection types require opening the wiring compartment or the power supply compartment. These connection types should be used only for temporary connections, and may require extra safety precautions.
- When you are using a HART connection, ProLink III will not allow you to open more than one window at a time. This is done to manage network traffic and optimize speed.
- You cannot make concurrent Modbus connections if the connections use the same terminals. You can make concurrent Modbus connections if the connections use different terminals.

B.2.2 Connect with ProLink III to the service port

Prerequisites

- ProLink III is installed and licensed on your PC
- One of the following:
  - RS-232 to RS-485 signal converter
  - USB to RS-485 signal converter
- An available serial port or USB port
• Adapters as required (for example, 9-pin to 25-pin)

**WARNING**

If the transmitter is in a hazardous area, do not use a service port connection. Service port connections require opening the wiring compartment, and opening the wiring compartment while the transmitter is powered up could cause an explosion. To connect to the transmitter in a hazardous environment, use a connection method that does not require removing the transmitter housing cover.

**Procedure**

1. Attach the signal converter to the serial port or USB port on your PC.
2. Access the service port terminals:
   a) Remove the transmitter end-cap to access the wiring compartment.
   b) Loosen the screw on the Warning flap and open the power supply compartment.
3. Connect the leads from the signal converter to the service port, terminals 7 (RS-485/B) and 8 (RS-485/A).
   **Tip**
   Usually, but not always, the black lead is RS-485/A and the red lead is RS-485/B.

**Figure B-1: Connection to service port**

A. PC  
B. Signal converter  
C. Service port terminal 7 (RS-485/B)  
D. Service port terminal 8 (RS-485/A)  
E. Transmitter, with wiring compartment and power supply compartment opened

**Note**

This figure shows a serial port connection. USB connections are also supported.

4. Start ProLink III.
5. Choose **Connect to Physical Device**.
6. Set **Protocol** to Service Port.
Tip
Service port connections use standard connection parameters and a standard address. You do not need to configure them here.

7. Set the **PC Port** value to the PC COM port that you are using for this connection.
8. Click **Connect**.

**Need help?**
If an error message appears:
- Switch the leads and try again.
- Ensure that you have specified the correct port on your PC.
- Check the wiring between the PC and the transmitter.

B.2.3 Make a HART/Bell 202 connection

**Prerequisites**
- ProLink III is installed and licensed on your PC
- One of the following:
  - RS-232 to Bell 202 signal converter
  - USB to Bell 202 signal converter
- An available serial port or USB port
- Adapters as required (for example, 9-pin to 25-pin)

You can connect directly to the mA terminals on the transmitter, to any point in a local HART loop, or to any point in a HART multidrop network.

⚠️ **WARNING**
If the transmitter is in a hazardous area, do not connect directly to the transmitter terminals. Connecting directly to the transmitter terminals requires opening the wiring compartment, and opening the wiring compartment while the transmitter is powered up could cause an explosion. To connect to the transmitter in a hazardous environment, use a connection method that does not require opening the wiring compartment.

⚠️ **WARNING**
If you connect directly to the mA terminals, the transmitter's mA Output may be affected. If you are using the mA Output for process control, set devices for manual control before connecting directly to the mA terminals.

**Procedure**
1. Attach the signal converter to the serial port or USB port on your PC.
2. To connect directly to the transmitter terminals:
   a) Remove the transmitter end-cap to access the wiring compartment.
   b) Connect the leads from the signal converter to terminals 1 and 2.
Tip
HART connections are not polarity-sensitive. It does not matter which lead you attach to which terminal.

c) Add resistance as necessary to achieve at least one volt across the connection points.

Important
HART/Bell 202 connections require a voltage drop of 1-5 VDC. To achieve this, add resistance of 250–600 Ω to the connection.

Figure B-2: Connection to transmitter terminals

A. Computer
B. Signal converter
C. Transmitter

Note
This figure shows a serial port connection. USB connections are also supported.

3. To connect to a point in the local HART loop:
   a) Attach the leads from the signal converter to any point in the loop.
   b) Add resistance as necessary to achieve at least one volt across the connection points.

Important
HART/Bell 202 connections require a voltage drop of 1-5 VDC. To achieve this, add resistance of 250–600 Ω to the connection.
Figure B-3: Connection over local loop

A. PC  
B. Signal converter  
C. Any combination of resistors R1, R2, and R3 as necessary to meet HART communication resistance requirements  
D. DCS or PLC  
E. Transmitter, with wiring compartment and power supply compartment opened

Note
This figure shows a serial port connection. USB connections are also supported.

4. To connect over a HART multidrop network:  
   a) Attach the leads from the signal converter to any point on the network.  
   b) Add resistance as necessary to achieve at least one volt across the connection points.

Important
HART/Bell 202 connections require a voltage drop of 1-5 VDC. To achieve this, add resistance of 250–600 Ω to the connection.
5. Start ProLink III.
6. Choose **Connect to Physical Device**.
7. Set **Protocol** to HART Bell 202.

**Tip**
HART/Bell 202 connections use standard connection parameters. You do not need to configure them here.

8. If you are using a USB signal converter, enable **Toggle RTS**.
9. Set **Address/Tag** to the HART polling address configured in the transmitter.

**Tip**
- If this is the first time you are connecting to the transmitter, use the default address: 0.
- If you are not in a HART multidrop environment, the HART polling address is typically left at the default value.
- If you are unsure of the transmitter’s address, click **Poll**. The program will search the network and return a list of the transmitters that it detects.

10. Set the **PC Port** value to the PC COM port that you are using for this connection.
11. Set **Master** as appropriate.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary</td>
<td>Use this setting if a primary HART host such as a DCS is on the network.</td>
</tr>
<tr>
<td>Option</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Primary</td>
<td>Use this setting if no other primary host is on the network. A field communicator is a secondary host.</td>
</tr>
</tbody>
</table>

12. Click **Connect**.

**Need help?**
If an error message appears:
- Verify the HART address of the transmitter, or poll HART addresses 1–15.
- Ensure that you have specified the correct port on your PC.
- Check the wiring between the PC and the transmitter.
- Increase or decrease resistance.
- Ensure that there is no conflict with another HART master. If any other host (DCS or PLC) is connected to the mA Output, temporarily disconnect the DCS or PLC wiring.

**B.2.4 Make a HART/RS-485 connection**
Use a Modbus connection instead of a HART protocol whenever possible, as a Modbus connection is faster.

**Prerequisites**
- ProLink III installed and licensed on your PC
- One of the following:
  - RS-232 to RS-485 signal converter
  - USB to RS-485 signal converter
- An available serial port or USB port
- Adapters as required (for example, 9-pin to 25-pin)

You can connect directly to the RS-485 terminals on the transmitter or to any point on the network.

**WARNING**
If the transmitter is in a hazardous area, do not connect directly to the transmitter terminals. Connecting directly to the transmitter terminals requires opening the wiring compartment, and opening the wiring compartment while the transmitter is powered up could cause an explosion. To connect to the transmitter in a hazardous environment, use a connection method that does not require opening the wiring compartment.

**Procedure**
1. Attach the signal converter to the serial port or USB port on your PC.
2. To connect directly to the transmitter terminals:
   a) Remove the transmitter end-cap to access the wiring compartment.
   b) Connect the leads from the signal converter to terminals 5 (RS-485/A) and 6 (RS-485/B).
Tip
HART connections are not polarity-sensitive, but RS-485 connections are.

Figure B-5: Connection to transmitter terminals

A. PC
B. Signal converter
C. Transmitter, with wiring compartment and power supply compartment opened

Note
This figure shows a serial port connection. USB connections are also supported.

3. To connect over the RS-485 network:
   a) Attach the leads from the signal converter to any point on the network.
Figure B-6: Connection over network

A. PC
B. Adapter, if necessary
C. Signal converter
D. 120-Ω, 1/2-watt resistors at both ends of the segment, if necessary for noise suppression
E. DCS or PLC
F. Transmitter, with wiring compartment and power supply compartment opened

Note
This figure shows a serial port connection. USB connections are also supported.

4. Start ProLink III.
5. Choose Connect to Physical Device.
6. Set the connection parameters to the values configured in the transmitter.
   If your transmitter has not been configured, use the default values shown here.

Table B-1: Default HART/RS-485 connection parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol</td>
<td>HART (default factory setting on the RS-485 channel)</td>
</tr>
<tr>
<td>Baud</td>
<td>1200</td>
</tr>
<tr>
<td>Parity</td>
<td>Odd</td>
</tr>
<tr>
<td>Stop Bits</td>
<td>1</td>
</tr>
<tr>
<td>Address</td>
<td>0</td>
</tr>
</tbody>
</table>

Tip
If you do not know the transmitter’s RS-485 communication settings, you can connect through the service port, which always uses default settings, or use another communications tool to view or change the settings.

7. Set the PC Port value to the PC COM port that you are using for this connection.
8. Set Master as appropriate.
### Option and Description

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary</td>
<td>Use this setting if a primary HART host such as a DCS is on the network.</td>
</tr>
<tr>
<td>Primary</td>
<td>Use this setting if no other primary host is on the network. A field communicator is a secondary host.</td>
</tr>
</tbody>
</table>

9. Click **Connect**.

**Need help?**
If an error message appears:
- Verify the HART address of the transmitter, or poll HART addresses 1–15.
- Ensure that you have specified the correct port on your PC.
- Check the wiring between the PC and the transmitter.
- Ensure that there is no conflict with another HART master. If any other host (DCS or PLC) is connected to the mA Output, temporarily disconnect the DCS or PLC wiring.
- For long-distance communication, or if noise from an external source interferes with the signal, install 120-Ω ½-W terminating resistors in parallel with the output at both ends of the communication segment.

### B.2.5 Connect with ProLink III to the RS-485 port

**Prerequisites**
- ProLink III is installed and licensed on your PC.
- One of the following:
  - RS-232 to RS-485 signal converter
  - USB to RS-485 signal converter
- An available serial port or USB port
- Adapters as required (for example, 9-pin to 25-pin)

You can connect directly to the RS-485 terminals on the transmitter.

**WARNING**
If the transmitter is in a hazardous area, do not connect directly to the transmitter terminals. Connecting directly to the transmitter terminals requires opening the wiring compartment, and opening the wiring compartment while the transmitter is powered up could cause an explosion. To connect to the transmitter in a hazardous environment, use a connection method that does not require opening the wiring compartment.

**Procedure**
1. Attach the signal converter to the serial port or USB port on your PC.
2. To connect directly to the transmitter terminals:
   a) Remove the transmitter end-cap to access the wiring compartment.
   b) Connect the leads from the signal converter to terminals 5 (RS-485/A) and 6 (RS-485/B).
**Tip**
Usually, but not always, the black lead is RS-485/A and the red lead is RS-485/B.

**Figure B-7: Connection to transmitter terminals**

![Diagram of connection to transmitter terminals](image)

A. Computer  
B. Signal converter  
C. Transmitter, with wiring compartment and power supply compartment opened

**Note**
This figure shows a serial port connection. USB connections are also supported.

3. To connect over the RS-485 network:  
   a) Attach the leads from the signal converter to any point on the network.
**Figure B-8: Connection over network**

A. Computer  
B. Signal converter  
C. 120-Ω, 1/2-watt resistors at both ends of the segment, if necessary for noise suppression  
D. DCS or PLC  
E. Transmitter, with wiring compartment and power supply compartment opened

**Note**
This figure shows a serial port connection. USB connections are also supported.

4. Start ProLink III.  
5. Choose **Connect to Physical Device**.  
6. Set the connection parameters to the values configured in the transmitter.  
   If your transmitter has not been configured, use the default values shown here.  

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protocol</strong></td>
<td>Modbus RTU</td>
</tr>
<tr>
<td><strong>Baud</strong></td>
<td>9600</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td>Odd</td>
</tr>
<tr>
<td><strong>Stop Bits</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Address</strong></td>
<td>1</td>
</tr>
</tbody>
</table>

**Tip**  
If you do not know the transmitter’s RS-485 communication settings, you can connect through the service port, which always uses default settings, or use another communications tool to view or change the settings.

7. Set the **PC Port** value to the PC COM port that you are using for this connection.  
8. Select **Connect**.
Need help?
If an error message appears:

• Verify the Modbus address of the transmitter.
• Ensure that you have specified the correct port on your PC.
• Check the wiring between the PC and the transmitter.
• Increase or decrease resistance.
• For long-distance communication, or if noise from an external source interferes with the signal, install 120-Ω ½-W terminating resistors in parallel with the output at both ends of the communication segment.
• Ensure that there is no concurrent Modbus communication to the transmitter.
C Using a field communicator with the transmitter

C.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 HART-compatible devices
- Send configuration data to the device
- Use the alpha keys to enter information

Device descriptions (DDs)

In order for a field communicator to work with your device, the appropriate device description (DD) must be installed: 2000 Mass flo, Dev v8 DD v1

To view the device descriptions that are installed on your field communicator:

1. At the HART 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.

If Micro Motion is not listed, or you do not see the required device description, use a field communicator's upgrade utility to install the device description or contact customer support.

Field communicator menus and messages

Many of the menus in this manual start with the On-Line menu. Ensure that you are able to navigate to the On-Line menu.

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.

Field communicator with PVR, TBR, TMR, and fuel consumption applications

Production Volume Reconciliation (PVR), Transient Bubble Remediation (TBR), Transient Mist Remediation (TMR), and fuel consumption are available only over HART with HART 7 enabled (default).
C.2 Connect with a field communicator

A connection from the Field Communicator to your transmitter allows you to read process data, configure the transmitter, and perform maintenance and troubleshooting tasks.

Prerequisites

The following HART device description (DD) must be installed on the Field Communicator: 2000 Mass flo, Dev v8, DD v1.

You can connect the Field Communicator to the mA terminals on the transmitter, to any point in a local HART loop, or to any point in a HART multidrop network.

⚠️ WARNING

If the transmitter is in a hazardous area, do not connect the Field Communicator to the mA terminals on the transmitter. This connection requires opening the wiring compartment, and opening the wiring compartment in a hazardous area can cause an explosion.

Procedure

1. To connect to the transmitter terminals:
   a) Remove the cover from the wiring compartment.
   b) Attach the leads from the Field Communicator to terminals 1 and 2 on the transmitter and add resistance as required.

   The Field Communicator must be connected across a resistance of 250–600 Ω.

   Tip
   HART connections are not polarity-sensitive. It does not matter which lead you attach to which terminal.

   Figure C-1: Field Communicator connection to transmitter terminals

   ![Diagram of Field Communicator connection to transmitter terminals]

   A. Field Communicator
   B. 250–600 Ω resistance
   C. Transmitter, with wiring compartment and power supply compartment opened

2. To connect to a point in the local HART loop, attach the leads from the Field Communicator to any point in the loop and add resistance as necessary.

   The Field Communicator must be connected across a resistance of 250–600 Ω.
3. To connect to a point in the HART multidrop network, attach the leads from the Field Communicator to any point on the network.

4. Turn on the field communicator and wait until the main menu is displayed.

5. If you are connecting across a multidrop network:
   • Set the field communicator to poll. The device returns all valid addresses.
   • Enter the HART address of the transmitter. The default HART address is 0. However, in a multidrop network, the HART address has probably been set to a different, unique value.
### Postrequisites

To navigate to the **Online** menu, choose **HART Application → Online**. Most configuration, maintenance, and troubleshooting tasks are performed from the **Online** menu.

---

**Tip**

You may see messages related to the DD or active alerts. Press the appropriate buttons to ignore the message and continue.

---

**Need help?**

The field communicator requires a minimum of 1 VDC across the connection leads to communicate. If necessary, increase the resistance at the connection point until 1 VDC is achieved.
## D Default values and ranges

### D.1 Default values and ranges

The default values and ranges represent the typical factory transmitter configuration. Depending on how the transmitter was ordered, certain values may have been configured at the factory and are not represented in the default values and ranges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Parameter</th>
<th>Default</th>
<th>Range</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>Flow direction</td>
<td>Forward</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flow damping</td>
<td>0.8 sec(^{(1)})</td>
<td>0.0 – 51.2 sec</td>
<td>User-entered value is corrected to the nearest valid value in list of preset values. In Special mode, the preset values are 1/5 normal. For gas applications, a minimum value of 2.56 is recommended. The 2.56 value will be automatically rounded up to 3.2 seconds.</td>
</tr>
<tr>
<td></td>
<td>Flow calibration factor</td>
<td>1.00005.13</td>
<td></td>
<td>For sensors, this value represents the FCF and FT factors concatenated.</td>
</tr>
<tr>
<td>Mass flow units</td>
<td>Sensor-specific value set at factory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass flow cutoff</td>
<td>Sensor-specific value set at factory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume flow type</td>
<td>Liquid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume flow units</td>
<td>L/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume flow cutoff</td>
<td>0/0 L/s</td>
<td>0.0 – x L/s</td>
<td>x is obtained by multiplying the flow calibration factor by 0.2, using units of L/s.</td>
<td></td>
</tr>
<tr>
<td>Meter factors</td>
<td>Mass factor</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density factor</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume factor</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>Density damping</td>
<td>1.6 sec</td>
<td>0.0 – 51.2 sec</td>
<td>User-entered value is corrected to nearest valid value in a list of preset values.</td>
</tr>
</tbody>
</table>
Table D-1: Transmitter default values and ranges (continued)

<table>
<thead>
<tr>
<th>Type</th>
<th>Parameter</th>
<th>Default</th>
<th>Range</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Density units</td>
<td>g/cm³</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Density cutoff</td>
<td>0.2 g/cm³</td>
<td>0.0 – 0.5 g/cm³</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D1</td>
<td>0 g/cm³</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D2</td>
<td>1 g/cm³</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>K1</td>
<td>1000 µsec</td>
<td>1000 – 50,000 µsec</td>
<td></td>
</tr>
<tr>
<td></td>
<td>K2</td>
<td>50,000 µsec</td>
<td>1000 – 50,000 µsec</td>
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</tr>
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<td>FD</td>
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</tr>
<tr>
<td></td>
<td>Temp Coefficient</td>
<td>4.44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two-phase flow</td>
<td>Two-phase flow low limit</td>
<td>0.0 g/cm³</td>
<td>0.0 – 10.0 g/cm³</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two-phase flow high limit</td>
<td>5.0 g/cm³</td>
<td>0.0 – 10.0 g/cm³</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two-phase duration</td>
<td>0.0 sec</td>
<td>0.0 – 60.0 sec</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>Temperature damping</td>
<td>4.8 sec</td>
<td>0.0 – 38.4 sec</td>
<td>User-entered value is corrected to nearest valid value in a list of preset values.</td>
</tr>
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<td></td>
<td>Temperature units</td>
<td>Deg C</td>
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<td>Temperature calibration factor</td>
<td>1.000000T0.000 0</td>
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<td>Pressure</td>
<td>Pressure units</td>
<td>PSI</td>
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<td>Flow factor</td>
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<td>Density factor</td>
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<td>Cal pressure</td>
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<td>T-Series sensor</td>
<td>D3</td>
<td>0 g/cm³</td>
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</tr>
<tr>
<td></td>
<td>D4</td>
<td>0 g/cm³</td>
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<td></td>
<td>K3</td>
<td>0 µsec</td>
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<tr>
<td></td>
<td>K4</td>
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<td>DFQ2</td>
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<td>Base mass unit</td>
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<td></td>
<td>Base mass time</td>
<td>sec</td>
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<td>Type</td>
<td>Parameter</td>
<td>Default</td>
<td>Range</td>
<td>Comments</td>
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<td>Mass flow conversion factor</td>
<td>1</td>
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<td></td>
<td>Base volume unit</td>
<td>L</td>
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<td>Base volume time</td>
<td>sec</td>
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<td>Volume flow conversion factor</td>
<td>1</td>
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<td>Variable mapping</td>
<td>Primary variable</td>
<td>Mass flow</td>
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<td>Secondary variable</td>
<td>Density</td>
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<td></td>
<td>Tertiary variable</td>
<td>Mass flow</td>
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<td></td>
<td>Quaternary variable</td>
<td>Volume flow</td>
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<td>mA Output 1</td>
<td>Primary variable</td>
<td>Mass flow</td>
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<td></td>
<td>LRV</td>
<td>-200.0000 g/s</td>
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<td></td>
<td>URV</td>
<td>200.0000 g/s</td>
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<td></td>
<td>AO cutoff</td>
<td>0.00000 g/s</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>AO added damping</td>
<td>0.00000 sec</td>
<td></td>
<td>The user-entered value is corrected down to the nearest lower value in a list of preset values.</td>
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<tr>
<td></td>
<td>LSL</td>
<td>-200 g/s</td>
<td>Read-only. LSL is calculated based on the sensor size and characterization parameters.</td>
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<td>USL</td>
<td>200 g/s</td>
<td>Read only. USL is calculated based on the sensor size and characterization parameters.</td>
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<td>MinSpan</td>
<td>0.3 g/s</td>
<td>Read-only.</td>
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<td>Fault action</td>
<td>Downscale</td>
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<tr>
<td></td>
<td>AO fault level – downscale</td>
<td>2.0 mA</td>
<td>1.0 – 3.6 mA</td>
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<td>AO fault level – upscale</td>
<td>22 mA</td>
<td>21.0 – 24.0 mA</td>
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<td>Last measured value timeout</td>
<td>0.00 sec</td>
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<td></td>
<td>AO fault level – downscale</td>
<td>1.0 – 3.6 mA</td>
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<td></td>
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<td></td>
<td>LRV</td>
<td>-200.0000 g/s</td>
<td></td>
<td></td>
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<td></td>
<td>Volume flow rate</td>
<td>-0.200 L/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>0.000 g/cm³</td>
<td></td>
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</tr>
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<td></td>
<td>Temperature</td>
<td>-240.000 °C</td>
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<td></td>
<td>Drive gain</td>
<td>0.000%</td>
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<td></td>
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<td>Type</td>
<td>Parameter</td>
<td>Default</td>
<td>Range</td>
<td>Comments</td>
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<td>----------------------------------</td>
<td>-----------</td>
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<td>Gas standard volume flow rate</td>
<td>−423.78SCFM</td>
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</tr>
<tr>
<td></td>
<td>External temperature</td>
<td>−240.000 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>External pressure</td>
<td>0.000 psi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>URV</td>
<td>Mass flow rate</td>
<td>200.000 g/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Volume flow rate</td>
<td>0.200 L/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>10.000 g/cm³</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>450.000 °C</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Drive gain</td>
<td>100.000%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gas standard volume flow rate</td>
<td>423.78 SCFM</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>External temperature</td>
<td>450.000 °C</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>External pressure</td>
<td>100.000 psi</td>
<td></td>
<td></td>
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<tr>
<td>Frequency</td>
<td>Tertiary variable</td>
<td>Mass flow</td>
<td></td>
<td></td>
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<td>Output</td>
<td>Frequency factor</td>
<td>1,000.00 Hz</td>
<td>0.001 – 10,000 Hz</td>
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<tr>
<td></td>
<td>Flow rate factor</td>
<td>1000 kg/min</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Scaling method</td>
<td>Freq=Flow</td>
<td>0 or 0.5 – 277.5 ms</td>
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</tr>
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<td></td>
<td>Frequency fault action</td>
<td>Downscale</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency fault level – upscale</td>
<td>15,000 Hz</td>
<td>10.0 – 15,000 Hz</td>
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<tr>
<td></td>
<td>Frequency Output polarity</td>
<td>Active high</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Last measured value timeout</td>
<td>0.0 seconds</td>
<td>0.0 – 60.0 sec</td>
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</tr>
<tr>
<td>Discrete</td>
<td>Source</td>
<td>Flow direction</td>
<td></td>
<td></td>
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<tr>
<td>Output</td>
<td>Fault Indicator</td>
<td>None</td>
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<td>Power</td>
<td>Internal</td>
<td></td>
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<td>Polarity</td>
<td>Active high</td>
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<td>Display</td>
<td>Backlight on/off</td>
<td>On</td>
<td></td>
<td></td>
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<td></td>
<td>Refresh rate</td>
<td>200 milliseconds</td>
<td>100 – 10,000 milliseconds</td>
<td></td>
</tr>
<tr>
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<td>Variable 1</td>
<td>Mass flow rate</td>
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<td>Variable 2</td>
<td>Mass total</td>
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</tr>
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<td></td>
<td>Variable 3</td>
<td>Volume flow rate</td>
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<td></td>
<td>Variable 4</td>
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<td>Variable 5</td>
<td>Density</td>
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Table D-1: Transmitter default values and ranges (continued)

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<tr>
<th>Type</th>
<th>Parameter</th>
<th>Default</th>
<th>Range</th>
<th>Comments</th>
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<tr>
<td>Variable 6</td>
<td>Temperature</td>
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<td>Variable 7</td>
<td>Drive gain</td>
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<tr>
<td>Variable 8–15</td>
<td>None</td>
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<tr>
<td>Display totalizer start/stop</td>
<td>Disabled</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Display totalizer reset</td>
<td>Disabled</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Display auto scroll</td>
<td>Disabled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display offline menu</td>
<td>Enabled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display offline password</td>
<td>Disabled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display alarm menu</td>
<td>Enabled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display acknowledge all alarms</td>
<td>Enabled</td>
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<tr>
<td>Offline password</td>
<td>1234</td>
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<tr>
<td>Auto scroll rate</td>
<td>10 sec</td>
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<td>Digital comm</td>
<td>Fault action</td>
<td>None</td>
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<td></td>
<td>Fault timeout</td>
<td>0 seconds</td>
<td>0.0 – 60.0 sec</td>
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<td></td>
<td>Modbus address</td>
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<td>Modbus ASCII support</td>
<td>Enabled</td>
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<td>Floating-point byte order</td>
<td>3-4-1-2</td>
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<td>Double-precision byte order</td>
<td>1-2-3-4-5-6-7-8</td>
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</table>

(1) In Special mode, the default value is 0.64 sec.
E Transmitter components and installation wiring

E.1 Installation types

The transmitter was ordered and shipped to be installed in one of several possible configurations.

Figure E-1: Integral installation

The transmitter is mounted directly to the sensor. Integral installations do not require separate transmitter installation. Power supply and I/O must be field wired to the transmitter.

A. Transmitter
B. Sensor

Figure E-2: High-temperature meters with factory connection

The transmitter is shipped with a flexible connection factory installed between the sensor and the transmitter. The transmitter must be dismounted from its shipping location (spot-welded to the sensor case) and then mounted separately. Power supply and I/O must be field wired to the transmitter.

A. Sensor
B. Transmitter or core processor
C. Factory-installed flexible connection
Figure E-3: 4-wire remote installation for Coriolis meters

The transmitter is installed remotely from the sensor. The 4-wire connection between the sensor and transmitter must be field wired. Power supply and I/O must be field wired to the transmitter.

A. Transmitter  
B. Field-wired 4-wire connection  
C. Core processor  
D. Sensor

Figure E-4: 9-wire remote installation

The transmitter and core processor are combined in a single unit that is installed remotely from the sensor. The 9-wire connection between the transmitter/core processor and the sensor must be field wired. The power supply must be field wired to the transmitter.

A. Transmitter  
B. Field-wired 9-wire connection  
C. Junction box  
D. Sensor
The transmitter, core processor, and sensor are all mounted separately. The 4-wire connection between the transmitter and core processor must be field wired. The 9-wire connection between the core processor and the sensor must be field wired. The power supply and I/O must be field wired to the transmitter. This configuration is sometimes called double-hop.

A. Junction box  
B. Sensor  
C. Transmitter  
D. Field-wired 4-wire connection  
E. Core processor  
F. Field-wired 9-wire connection

### E.2 Power supply terminals and ground

The configuration is shown in Figure E-6.

Figure E-6: Power supply wiring terminals

A. Warning flap  
B. Equipment ground  
C. Power supply wiring terminals (9 and 10)
E.3 Input/output (I/O) wiring terminals

Figure E-7: I/O wiring terminals

A. mA/HART
B. Frequency Output or Discrete Output
C. RS-485
F NE 53 history

F.1 NE 53 history

Important
Not all features and capabilities described in this section may apply to your transmitter or configuration.

August 2000, Version 1.x

<table>
<thead>
<tr>
<th>Modification type</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expansion</td>
<td>Added writing of the device tag using Modbus</td>
</tr>
<tr>
<td>Adjustment</td>
<td>Improved communication handling with the HART Tri-Loop product</td>
</tr>
<tr>
<td>Feature</td>
<td>Indication of outputs option board type appears on display at power-up</td>
</tr>
</tbody>
</table>

May 2001, version 2.x

<table>
<thead>
<tr>
<th>Modification type</th>
<th>Change</th>
</tr>
</thead>
</table>
| Expansion         | • Added alarm A106 to indicate that HART burst mode is enabled  
|                   | • Indication of outputs option board type appears on display at power-up  
|                   | • Added alarm A106 to indicate that HART burst mode is enabled  
|                   | • Control of HART burst mode now available via Modbus  
|                   | • Added support for the Model 1700 transmitter  
|                   | • Added support for the intrinsically safe transmitter option  
|                   | • Added support to configure the process variable units for mass flow, volume flow, density and temperature from the display  
|                   | • Added support for assigning process variables to the mA and Frequency Output from the display |
| Adjustment        | Clarified the interaction of the digital fault setting and the fault timeout (last measured value timeout) |
| Feature           | • Drive gain can be assigned to mA Output  
|                   | • Pressure compensation added via HART  
|                   | • Channel B can be configured as a Discrete Output |
### December 2001, version 3.x

<table>
<thead>
<tr>
<th>Modification type</th>
<th>Change</th>
</tr>
</thead>
</table>
| **Expansion**     | • Added support for the configurable I/O option board  
|                   | • Software version information available via the display or Modbus  
|                   | • Configurable density cutoff  
|                   | • Additional HART variables can be assigned to QV  
|                   | • The display start/stop totalizers function can be enabled or disabled  
|                   | • Petroleum measurement application improvements  
|                   | • Live zero available as display variable  
|                   | • Increased options for fault output settings  
|                   | • New cryogenic application temperature algorithms |
| **Adjustment**    | • Improved Frequency Output stability and unit conversions  
|                   | • Improved the handling of volume flow rate when two-phase flow is detected  
|                   | • Improved handling of density values and calibrations during fault conditions  
|                   | • Display configuration, screen flow and optical switch changes  
|                   | • HART communication and burst mode improvements |
| **Feature**       | • Petroleum measurement application added  
|                   | • Custody transfer option added to the configurable I/O option board  
|                   | • HART polling for external pressure/temperature added |

### June 2003, version 4.x

<table>
<thead>
<tr>
<th>Modification type</th>
<th>Change</th>
</tr>
</thead>
</table>
| **Expansion**     | • Added support for the Model 1500 transmitter  
|                   | • Additional variables displayed by the Model 1700 transmitter |
| **Adjustment**    | • Improved the handling of certain alarm conditions  
|                   | • Clarified the behavior of certain Modbus calibration coils  
|                   | • Clarified the interaction between certain density measurement units and density cutoff values  
|                   | • Improved the handling of the mA source setting via the display  
|                   | • Improvements to pressure and temperature polling  
|                   | • HART Tri-Loop and other communication improvements  
|                   | • Clarified the value returned by Modbus scaled integer registers during a fault condition |
| **Feature**       | Discrete values now available through Modbus |
### September 2006, version 5.x

<table>
<thead>
<tr>
<th>Modification type</th>
<th>Change</th>
</tr>
</thead>
</table>
| Expansion         | • Discrete Output assignable as a flow switch  
|                   | • Discrete Output fault indication configurability  
|                   | • Discrete Input support for multiple action assignments  
|                   | • Added support for querying the display LED status via Modbus  
|                   | • Additional HART and Modbus commands  
|                   | • Process comparator expanded to five configurable events  
|                   | • Factory configuration restore function  
|                   | • Factory zero restore function  
|                   | • Alarm history expanded  
|                   | • Selectable write protection for configuration data  
|                   | • Expanded selection of source assignments for mA Output  
|                   | • Expanded storage of mA range values  
|                   | • Expanded custody transfer application for independent implementation of NTEP and OIML compliance  
| Adjustment        | Display improvements for floating-point data  
| Feature           | • Configurable alarm severity  
|                   | • Gas standard volume functionality  
|                   | • Meter verification availability as an option  
|                   | • Multiple display language selections  

### September 2009, version 6.x

<table>
<thead>
<tr>
<th>Modification type</th>
<th>Change</th>
</tr>
</thead>
</table>
| Expansion         | • Frequency Output configurable as Discrete Output on Series 1000 transmitters  
|                   | • Discrete Output assignable as flow switch on Series 1000 transmitters  
|                   | • Display Variable 1 optionally fixed to process variable assigned to primary mA Output  
|                   | • Frequency Output scaling method and related parameters configurable from display  
|                   | • For enhanced density and petroleum measurement process variables, display cycles among variable name, current value and unit, and reference temperature  

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**Note:** The above text contains a table that outlines the changes made to the instrument. Each modification type (Expansion, Adjustment, Feature) is listed with the specific changes associated with it. The modifications are categorized into September 2006, version 5.x and September 2009, version 6.x.
<table>
<thead>
<tr>
<th>Modification type</th>
<th>Change</th>
</tr>
</thead>
</table>
| Adjustment        | • mA Output Fault Action = None and Digital Communications Fault Action = NAN is no longer allowed  
|                   | • Frequency Output Fault Action = None and Digital Communications Fault Action = NAN is no longer allowed  
|                   | • Display variables set to a volume process variable automatically switch between liquid and GSV, according to current setting of Volume Flow Type |
| Feature           | • Configurable hysteresis for flow switch  
|                   | • Field Verification Zero added to support Weights & Measures application  
|                   | • Transmitter firmware checksum and core processor firmware checksum assignable as display variables and viewable in ProLink |

**February 2018, version 8.x**

<table>
<thead>
<tr>
<th>Modification type</th>
<th>Change</th>
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</table>
| Expansion         | • Polling an external device for base density Gas Standard Volume (GSV)  
|                   | • NE 53 version added to the display and accessed using Modbus and HART  
|                   | • Improved data update rate for Advanced Zero Check using ProLink III  
|                   | • Byte order configuration for double totals  
|                   | • Modbus Function 43 basic objects for FDI identification  
|                   | • Fast access to Live Zero in 100 Hz mode  
<p>|                   | • Display used to disable user access to the Smart Meter Verification menu. Once disabled, access can only be enabled using ProLink III or a HART device |</p>
<table>
<thead>
<tr>
<th>Modification type</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustment</td>
<td>• Sensors that are not straight tube sensors are now correctly identified</td>
</tr>
<tr>
<td></td>
<td>• The mA Output fixed alert is now set</td>
</tr>
<tr>
<td></td>
<td>• The Factory Configuration Invalid status bit is now set correctly when connected to a 700 core processor — as the 700 core processor does not support saving and restoring the factory configuration</td>
</tr>
<tr>
<td></td>
<td>• Enabling a new feature on a flow-only device does not reset the output configuration to factory defaults</td>
</tr>
<tr>
<td></td>
<td>• Polled variables are now converted to the transmitter units before being used</td>
</tr>
<tr>
<td></td>
<td>• HART Primary, Secondary, and Tertiary Variables can be changed using HART when the transmitter is configured for gas standard volume</td>
</tr>
<tr>
<td></td>
<td>• Petroleum measurement variables are removed from the display when petroleum measurement is disabled</td>
</tr>
<tr>
<td></td>
<td>• The mA Output can be fixed when assigned to a concentration measurement, petroleum measurement, or GSV variable when the transmitter is not connected to a core processor</td>
</tr>
<tr>
<td></td>
<td>• The units for concentration curve data are correctly converted when the data is entered using HART</td>
</tr>
<tr>
<td></td>
<td>• Meter verification failed and aborted alerts are now reflected in the HART More Status flag</td>
</tr>
<tr>
<td></td>
<td>• The HART Squawk command is functional when the HART write protect is enabled</td>
</tr>
<tr>
<td></td>
<td>• Locking the transmitter, unlocking the transmitter, or changing write protection does not set the HART Configuration Changed flag</td>
</tr>
<tr>
<td></td>
<td>• If connected to a 700 core processor with software version 3.1 or earlier, there is no longer a core processor write failed alert when setting volume flow units to beer barrels per time unit</td>
</tr>
<tr>
<td></td>
<td>• The factory zero value is immediately updated from the core processor after running a zero calibration and saving the factory configuration</td>
</tr>
<tr>
<td></td>
<td>• A firmware upgrade done without clearing non-volatile memory no longer causes an EEPROM Failure alert</td>
</tr>
<tr>
<td></td>
<td>• The status bit for the undefined A141 alert (Device Data Capture Triggered) no longer appears in the Modbus status register</td>
</tr>
<tr>
<td></td>
<td>• When using AMS to configure the transmitter:</td>
</tr>
<tr>
<td></td>
<td>— Changing the output configuration for mA 1, mA 2, or the Frequency Output, does not change the configuration of all three outputs</td>
</tr>
<tr>
<td></td>
<td>— mA configuration methods can be cancelled</td>
</tr>
<tr>
<td></td>
<td>— Density and temperature units display on the concentration measurement configuration page</td>
</tr>
<tr>
<td></td>
<td>— An AMS Field Device did not respond message no longer displays when the concentration offset is configured even though the value was changed</td>
</tr>
</tbody>
</table>
Modification type | Change
---|---
 | When the volume flow type is changed, the new setting is updated from the transmitter without having to rescan the device

Feature | • Basic meter verification  
• Production Volume Reconciliation (PVR)  
• Transient Mist Remediation (TMR)  
• Transient Bubble Remediation (TBR)  
• Piecewise Linearization for Gas  
• Fuel consumption  
• Support for Micro Load

May 2018, version 8.02/v6.82

- Added Basic Smart Meter Verification (SMV).
- Changed the default for the HART version to HART 7.
- Added Production Volume Reconciliation (PVR) that requires an 800 Enhanced Core Processor with version 4.42 or greater software and HART 7.
- Added Transient Mist Remediation (TMR) that requires an 800 Enhanced Core Processor with version 4.42 or greater software and HART 7.
- Added Transient Bubble Remediation (TBR) that requires an 800 Enhanced Core Processor with version 4.42 or greater software and HART 7.
- Added Piecewise Linearization for gas that requires an 800 Enhanced Core Processor with version 4.42 or greater software and HART 7.
- Added fuel consumption to require HART 7.
- Added polling an external device for base density for Gas Standard Volume.
- Added support for Micro Load.
- The NE53 version is added to the display and can be accessed using Modbus and HART.
- Improved the update rate of the data for Advanced Zero Check using ProLink III.
- Added byte order configuration for double totals.
- Added Modbus Function 43 basic objects for FDI identification.
- Added fast access to Live Zero in 100 Hz mode.
- Added the ability to use the display to configure user access to the Smart Meter Verification menu on the display. This feature can be used only to disable access. Once disabled, access can only be enabled using ProLink III or a HART device.