Configuration and Use Manual
P/N MMI-20012741, Rev. A
September 2008

Micro Motion®
Model 2200S Transmitters

Configuration and Use Manual

Micro Motion®

EMERSON™
Process Management

Contents

Before You Begin

Chapter 1
Before You Begin

1.1 Overview

This chapter provides an orientation to the use of this manual. This manual describes the procedures required to start, configure, use, maintain, and troubleshoot the Model 2200S transmitter.

If you do not know what transmitter you have, see Section 1.4 for instructions on identifying the transmitter type from the model number on the transmitter's tag.

1.2 Safety

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

1.3 Using this manual

This manual is organized into four sections, as described in Table 1-1.

Table 1-1 Manual organization

Section	Chapters	Audience	Description
Commissioning	2	Person responsible for process design and device configuration Person responsible for device testing and commissioning	"Quick start" tools for device commissioning
	3 through 7		Detailed information for all parameters that can be configured Procedures for testing device operation Procedures for backing up and write-protecting configuration
Operation	8	Person responsible for operation	Procedures for viewing process data and alarms, and managing totalizers and inventories
Maintenance and troubleshooting	9 and 10	Person responsible for periodic maintenance and troubleshooting	Information and procedures for flowmeter zero, meter proving, calibration, and troubleshooting.
Appendices	All	All	Reference information

1.4 Interpreting your model number

Model 2200S transmitter options are encoded in the model number located on the transmitter tag. The model number is a string of the following form:

2200S*(H or K)******

In this string:

- **H** = No adapter-barrier supplied with the transmitter
- **K** = Adapter-barrier supplied with the transmitter

Note: See the product data sheet for information on the remaining characters in the model number.

1.5 Obtaining version information

Table 1-2 lists the version information that you may need and describes how to obtain the information.

Table 1-2 **Obtaining version information**

Component	With ProLink II	With Communicator	With Display
Transmitter software	View > Installed Options > Software Revision	Review > Device info > Software rev	OFF-LINE MAINT > VER
ProLink II	Help > About ProLink II	Not applicable	Not applicable
Communicator device description	Not applicable	See Section E.2	Not applicable

1.6 Communication tools

To configure and administer the Model 2200S transmitter, an administrative connection is required. You can use any of the following tools for the administrative connection:

- 375 Field Communicator with the following device description

  Micro Motion 2200S Analog
- ProLink® II software, v2.8 and later

Information on setting up the administrative connection is provided in Chapter 3.

Note: Some configuration and administrative procedures can also be performed via the display menus. However, for complete access to transmitter functions, Micro Motion recommends setting up and using an administrative connection.

Basic information on using ProLink II and connecting ProLink II to your transmitter is provided in Appendix D. For more information, see the ProLink II manual, available on the Micro Motion web site (www.micromotion.com).

Basic information on the 375 Field Communicator and connecting the Communicator to your transmitter is provided in Appendix E. For more information, see the Field Communicator documentation available on the Micro Motion web site (www.micromotion.com).

You may be able to use other tools from Emerson Process Management, such as AMS Suite: Intelligent Device Manager. Use of AMS is not discussed in this manual.

1.7 Flowmeter documentation

Table 1-3 lists additional documentation that may be required or useful for your flowmeter.

Table 1-3 Flowmeter documentation resources

Topic	Document
Sensor installation	Sensor documentation
Transmitter installation	*Micro Motion® Model 2200S Transmitters: Installation Manual*
Hazardous area installation	See the approval documentation shipped with the transmitter, or download the appropriate documentation from the Micro Motion web site (www.micromotion.com)

1.8 Micro Motion customer service

For customer service, phone the support center nearest you:

- In the U.S.A., phone **800-522-MASS** (800-522-6277) (toll-free)
- In Canada and Latin America, phone +1 303-527-5200
- In Asia:
  - In Japan, phone 3 5769-6803
  - In other locations, phone +65 6777-8211 (Singapore)
- In Europe:
  - In the U.K., phone 0870 240 1978 (toll-free)
  - In other locations, phone +31 (0) 318 495 555 (The Netherlands)

Customers outside the U.S.A. can also email Micro Motion customer service at *International.MMISupport@EmersonProcess.com*.

Chapter 2
Quick Start

2.1 Overview

This chapter provides “quick start” tools for people who already understand most or all of the commissioning methods and options for the Model 2200S transmitter. The following tools are provided:

- Configuration overview and flowchart – see Section 2.2
- Configuration worksheet – see Section 2.3
- Menu flowcharts
  - For the Communicator – see Section 2.4.1
  - For ProLink II – see Section 2.4.2
  - For the display – see Section 2.4.3

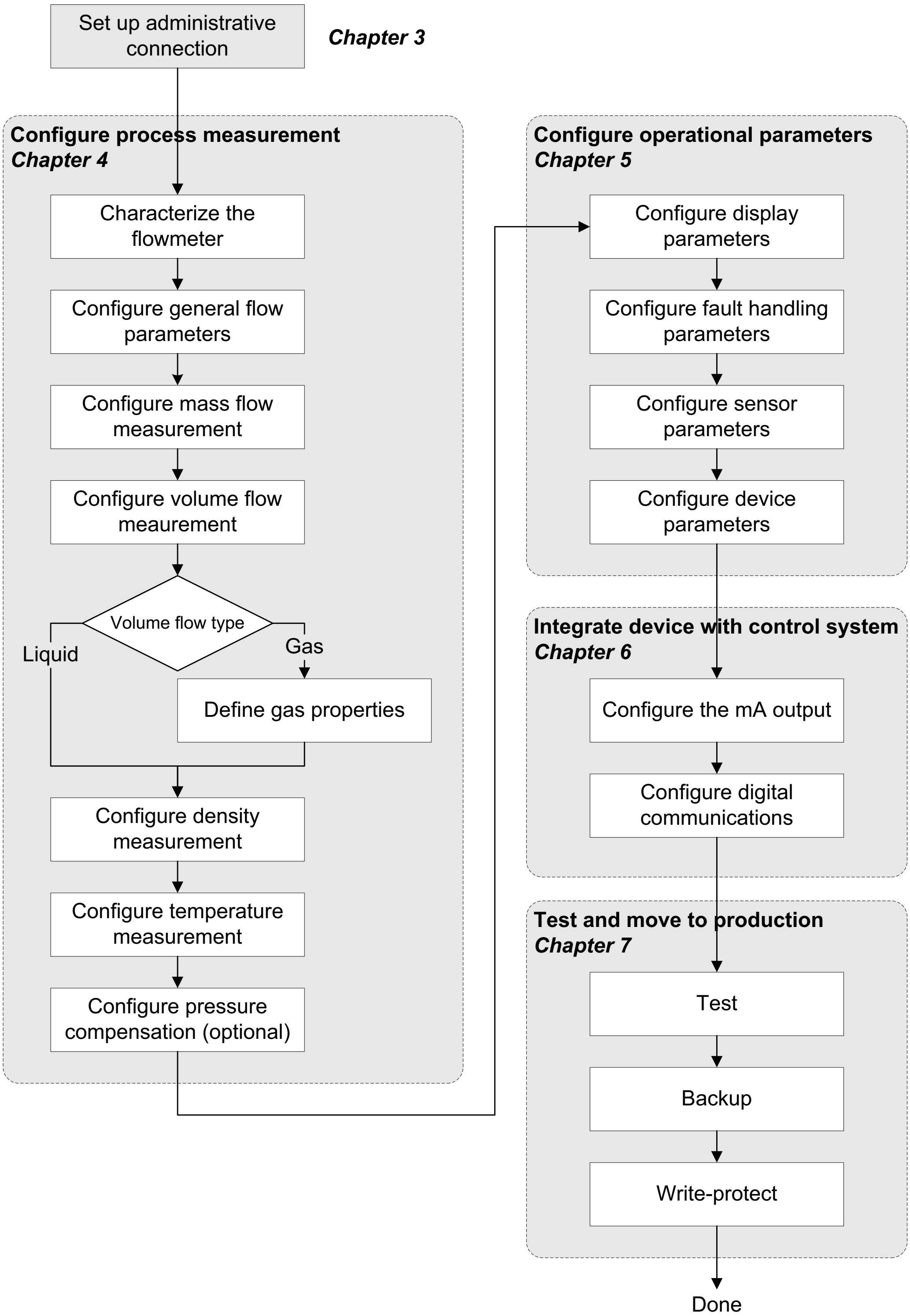
If you need more help:

- On using the display, ProLink II, or the Communicator, see Appendix C, D, or E.
- On general startup and configuration topics, see Chapter 3.
- On configuration parameters, see Chapters 4 through 6.
- On testing and final commissioning procedures, see Chapter 7.

2.2 Configuration overview and flowchart

To perform a complete configuration, work though the tasks shown in Figure 2-1, in the order shown. Detailed information and instructions for each step are provided in Chapters 3 through 7.

Figure 2-1 Configuration flowchart



2.3 Configuration worksheet

The configuration worksheet in this section provides a place to specify and record information about your flowmeter and your transmitter configuration. If you are configuring multiple transmitters, make copies of this worksheet and fill one out for each transmitter.

Configuration Worksheet		Transmitter ________________	
Transmitter model number		________________	
Transmitter serial number		________________	
Transmitter software version		________________	
HART	Address	________________	
	Software tag	________________	
Chapter 4			
Characterization parameters	K1 K2 FD D1 D2 TC Flowcal	________________ ________________ ________________ ________________ ________________ ________________ ________________	
Flow parameters	Flow direction	☐ Forward ☐ Reverse ☐ Absolute Value	☐ Bidirectional ☐ Negate/Forward ☐ Negate/Absolute Value
	Flow damping	☐ Default (0.8 sec) ☐ Other ________________	
Mass flow	Units	________________	
	Cutoff	☐ Default (0.0 g/s) ☐ Other ________________	
Volume flow	Type	☐ Liquid ☐ Gas standard volume (GSV) Gas data ________________ ________________	
	Units	________________	
	Cutoff	☐ Default (0.0 L/s) ☐ Other ________________	
Density	Units	________________	
	Cutoff	☐ Default (0.2 g/cm^3) ☐ Other ________________	
	Damping	☐ Default (1.6 sec) ☐ Other ________________	
	Slug flow	Low limit	☐ Default (0 g/cm^3) ☐ Other ________
		High limit	☐ Default (5 g/cm^3) ☐ Other ________
		Duration	☐ Default (0 sec) ☐ Other ________

Configuration Worksheet		Transmitter ______________________	
Temperature	Units	______________________	
	Damping	☐ Default (4.8 sec) ☐ Other ______________________	
Pressure compensation	☐ Enabled ☐ Disabled	Units Flow factor Density factor Cal pressure Static pressure	____________ ____________ ____________ ____________ ____________
Chapter 5			
Display	Update period	☐ Default (200 millisec) ☐ Other ______________________	
	Language	☐ English ☐ French	☐ Spanish ☐ German
	Display variables and precision	Var 1 Var 2 Var 3 Var 4 Var 5 Var 6 Var 7 Var 8 Var 9 Var 10 Var 11 Var 12 Var 13 Var 14 Var 15	____________ ____________ ____________ ____________ ____________ ____________ ____________ ____________ ____________ ____________ ____________ ____________ ____________ ____________ ____________
	Auto scroll	☐ Enabled ☐ Disabled	
	Scroll rate	☐ Default (10 sec) ☐ Other ______________________	
	Off-line menu	☐ Enabled ☐ Disabled	
	Off-line password	☐ Enabled ☐ Disabled	____________
	Alarm menu	☐ Enabled ☐ Disabled	
	Totalizer start/stop	☐ Enabled ☐ Disabled	
	Totalizer reset	☐ Enabled ☐ Disabled	
Fault handling	Status alarm severity	______________________ ______________________ ______________________ ______________________ ______________________ ______________________ ______________________	
	LMV timeout	☐ Default (0 sec) ☐ Other ______________________	

Configuration Worksheet		Transmitter ____________________
Sensor parameters	Serial number	____________________
	Sensor material	____________________
	Liner material	____________________
	Flange	____________________
Device parameters	Descriptor	____________________
	Message	____________________
	Date	____________________
Chapter 6		
mA output	Scale at DCS	☐ 12–20 mA (installation does not include adapter-barrier) ☐ 4–20 mA (installation includes adapter-barrier)
	Primary variable (PV)	☐ Mass flow ☐ Volume flow ☐ GSV flow ☐ Temperature ☐ Density ☐ Drive gain
	LRV	____________________
	URV	____________________
	AO cutoff	☐ Default (0.0 g/s) ☐ Other ____________________
	Added damping	☐ Default (0.0 sec) ☐ Other ____________________
	Fault action	☐ Upscale Fault value ________ ☐ Downscale Fault value ________ ☐ Internal zero ☐ None

Configuration Worksheet		Transmitter ______________	
Digital communications	Fault action	☐ Upscale ☐ Downscale ☐ Internal zero ☐ Not-a-Number ☐ Flow to zero ☐ None	Fault value ________ Fault value ________
	Loop current mode	☐ Enabled ☐ Disabled	
	Burst mode	☐ Enabled ☐ Disabled	
		Output	☐ PV ☐ PV and % of range ☐ HART vars and PV current ☐ Field device vars
		Field device variables	Var 1 ________ Var 2 ________ Var 3 ________ Var 3 ________
HART variables (SV, TV, QV)	___ Mass flow ___ Volume flow ___ GSV flow ___ Temperature (process) ___ Density ___ Drive gain	___ Mass total ___ Volume total ___ GSV total ___ Mass inventory ___ Volume inventory ___ GSV inventory	___ Board temperature ___ LPO amplitude ___ RPO amplitude ___ Raw tube frequency ___ Live zero

2.4 Menu flowcharts

This section provides the following menu flowcharts for the Model 2200S transmitter:

- ProLink II menus
  - Main menu – see Figure 2-2
  - Configuration menu – see Figures 2-3 and 2-4
- Communicator menus – see Figures 2-5 through 2-10
- Display menus
  - Managing totalizers and inventories – see Figure 2-10
  - Off-line maintenance menu: Top level – see Figure 2-11
  - Off-line maintenance menu: Version information – see Figure 2-12
  - Off-line maintenance menu: Configuration – see Figures 2-13 and 2-14
  - Off-line maintenance menu: Simulation (loop testing) – see Figure 2-15
  - Off-line maintenance menu: Zero – see Figure 2-16
  - Alarm menu – see Figure 2-17

  For information on the codes and abbreviations used on the display, see Appendix C.

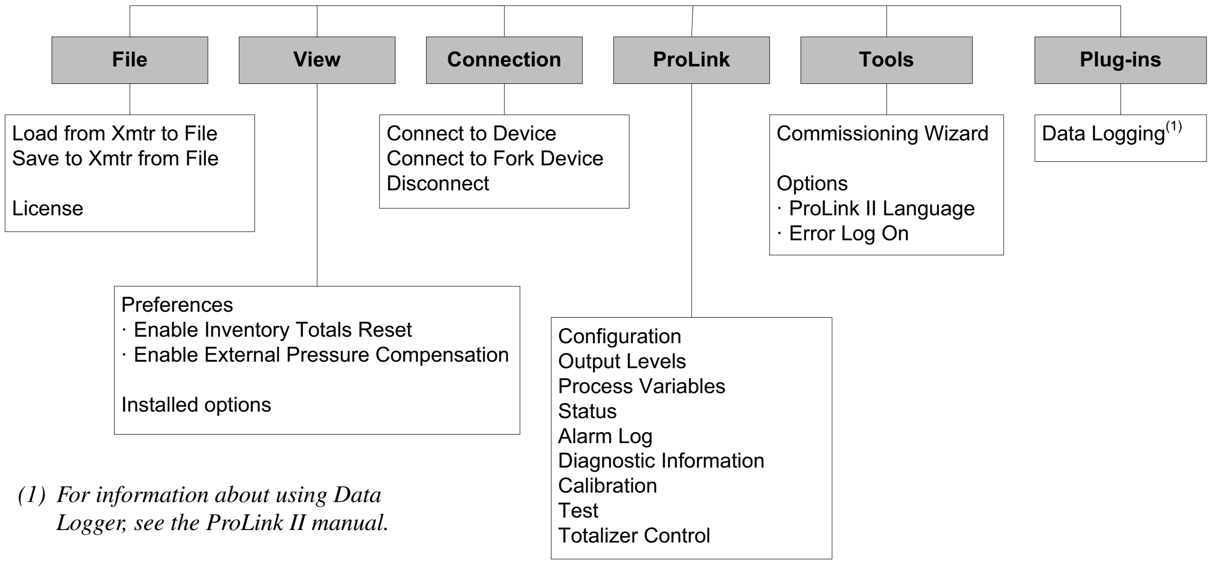
These menu flowcharts are based on:

- Transmitter software v1.0
- ProLink II v2.8
- Field Communicator device description **Micro Motion 2200S Analog dev rev 1 DD rev 1**

Menus may vary slightly for different versions of these components.

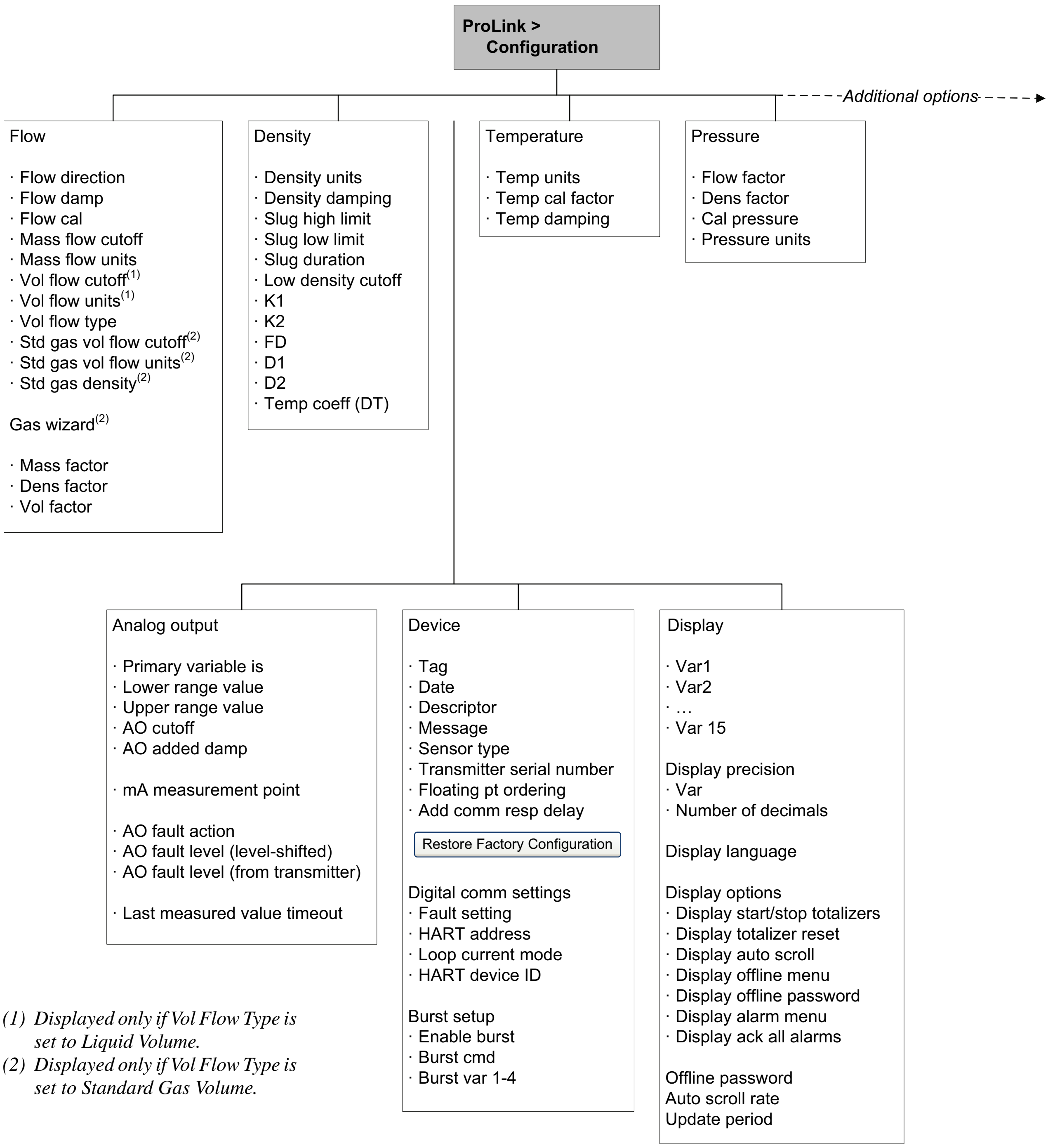
2.4.1 ProLink II menus

Figure 2-2 ProLink II main menu



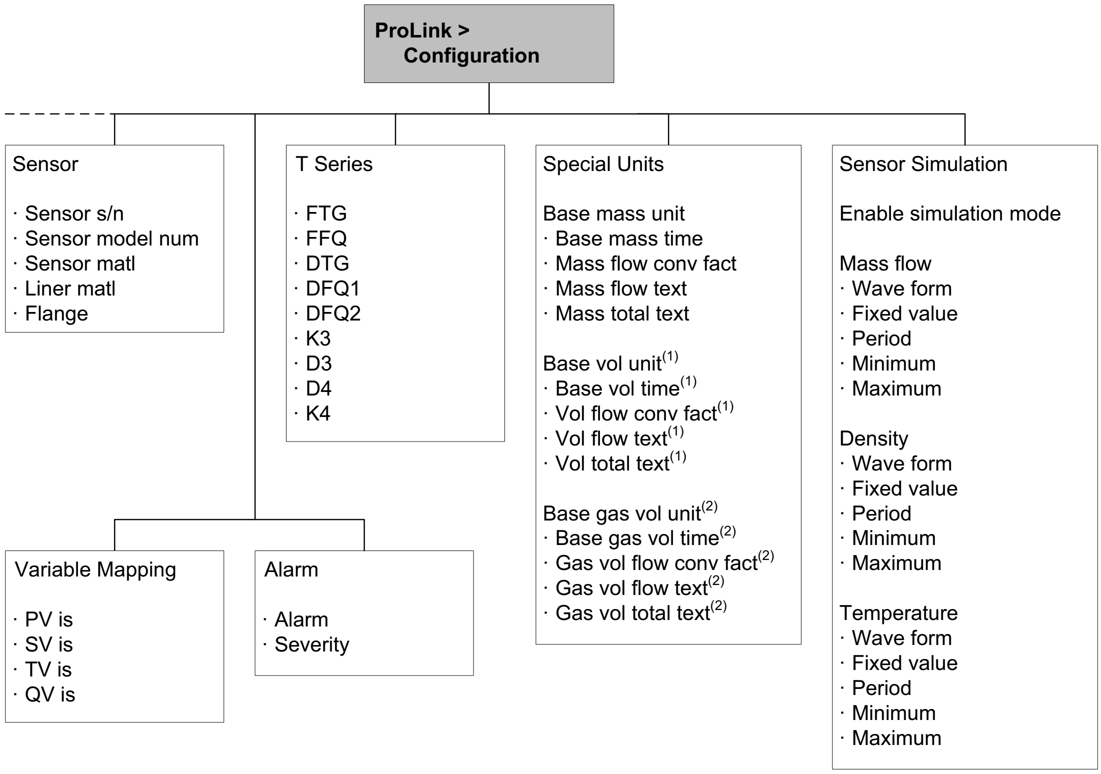
(1) *For information about using Data Logger, see the ProLink II manual.*

Figure 2-3 ProLink II configuration menu



(1) *Displayed only if Vol Flow Type is set to Liquid Volume.*
(2) *Displayed only if Vol Flow Type is set to Standard Gas Volume.*

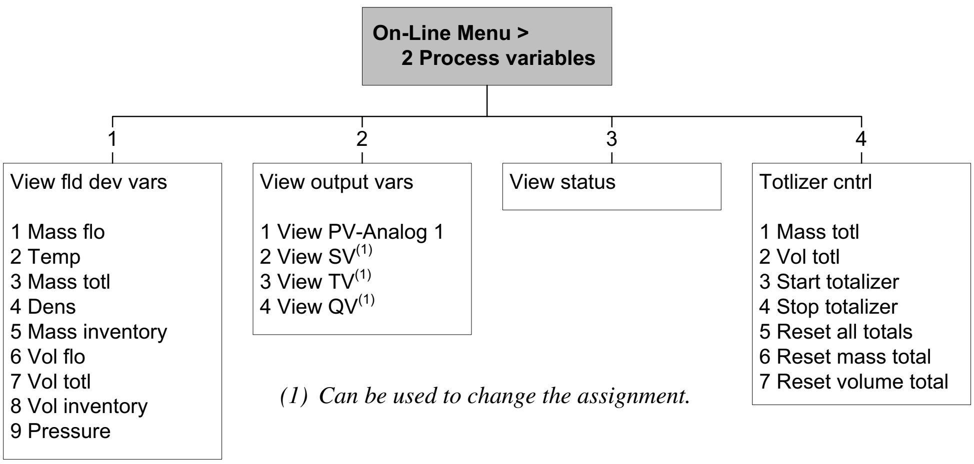
Figure 2-4 ProLink II configuration menu *continued*



(1) Displayed only if Vol Flow Type is set to Liquid Volume.
(2) Displayed only if Vol Flow Type is set to Standard Gas Volume.

2.4.2 Communicator menus

Figure 2-5 Communicator process variables menu



(1) Can be used to change the assignment.

Figure 2-6 Communicator diagnostics/service menu

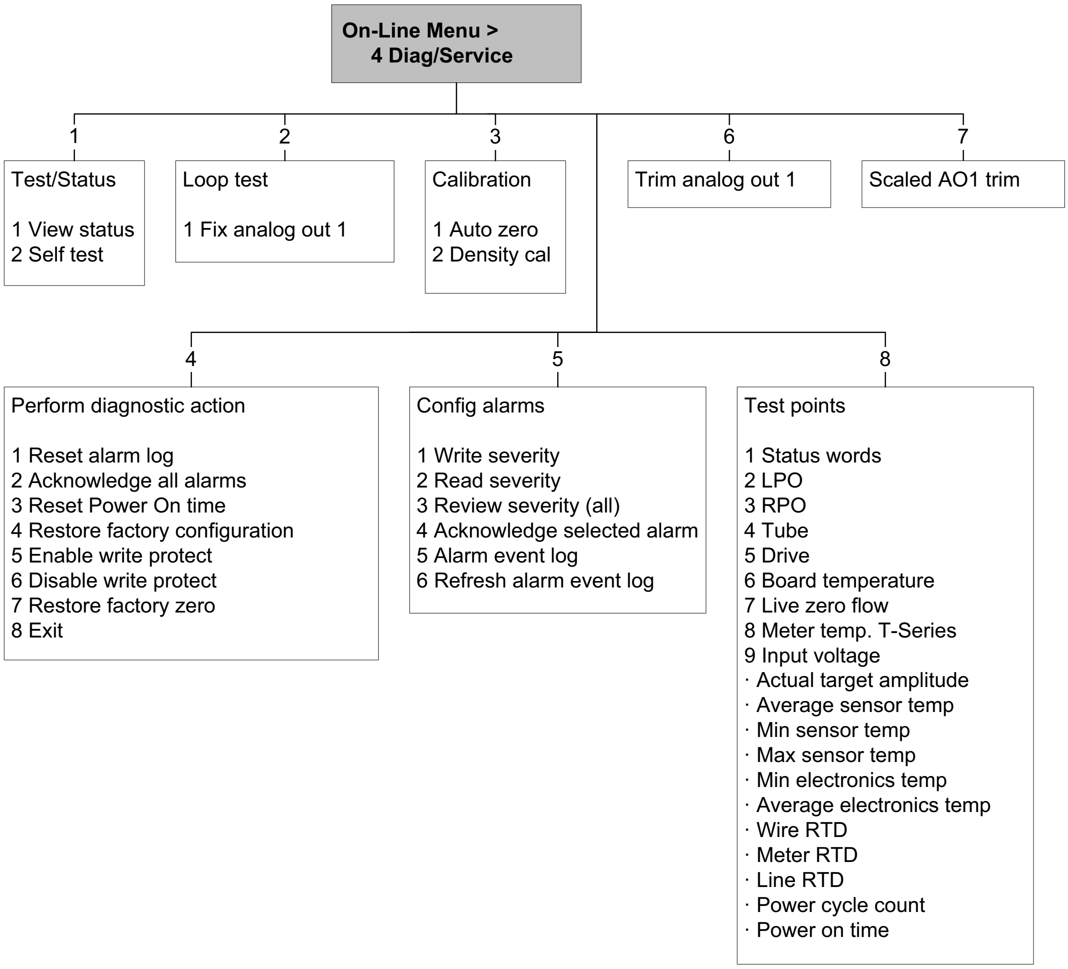
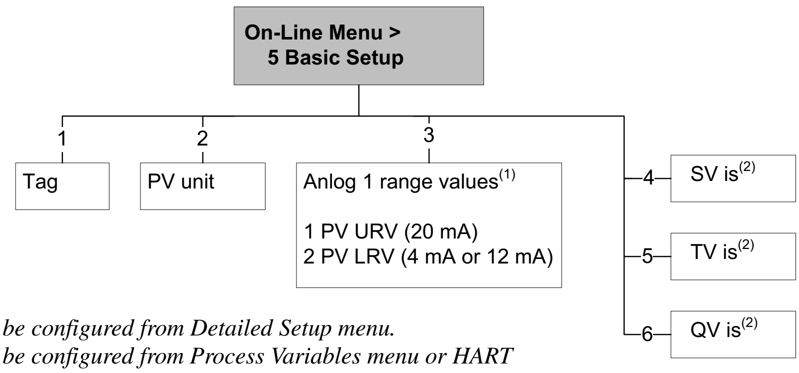


Figure 2-7 Communicator basic setup menu



(1) Can also be configured from Detailed Setup menu.
(2) Can also be configured from Process Variables menu or HART Output menu.

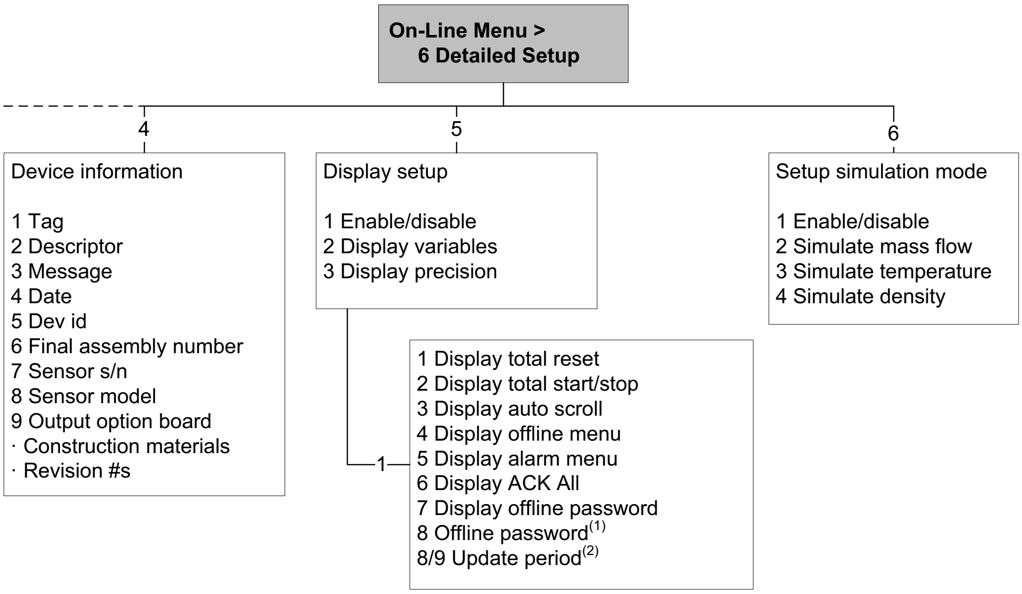
Figure 2-8 Communicator detailed setup menu

On-Line Menu > 6 Detailed Setup

- 1 Charize sensor
  - 1 Sensor type (read only)
  - 2 Sensor selection
    - 1 T-Series
    - 2 Other
  - 3 Flow
    - 1 FlowCal[1]
    - 1 FCF[2]
    - 2 FTG[2]
    - 3 FFQ[2]
  - 4 Density
    - 1 D1
    - 2 K1
    - 3 D2
    - 4 K2
    - 5 Temp coeff[1]
    - 5 DTG[2]
    - 6 FD[1]
    - 6 DFQ1[2]
    - 7 DFQ2[2]
    - 8 DT[2]
    - 9 FD[2]
    - · D3[2]
    - · K3[2]
    - · D4[2]
    - · K4[2]
  - 5 Temp cal factor
  - 6 Pressure compensation
    - 1 Enable pressure
    - 2 Flow factor
    - 3 Dens factor
    - 4 Flowcal pressure
    - 5 Static pressure
  - 7 Meter factors
    - 1 Mass factor
    - 2 Vol factor
    - 3 Dens factor
  - 8 Polling setup
    - 1 Enable ext temp
    - 2 Static temperature
  - 9 External temp
- 2 Config fld dev vars
  - 1 Flow
    - 1 Mass flow unit
    - 2 Mass flow cutoff
    - 3 Spcl mass units
    - 4 Vol flow unit
    - 5 Vol flow cutoff
    - 6 Spcl vol units
    - 7 Flo direction
    - 8 Flo damp
  - 2 Density
    - 1 Density unit
    - 2 Density damp
    - 3 Density cutoff
    - 4 Slug low limit
    - 5 Slug high limit
    - 6 Slug duration
  - 3 Temperature
    - 1 Temp unit
    - 2 Temp damp
  - 4 Pressure
    - 1 Pressure unit
- 3 Config outputs
  - 1 Channel setup
    - 1 AO setup
      - 1 PV is
      - 2 Range values[3]
      - 3 PV AO cutoff
      - 4 PV AO added damp
      - 5 AO1 fault setup
  - 2 HART output
    - 1 Poll addr
    - 2 Num preambles
    - 3 Burst mode
    - 4 Burst option
    - 5 Burst var 1
    - 6 Burst var 2
    - 7 Burst var 3
    - 8 Burst var 4
    - SV is[4]
    - TV is[4]
    - QV is[4]
  - 3 Modbus data
    - 1 Read Modbus data value
    - 2 Write Modbus data value
  - 4 Fault timeout
  - 5 Comm fault indicator
- – – Additional options – – ►

(1) Displayed only if Sensor Selection is set to Other.
(2) Displayed only if Sensor Selection is set to T-Series.
(3) Can also be configured from Basic Setup menu.
(4) Can also be configured from Process Variables menu or Basic Setup menu.

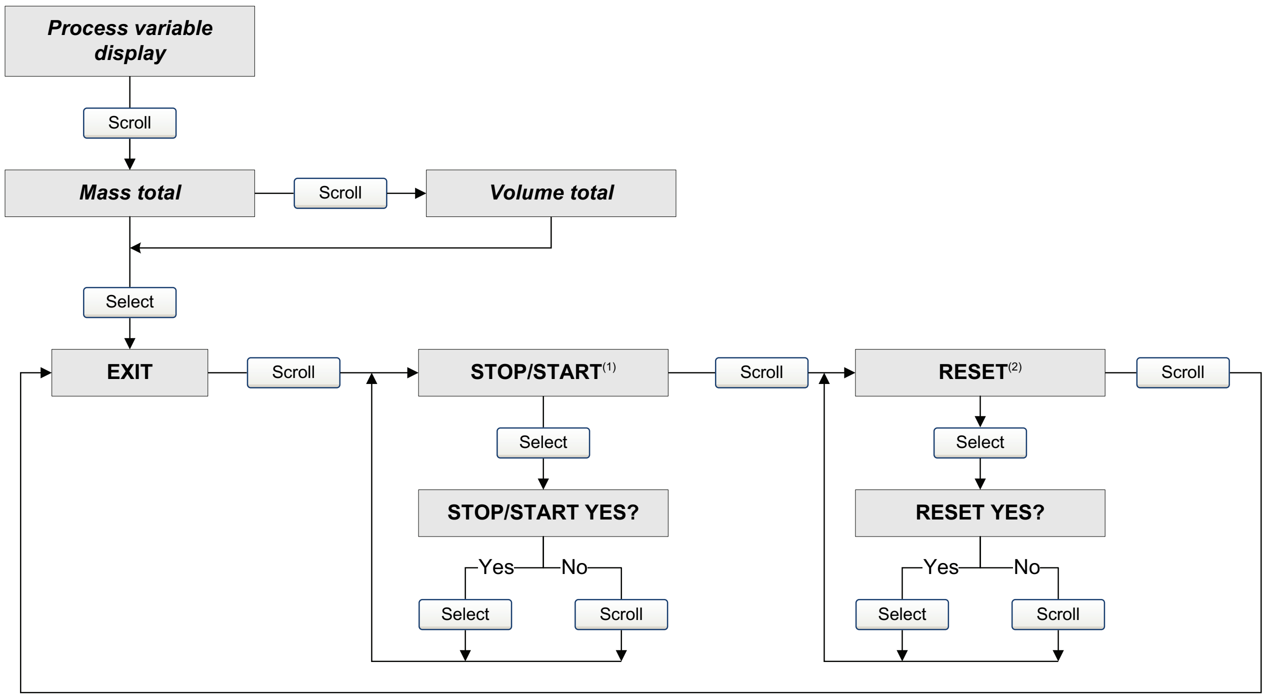
Figure 2-9 Communicator detailed setup menu *continued*



(1) Displayed only if Display Offline Password is enabled.
(2) Menu number varies depending on Display Offline Password configuration.

2.4.3 Display menus

Figure 2-10 Display menu – Managing totalizers and inventories



(1) The transmitter must be configured to allow resetting totalizers from the display. See Section 5.2.4.
(2) The transmitter must be configured to allow starting and stopping totalizers from the display. See Section 5.2.4.

Figure 2-11 Display menu – Off-line menu, top level

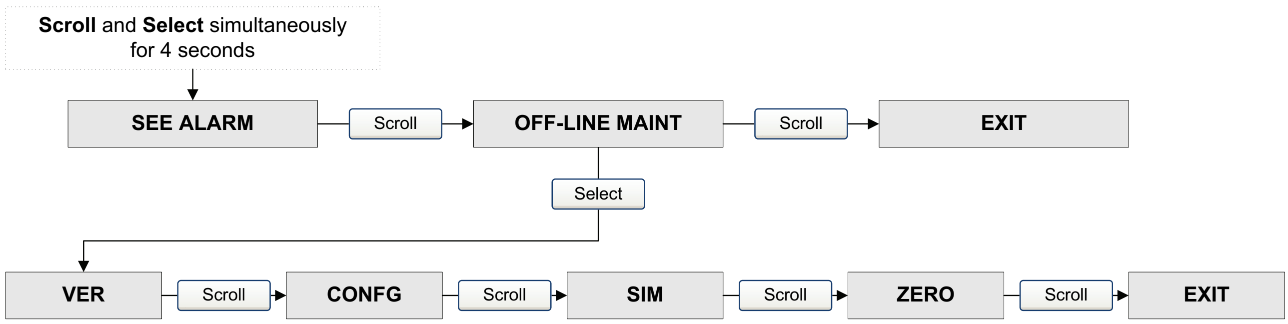


Figure 2-12 Display menu – Maintenance – Version information

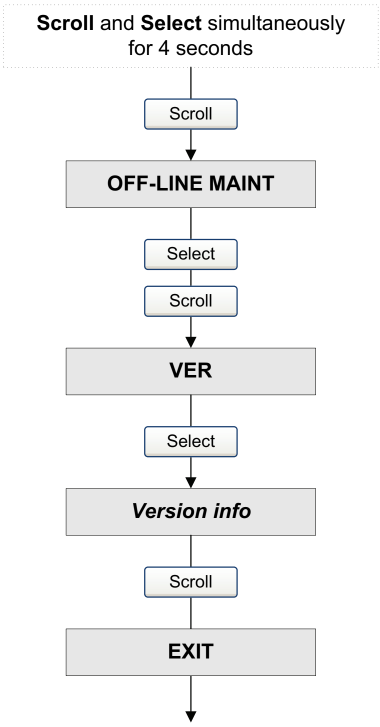
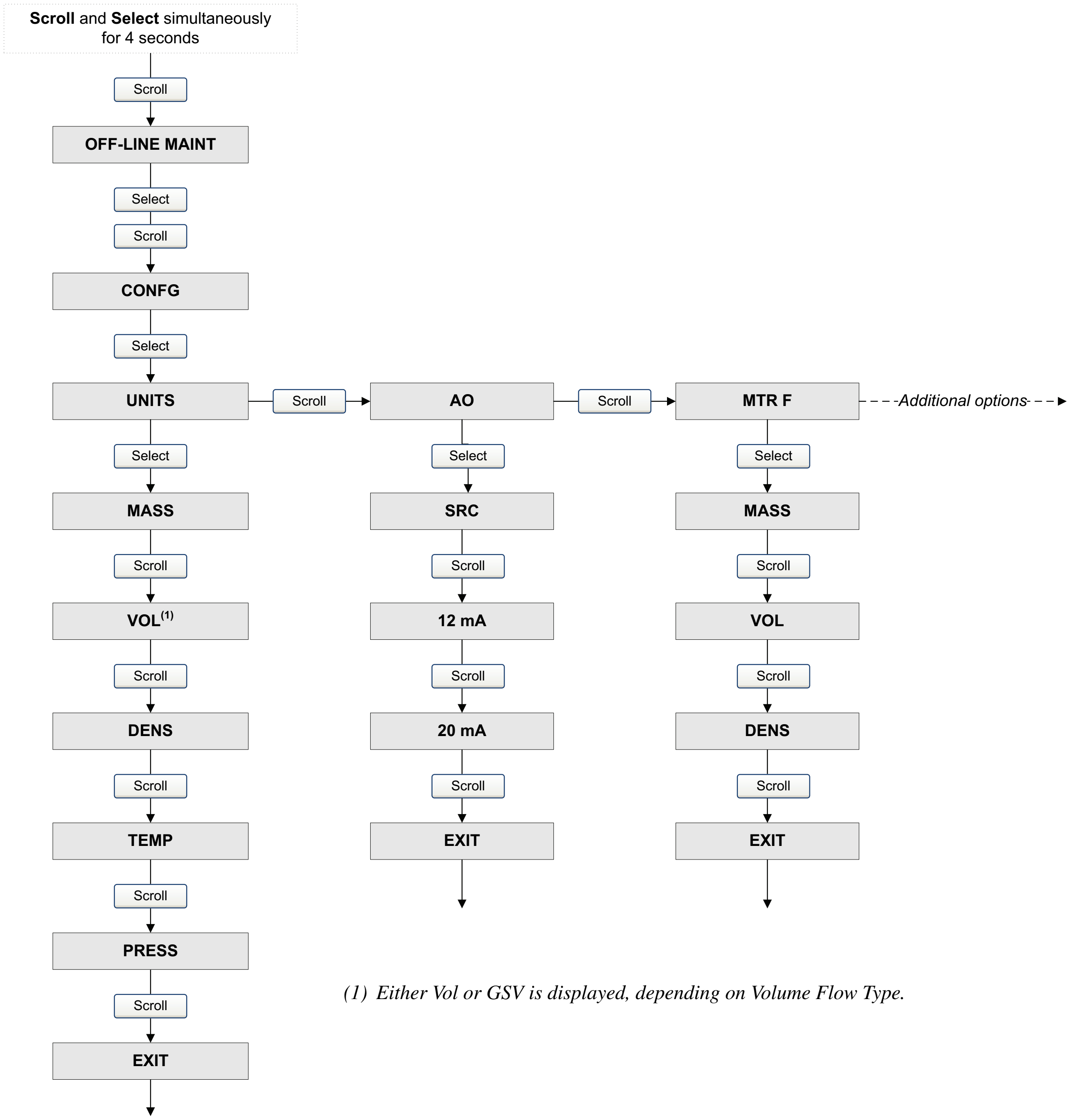
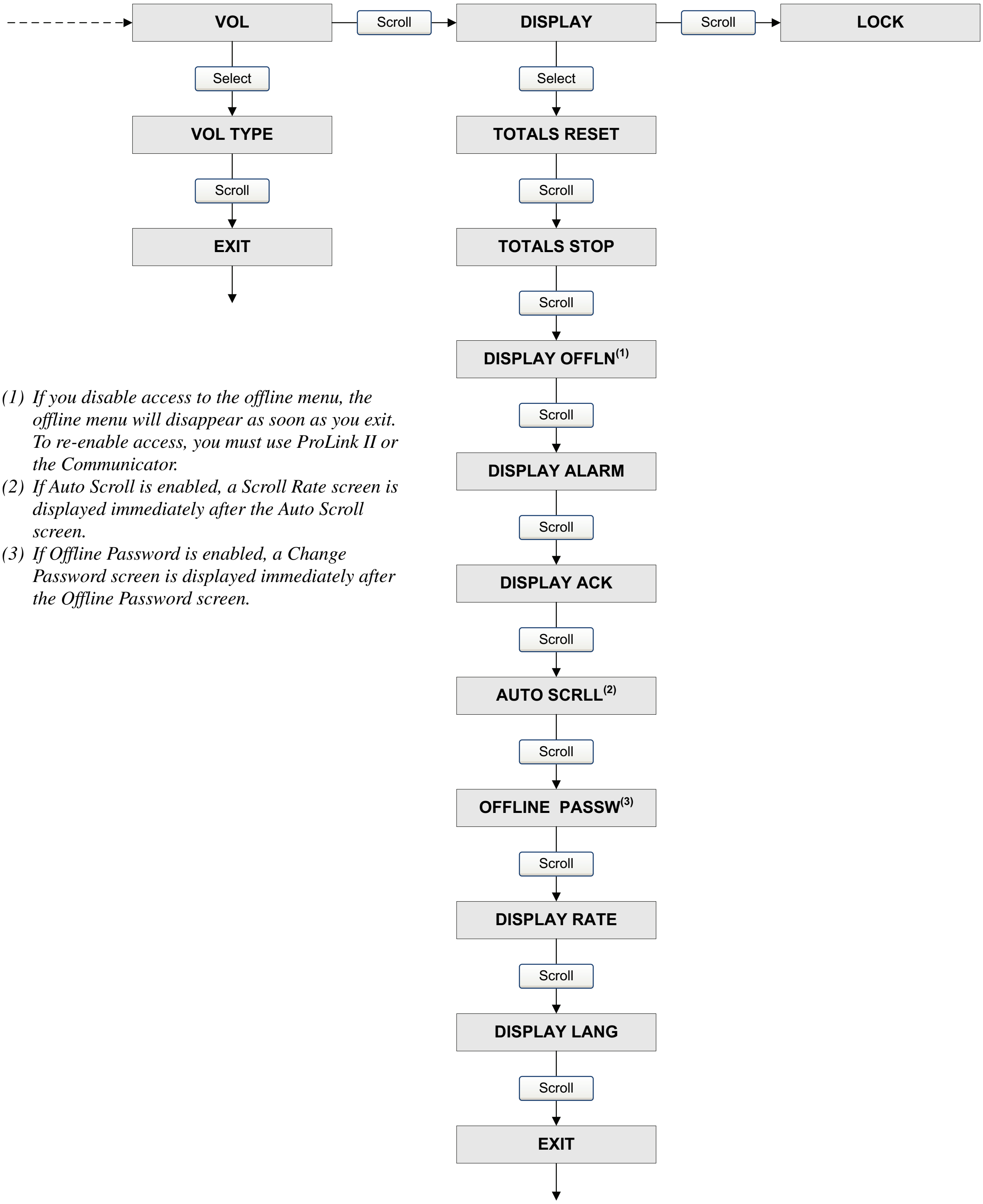


Figure 2-13 Display menu – Maintenance – Configuration: Units, AO, Meter Factors



(1) Either Vol or GSV is displayed, depending on Volume Flow Type.

Figure 2-14 Display menu – Maintenance – Configuration: Volume Type, Display, Lock

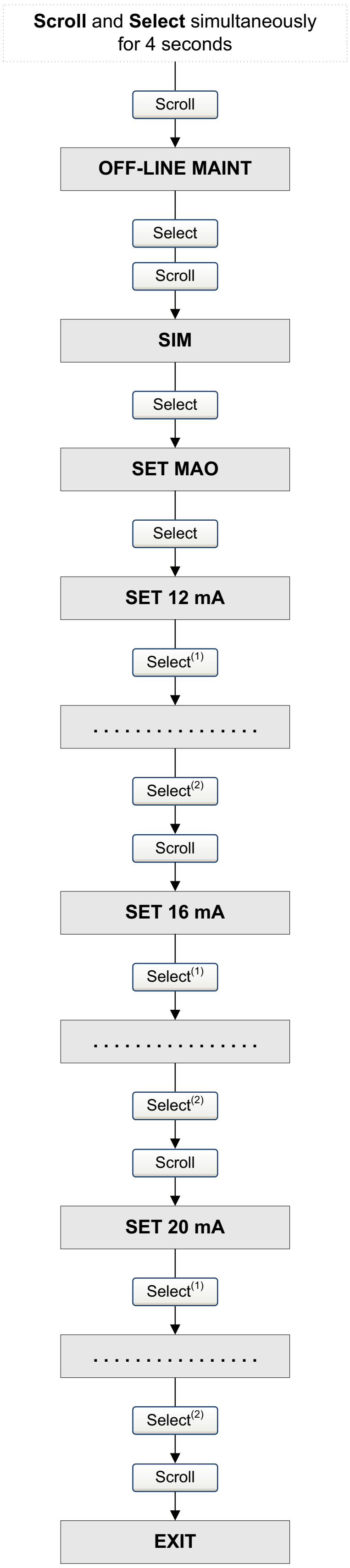


(1) If you disable access to the offline menu, the offline menu will disappear as soon as you exit. To re-enable access, you must use ProLink II or the Communicator.

(2) If Auto Scroll is enabled, a Scroll Rate screen is displayed immediately after the Auto Scroll screen.

(3) If Offline Password is enabled, a Change Password screen is displayed immediately after the Offline Password screen.

Figure 2-15 Display menu – Simulation (loop testing)



(1) *Fixes the output.*
(2) *Unfixes the output.*

Figure 2-16 Display menu – Zero

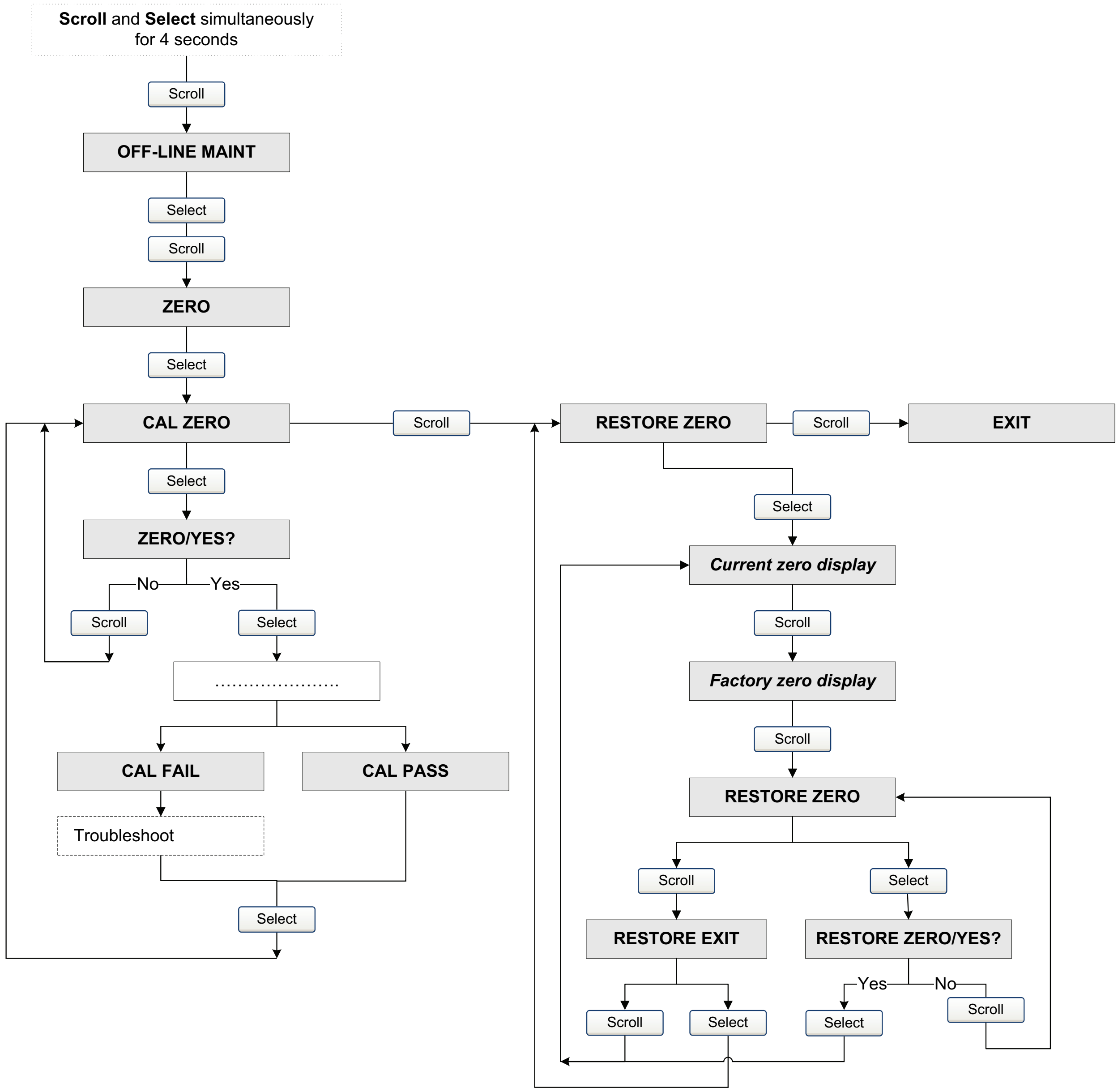
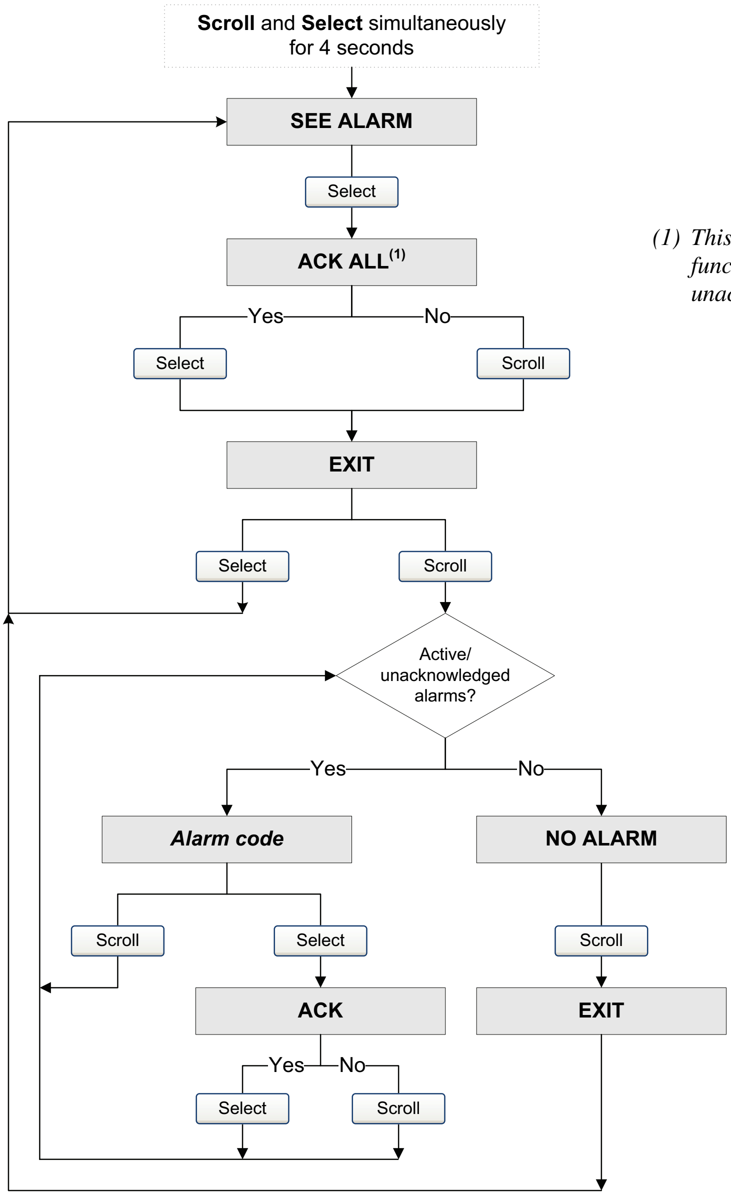


Figure 2-17 Display menu – Alarms



(1) This screen is displayed only if the ACK ALL function is enabled (see Section 5.2.4) and there are unacknowledged alarms.

Chapter 3
Getting Ready to Configure

3.1 Overview

This chapter contains information and procedures that are required or useful for flowmeter configuration planning and configuration. The following topics are discussed:

- Applying power to the flowmeter – see Section 3.2
- Setting up and making an administrative connection – see Section 3.3
- Working with mA output scales – see Section 3.4
- Configuration tips and tricks – see Section 3.5
- Process variables, display variables, and reporting options – see Section 3.6

3.2 Applying power

To apply power to the flowmeter:

1. Close and tighten all covers. **WARNING! Be sure that the Warning flap is closed and the transmitter housing cover is in place before applying power. Operating the flowmeter without covers in place creates electrical hazards that can cause death, injury, or property damage.**
2. Apply power to the mA output wiring.

The flowmeter will automatically perform diagnostic routines. When the flowmeter has completed its power-up sequence, if the default settings are in effect:

- The display will show the current mass flow rate and measurement unit.
- If there are any active Fault or Informational alarms, the display will flash **ALM_F** or **ALM_I** alternately with the mass flow measurement unit.

Note: See Section 5.3.1 for information on alarm severity (Fault, Informational, and Ignore).

Note: The flowmeter is ready to receive process fluid approximately one minute after power-up. However, the transmitter may not be warmed up sufficiently, and may exhibit minor instability or inaccuracy. If you observe this, wait approximately ten minutes. If the condition does not disappear, follow standard troubleshooting procedures.

3.3 Setting up and making an administrative connection

To configure and make the administrative connection using the Communicator or ProLink II:

1. Make a startup connection to the transmitter using default HART parameters as listed below:
   - HART address = 0
   - Baud rate = 1200
   - Parity = Odd
   - Stop bits = 1

Note: For information on using ProLink II, see Appendix D. For information on using the Communicator, see Appendix E.

2. Set the HART address as required. Valid HART addresses are 0–63. The HART address must be unique on the network. You do not need to change the default address unless the transmitter will be on a multidrop network. To set the HART address:
   - Using the Communicator, select **Detailed Setup > Config Outputs > HART Output > Poll Addr**.
   - Using ProLink II, click **ProLink > Configuration > Device**.

Note: If you set the HART address to a non-zero value, Loop Current Mode is automatically disabled and the mA output will not report process data. See Section 6.3.2 for information on enabling Loop Current Mode.

3. If desired, set the software tag (also called the HART tag). Devices on the network may use either the HART address or the software tag to communicate with the transmitter. To set the software tag:
   - Using the Communicator, select **Detailed Setup > Device Information > Tag**.
   - Using ProLink II, click **ProLink > Configuration > Device**.
4. Disconnect the startup connection and reconnect using the new parameters.

3.4 Working with the mA output scale

If the Micro Motion adapter-barrier is installed, the mA signal received by the host is scaled from 4–20 mA. If the adapter-barrier is not installed, the mA signal received by the host is scaled from 12–20 mA. For the configuration and maintenance tasks listed below, you must know which scale applies:

- Configuring the fault value (if Fault Action is set to Downscale)
- Performing a loop test on the mA output
- Performing an mA output trim or scaled AO trim
- Viewing output levels

For these tasks, Micro Motion has included scale conversion routines in the Communicator device description and in ProLink II. These tools will perform scale conversion based on the mA measurement point (see Section 3.4.1). If you are not using the Communicator or ProLink II, you may need to perform scale conversion manually (see Section 3.4.2).

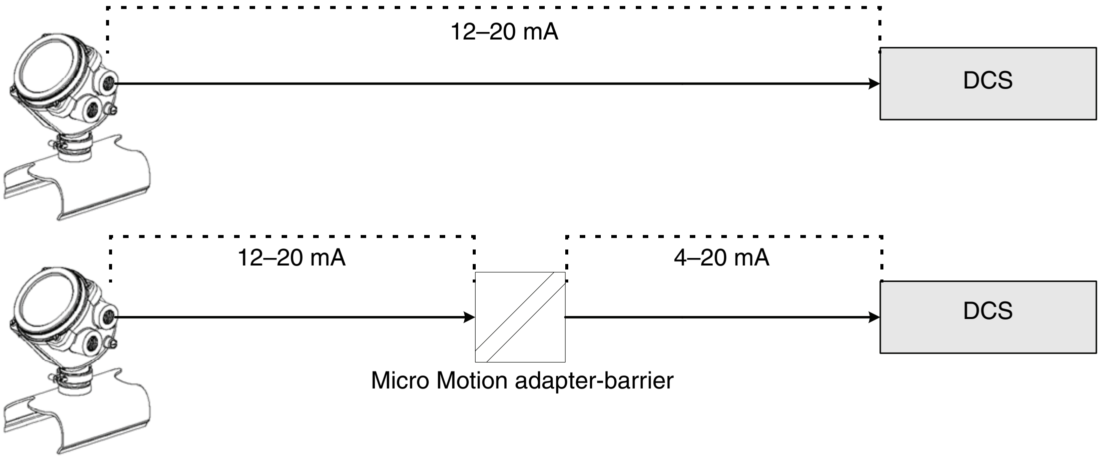
3.4.1 Specifying the mA measurement point

The *mA measurement point* is used by ProLink II and the Communicator to interpret the mA data, that is, whether to use a 12–20 mA scale or a 4–20 mA scale. Both ProLink II and the Communicator prompt you to specify this information whenever it is needed.

Figure 3-1 illustrates the mA measurement point options. As shown:

- If your installation does not include the Micro Motion adapter-barrier, always use 12–20 mA. .
- If your installation does include the Micro Motion adapter-barrier, be sure you know the location of the measurement device and set the mA measurement point appropriately:
  - If the mA measurement device is between the transmitter and the adapter-barrier, use 12–20 mA.
  - If the mA measurement device is between the adapter-barrier and the host, use 4–20 mA.
- If you don't know how to set the mA measurement point, specify Don't Know. The Communicator and ProLink II will display data for both output scales.

Figure 3-1 mA measurement point options



3.4.2 Converting between mA output scales

Equations for converting between mA output scales are shown in Table 3-1.

Table 3-1 mA output scale conversion equations

Conversion	Equation	
12–20 mA to 4–20 mA	$X = (Y - 10) \times 2$	• *X* = value on the 4–20 mA scale • *Y* = value on the 12–20 mA scale
4–20 mA to 12–20 mA	$Y = \frac{X}{2} + 10$	• *X* = value on the 4–20 mA scale • *Y* = value on the 12–20 mA scale

Example	When you connect a digital multimeter (DMM) to the I/O wiring, it reads 13.5 mA. At the mA receiving device, you see a value of 7.2 mA. You don't know if you have an adapter-barrier or if respanning is implemented in the DCS. Is there a problem? 1. Convert 13.5 mA to the corresponding value on the 4–20 mA scale: $X = (13.5 - 10) \times 2$ $X = 7$ 2. Compare and interpret the results: 7 vs. 7.2. In this case, you probably do not have a configuration or wiring problem but you may want to perform an mA output trim.

3.5 Configuration tips and tricks

This section provides information that may be useful before and during configuration.

3.5.1 Write-protection

Before beginning configuration, you may need to disable write-protection. To do this:

- Using ProLink II, click **ProLink > Configuration > Device**, then ensure that the write-protection option is disabled.
- Using the Communicator, select **Diag/Service > Perform Diagnostic Action > Disable Write Protect**.
- Using the display:
  a. Enter the display menu system.
  b. Enter the off-line maintenance menu.
  c. Select the Config menu and scroll to **Lock**.
  d. Ensure that the Lock option is disabled.

  For more details on the display menu sequence, see Figures 2-13 and 2-14.

3.5.2 Default values and ranges

Default values and ranges for the most commonly used parameters are provided in Appendix A.

3.5.3 Restoring factory configuration

If you are using ProLink II or the Communicator, you can restore the factory configuration to return to a known state. To do this:

- Using ProLink II, click **ProLink > Configuration > Device**, then click **Restore Factory Configuration**.
- Using the Communicator, select **Diag/Service > Perform Diagnostic Action > Restore Factory Configuration**.

All configuration parameters will be rewritten.

Note: This action is not available from the display.

3.6 Display and reporting options for process variables

Table 3-2 lists the process variables that are available from the Model 2200S, and how each of them can be displayed, reported, or queried. Refer to this list as you plan the transmitter configuration.

Table 3-2 Process variables and display/reporting/query options

	Display, reporting, and query options					
Process variable	**Display**	**mA output**	**HART PV**	**HART SV**	**HART TV**	**HART QV**
Mass flow	✓	✓	✓	✓	✓	✓
Volume flow(1)	✓	✓	✓	✓	✓	✓
GSV flow(1)	✓	✓	✓	✓	✓	✓
Temperature (process)	✓	✓	✓	✓	✓	✓
Density	✓	✓	✓	✓	✓	✓
Drive gain	✓	✓	✓	✓	✓	✓
Mass total	✓			✓	✓	✓
Volume total(1)	✓			✓	✓	✓
GSV total(1)	✓			✓	✓	✓
Mass inventory	✓			✓	✓	✓
Volume inventory(1)	✓			✓	✓	✓
GSV inventory(1)	✓			✓	✓	✓
Board temperature	✓			✓	✓	✓
LPO amplitude	✓			✓	✓	✓
RPO amplitude	✓			✓	✓	✓
Raw tube frequency	✓			✓	✓	✓
Live zero	✓			✓	✓	✓

(1) Volume and GSV process variables are mutually exclusive.

Chapter 4
Configuring Process Measurement

4.1 Overview

The process measurement parameters control how the transmitter interprets data from the sensor. Process measurement parameters include the following:

- Characterization parameters – see Section 4.2
- General flow parameters – see Section 4.3
- Mass flow parameters – see Section 4.4
- Volume flow parameters – see Section 4.5
- Density parameters – see Section 4.7
- Temperature parameters – see Section 4.8
- Pressure compensation parameters – see Section 4.9

Before beginning configuration, make an administrative connection to the transmitter and ensure that you are complying with all applicable safety requirements.

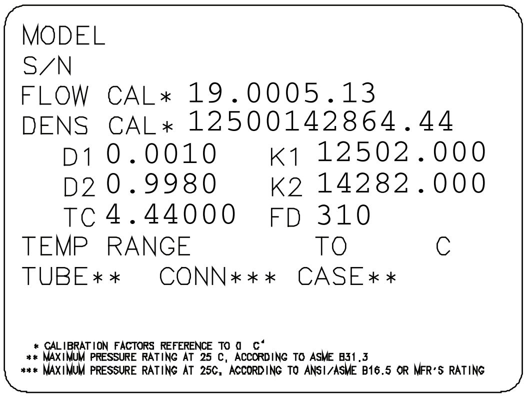
4.2 Characterizing the flowmeter

Characterizing the flowmeter adjusts the transmitter to compensate for the unique traits of the sensor it is paired with. The characterization parameters, or calibration parameters, describe the sensor's sensitivity to flow, density, and temperature.

If the transmitter and sensor were ordered together, the flowmeter was characterized at the factory. You need to characterize the flowmeter only if the transmitter and sensor are being paired together for the first time. However, you may want to verify the characterization parameters.

The characterization parameters are listed in Table 4-1. The characterization parameters for your sensor are provided on the sensor tag.

Table 4-1 Characterization parameters

Parameter	Description	Sample sensor tag
K1	Tube period when sensor is filled with air	
K2	Tube period when sensor is filled with water	
FD	Density correction factor for high flow rates	
D1	Density of air for K1	
D2	Density of water for K2	
TC	Temperature coefficient to compensate for the effect of temperature on the density measurement	
Flowcal	Flow calibration factor to define the relationship between sensor data and mass flow rate and compensate for the effect of temperature on the mass measurement	

Configuration

To characterize the flowmeter using the Communicator:

1. Select **Detailed Setup > Charize Sensor**.
2. In the Sensor Selection menu, select **Other**.
3. In the Flow menu, set the **FlowCal** parameter.
4. In the Density menu, set the remainder of the parameters listed in Table 4-1.

To characterize the flowmeter using ProLink II:

1. Click **ProLink > Configuration.**
2. On the Device panel, set **Sensor Type** to **Curved**.
3. On the Flow panel, set the **Flow Cal** parameter.
4. On the Density panel, set the remainder of the parameters listed in Table 4-1.

4.3 Configuring general flow parameters

The general flow parameters include:

- Flow Direction
- Flow Damping

4.3.1 Flow direction

The Flow Direction parameter controls how the transmitter reports flow rate and how flow is added to or subtracted from the totalizers, under conditions of forward flow, reverse flow, or zero flow.

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

Options for Flow Direction include:

- Forward
- Reverse
- Absolute Value
- Bidirectional
- Negate/Forward
- Negate/Absolute Value

Effects of flow direction

For the effect of Flow Direction on the mA output (i.e., a flow variable has been assigned to the mA output):

- See Figure 4-1 if the LRV is set to 0 (zero flow).
- See Figure 4-2 if the LRV is set to a negative value.

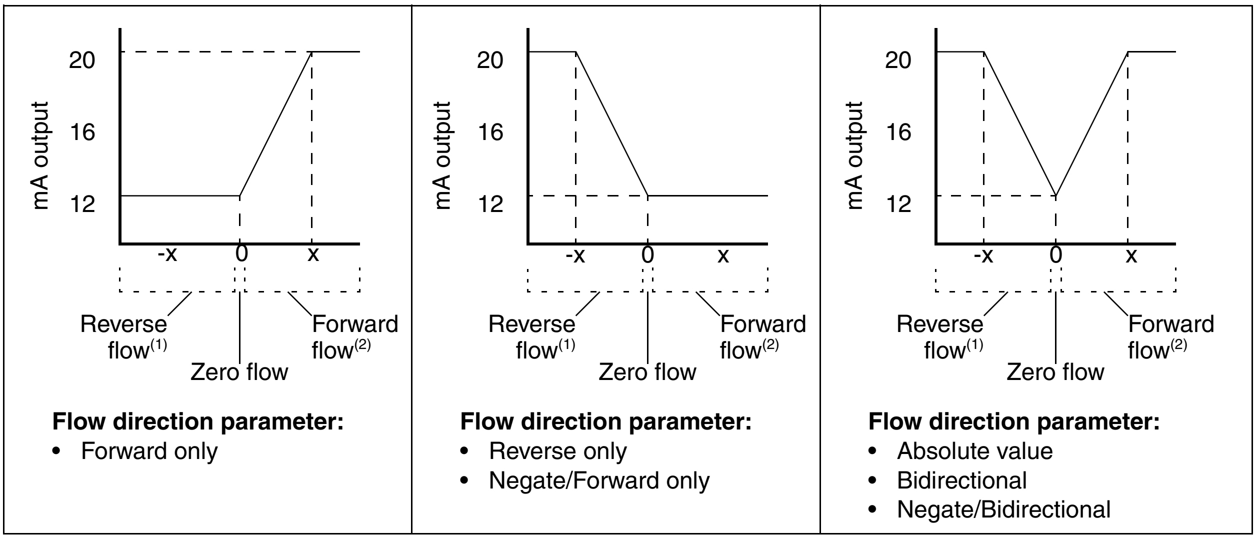
In both figures, the mA output scale is 12–20 mA. If your installation includes the Micro Motion adapter-barrier, adjust the *y* axis as follows:

- URV = 20 mA
- Midpoint = 12 mA
- LRV = 4 mA

For a discussion of these figures, see the examples following the figures.

For the effect of Flow Direction on totalizers and the flow values reported via digital communications, see Table 4-2.

Figure 4-1 Effect of flow direction on mA output: LRV = 0



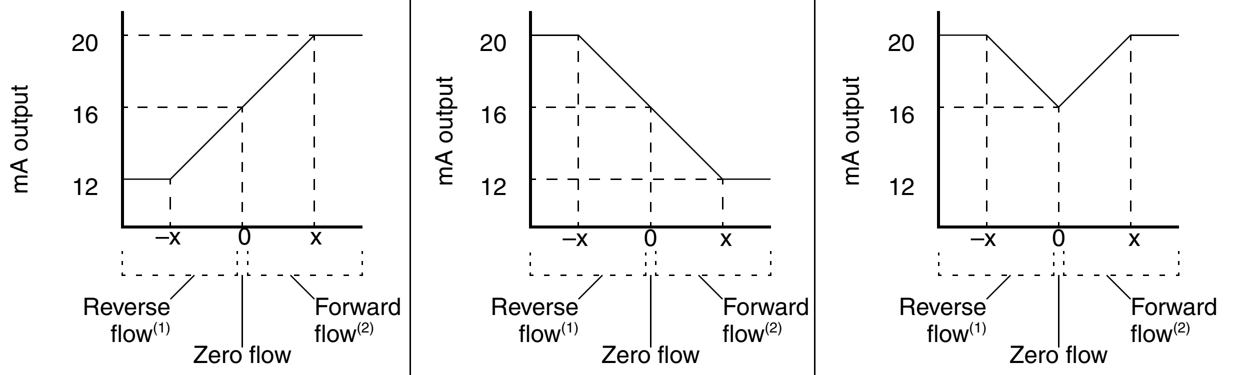
mA output configuration:

- URV = x
- LRV = 0

To set the LRV and URV, see Section 6.2.2.

(1) Process fluid flowing in opposite direction from flow direction arrow on sensor.
(2) Process fluid flowing in same direction as flow direction arrow on sensor.

Figure 4-2 Effect of flow direction on mA output: LRV < 0



Flow direction parameter:	Flow direction parameter:	Flow direction parameter:
• Forward only	• Reverse only • Negate/Forward only	• Absolute value • Bidirectional • Negate/Bidirectional

mA output configuration:
- URV = x
- LRV = –x
- –x < 0

To set the LRV and URV, see Section 6.2.2.

(1) Process fluid flowing in opposite direction from flow direction arrow on sensor.
(2) Process fluid flowing in same direction as flow direction arrow on sensor.

Example 1

Configuration:

- Flow direction = Forward Only
- mA output: LRV = 0 g/s; URV = 100 g/s

(See the first graph in Figure 4-1.)

As a result:

- Under conditions of zero flow, the mA output of the transmitter is 12 mA.
- Under conditions of reverse flow, the mA output saturates at 11.9 mA.
- Under conditions of forward flow, up to a flow rate of 100 g/s, the mA output of the transmitter 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/s, the mA output will be proportional to the flow rate up to 20.5 mA, and will be level at 20.5 mA at higher flow rates.

Example 2	Configuration: • Flow direction = Reverse Only • mA output: LRV = 0 g/s; URV = 100 g/s (See the second graph in Figure 4-1.) As a result: • Under conditions of forward flow or zero flow, the mA output of the transmitter is 12 mA. • Under conditions of reverse flow, up to a flow rate of 100 g/s, the mA output of the transmitter varies between 12 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/s, the mA output of the transmitter 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.

Example 3	Configuration: • Flow direction = Forward Only • mA output: LRV = –100 g/s; URV = 100 g/s (See the first graph in Figure 4-2.) As a result: • Under conditions of zero flow, the mA output is 12 mA (before respanning). • Under conditions of forward flow, up to a flow rate of 100 g/s, the mA output of the transmitter 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/s, the mA output of the transmitter 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, up to a flow rate of 100 g/s, the mA output of the transmitter varies between 12 mA and 16 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/s, the mA output of the transmitter is inversely proportional to the flow rate down to 11.9 mA (3.8 mA if level-shifted), and will be level at 11.9 mA (3.8 mA) at higher absolute values.

Table 4-2 Effect of flow direction on totalizers and digital communications

	Forward flow	
Flow direction value	**Flow totals**	**Flow values via digital comm.**
Forward only	Increase	Positive
Reverse only	No change	Positive
Bidirectional	Increase	Positive
Absolute value	Increase	Positive(1)
Negate/Forward	No change	Negative
Negate/Bidirectional	Decrease	Negative
	Zero flow	
Flow direction value	**Flow totals**	**Flow values via digital comm.**
All	No change	0
	Reverse flow	
Flow direction value	**Flow totals**	**Flow values via digital comm.**
Forward only	No change	Negative
Reverse only	Increase	Negative
Bidirectional	Decrease	Negative
Absolute value	Increase	Positive(1)
Negate/Forward	Increase	Positive
Negate/Bidirectional	Increase	Positive

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

Configuration

To configure flow direction:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Flow**.
- Using ProLink II, click **ProLink > Configuration > Flow**.

Note: You cannot configure flow direction with the display.

4.3.2 Flow damping

Before configuring flow damping, review the information in Section 4.10.

Configuration

To configure flow damping:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Flow**.
- Using ProLink II, click **ProLink > Configuration > Flow**.

Note: You cannot configure flow damping with the display.

4.4 Configuring mass flow measurement

The mass flow measurement parameters control how the flowmeter measures and reports mass flow. You must configure:

- Mass flow measurement units
- Mass flow cutoff

Note: If you use the display, you can configure only the mass flow measurement unit.

4.4.1 Mass flow measurement unit

The default mass flow measurement unit is g/s. See Table 4-3 for a complete list of mass flow measurement units.

If the mass flow unit you want to use is not listed, you can define a special measurement unit for mass flow (see Section 4.4.3).

Table 4-3 Mass flow measurement units

Mass flow unit			
Display	**Communicator**	**ProLink II**	**Unit description**
G/S	g/s	g/s	Grams per second
G/MIN	g/min	g/min	Grams per minute
G/H	g/h	g/hr	Grams per hour
KG/S	kg/s	kg/s	Kilograms per second
KG/MIN	kg/min	kg/min	Kilograms per minute
KG/H	kg/h	kg/hr	Kilograms per hour
KG/D	kg/d	kg/day	Kilograms per day
T/MIN	MetTon/min	mTon/min	Metric tons per minute
T/H	MetTon/h	mTon/hr	Metric tons per hour
T/D	MetTon/d	mTon/day	Metric tons per day
LB/S	lb/s	lbs/s	Pounds per second
LB/MIN	lb/min	lbs/min	Pounds per minute
LB/H	lb/h	lbs/hr	Pounds per hour
LB/D	lb/d	lbs/day	Pounds per day
ST/MIN	STon/min	sTon/min	Short tons (2000 pounds) per minute
ST/H	STon/h	sTon/hr	Short tons (2000 pounds) per hour
ST/D	STon/d	sTon/day	Short tons (2000 pounds) per day
LT/H	LTon/h	lTon/hr	Long tons (2240 pounds) per hour
LT/D	LTon/d	lTon/day	Long tons (2240 pounds) per day
SPECL	Spcl	special	Special unit (see Section 4.4.3)

Configuration

To configure the mass flow measurement unit:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Flow**.
- Using ProLink II, click **ProLink > Configuration > Flow**.
- Using the display, see Figure 2-13.

4.4.2 Mass flow cutoff

If the mass flow measurement drops below the configured mass flow cutoff, the transmitter will report 0 for the mass flowrate.

The default value for the mass flow cutoff is 0.0 g/s. The recommended setting is 5% of the sensor's rated maximum flow rate.

Note the following:

- The mass flow cutoff is not applied to either volume (liquid) or gas standard volume measurement. Even if the measured mass flow drops below the mass flow cutoff, and therefore the mass flow indicators go to zero, the volume flow rate will be calculated from the actual mass flow process variable.
- The mass flow rate reported via the mA output may also be limited by the AO cutoff. See Section 6.2.3 for more information.

Configuration

To configure the mass flow cutoff:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Flow**.
- Using ProLink II, click **ProLink > Configuration > Flow**.

Note: You cannot configure the mass flow cutoff with the display.

4.4.3 Defining a special unit for mass flow

To define a special unit for mass flow:

1. Navigate to the special units menu:
   - If you are using the Communicator, select **Detailed Setup > Config Fld Dev Var > Flow > Spcl mass units**.
   - If you are using ProLink II, click **ProLink > Configuration > Special Units**.

Note: You cannot define a special unit for mass flow with the display.

2. Specify the existing mass unit that the special unit will be based on.
3. Specify the existing time unit that the special unit will be based on.
4. Calculate and specify the mass flow conversion factor. This value is used to calculate the special unit from the base mass unit and the base time unit. Use the following equations:

$$x[\text{BaseUnit(s)}] = y[\text{SpecialUnit(s)}]$$

$$\text{ConversionFactor} = \frac{x[\text{BaseUnit(s)}]}{y[\text{SpecialUnit(s)}]}$$

5. Assign a name to the new special unit for mass flow.
6. Assign a name to the unit to be used for the associated mass totalizer and inventory.

Example	You want to measure the mass flow in ounces per second. 1. Set the base mass unit to pounds (lb). 2. Set the base time unit to seconds (sec). 3. Calculate and set the conversion factor: $1\text{lb} = 16\text{oz}$ $0.0625 = \frac{1}{16}$ 4. Set the unit name as desired, e.g., *oz/sec*. 5. Set the totalizer and inventory name as desired, e.g., *oz*. 6. Configure the transmitter to use this measurement unit for mass flow.

4.5 Configuring volume flow measurement

The volume flow measurement parameters control how the flowmeter measures and reports volume flow. You must configure:

- Volume flow type
- Volume flow measurement units
- Volume flow cutoff

If you set Volume Flow Type to GSV, you must also specify the properties of your gas.

Note: If you use the display, you can configure only volume flow type and the volume flow measurement unit.

4.5.1 Volume flow type

Volume Flow Type allows you to specify that your process fluid is a liquid (typical applications) or a gas. Your choice here controls the volume measurement units that are available. If you specify Gas Standard Volume (GSV), you must describe the properties of your gas (see Section 4.6).

Configuration

To configure Volume Flow Type:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Flow**.
- Using ProLink II, click **ProLink > Configuration > Flow**.
- Using the display, see Figure 2-14.

4.5.2 Volume flow measurement unit

Default volume measurement units are as follows:

- Liquid – liters/second
- GSV – SCFM

For the complete list of volume flow measurement units:

- Liquid – see Table 4-4
- GSV – see Table 4-5

If the volume flow unit you want to use is not listed, you can define a special measurement unit for volume flow (see Section 4.6.2).

Table 4-4 Volume flow measurement units – Liquid

Volume flow unit			
Display	**Communicator**	**ProLink II**	**Unit description**
CUFT/S	Cuft/s	ft3/sec	Cubic feet per second
CUF/MN	Cuft/min	ft3/min	Cubic feet per minute
CUFT/H	Cuft/h	ft3/hr	Cubic feet per hour
CUFT/D	Cuft/d	ft3/day	Cubic feet per day
M3/S	Cum/s	m3/sec	Cubic meters per second
M3/MIN	Cum/min	m3/min	Cubic meters per minute
M3/H	Cum/h	m3/hr	Cubic meters per hour
M3/D	Cum/d	m3/day	Cubic meters per day
USGPS	gal/s	US gal/sec	U.S. gallons per second
USGPM	gal/min	US gal/min	U.S. gallons per minute
USGPH	gal/h	US gal/hr	U.S. gallons per hour
USGPD	gal/d	US gal/d	U.S. gallons per day
MILG/D	MMgal/d	mil US gal/day	Million U.S. gallons per day
L/S	L/s	l/sec	Liters per second
L/MIN	L/min	l/min	Liters per minute
L/H	L/h	l/hr	Liters per hour
MILL/d	ML/d	mil l/day	Million liters per day
UKGPS	Impgal/s	Imp gal/sec	Imperial gallons per second
UKGPM	Impgal/min	Imp gal/min	Imperial gallons per minute
UKGPH	Impgal/h	Imp gal/hr	Imperial gallons per hour
UKGPD	Impgal/d	Imp gal/day	Imperial gallons per day
BBL/S	bbl/s	barrels/sec	Barrels per second(1)
BBL/MN	bbl/min	barrels/min	Barrels per minute(1)
BBL/H	bbl/h	barrels/hr	Barrels per hour(1)
BBL/D	bbl/d	barrels/day	Barrels per day(1)
BBBL/S	bbl/s	Beer barrels/sec	Beer barrels per second(2)
BBBL/MN	bbl/min	Beer barrels/min	Beer barrels per minute(2)
BBBL/H	bbl/h	Beer barrels/hr	Beer barrels per hour(2)
BBBL/D	bbl/d	Beer barrels/day	Beer barrels per day(2)
SPECL	Spcl	special	Special unit (see Section 4.6.2)

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

Table 4-5 Volume flow measurement units – Gas

Volume flow unit			
Display	**Communicator**	**ProLink II**	**Unit description**
NM3/S	Not available	Nm3/sec	Normal cubic meters per second
NM3/MN	Not available	Nm3/min	Normal cubic meters per minute
NM3/H	Not available	Nm3/hr	Normal cubic meters per hour
NM3/D	Not available	Nm3/day	Normal cubic meters per day
NLPS	Not available	NLPS	Normal liter per second
NLPM	Not available	NLPM	Normal liter per minute
NLPH	Not available	NLPH	Normal liter per hour
NLPD	Not available	NLPD	Normal liter per day
SCFS	Not available	SCFS	Standard cubic feet per second
SCFM	Not available	SCFM	Standard cubic feet per minute
SCFH	Not available	SCFH	Standard cubic feet per hour
SCFD	Not available	SCFD	Standard cubic feet per day
SM3/S	Not available	Sm3/S	Standard cubic meters per second
SM3/MN	Not available	Sm3/min	Standard cubic meters per minute
SM3/H	Not available	Sm3/hr	Standard cubic meters per hour
SM3/D	Not available	Sm3/day	Standard cubic meters per day
SLPS	Not available	SLPS	Standard liter per second
SLPM	Not available	SLPM	Standard liter per minute
SLPH	Not available	SLPH	Standard liter per hour
SLPD	Not available	SLPD	Standard liter per day
SPECL	Spcl	special	Special unit (see Section 4.6.2)

Configuration

To configure the volume flow measurement unit:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Flow**.
- Using ProLink II, click **ProLink > Configuration > Flow**.
- Using the display, see Figure 2-13.

4.6 Describing gas properties for GSV flow measurement

You must use ProLink II to describe the properties of your gas. To describe the properties of your gas:

1. Click **ProLink > Configure > Flow.**
2. If you know the standard density of your gas (density at reference conditions), enter it on this panel, in g/cm3, and click **Next**.

3. If you do not know the standard density of your gas:
   a. Click the **Gas Wizard** button.
   b. Click **Choose Gas** and check the list.
   c. If your gas is listed, select it and click **Next**.
   d. If your gas is not listed, click **Enter Other Gas Property** and provide the required information. You can describe your gas by molecular weight, its specific gravity, or density. If you use density, you must enter the density value in the configured density units and you must provide the temperature and pressure at which the density value was determined. When you are finished, click **Next**.
   e. Verify the reference temperature and reference pressure. If these are not appropriate for your application, click **Change Reference Conditions** and enter new values for reference temperature and reference pressure.
   f. Click **Next**. The calculated standard density value is displayed.
      - If the value is correct, click **Finish**. The value will be written to transmitter configuration.
      - If the value is not correct, click **Back** and modify input values as required.

Note: The Gas Wizard displays density, temperature, and pressure in the configured units. If required, you can configure the transmitter to use different units.

4.6.1 Volume or GSV flow cutoff

If the volume or GSV flow measurement drops below the configured volume or GSV flow cutoff, the transmitter will report a value of 0 for volume flow or GSV flow.

Note the following:

- If Volume Flow Type is set to Liquid:
  - The volume flow rate is affected by the density cutoff. Accordingly, if the density drops below its configured cutoff value, the volume flow rate will go to zero even if flow is present and the volume flow rate is above the volume flow cutoff.
  - The volume flow rate is not affected by the mass flow cutoff.
- If Volume Flow Type is set to GSV, the volume flow rate is not affected by either the density cutoff or the mass flow cutoff.
- The volume or GSV flow rate reported via the mA output may also be limited by the AO cutoff. See Section 6.2.3 for more information.

Configuration

To configure the volume flow cutoff or GSV flow cutoff:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Flow**.
- Using ProLink II, click **ProLink > Configuration > Flow**.

Note: You cannot configure the volume flow cutoff or GSV flow cutoff with the display.

4.6.2 Defining a special unit for volume or GSV flow

To define a special unit for volume or GSV flow:

1. Navigate to the special units menu:
   - If you are using the Communicator, select **Detailed Setup > Config Fld Dev Var > Flow > Spcl vol units**.
   - If you are using ProLink II, click **ProLink > Configuration > Special Units**.

Note: You cannot define a special unit for GSV flow with the Communicator. You cannot define a special unit for either volume flow or GSV flow with the display.

2. Specify the existing volume or GSV unit that the special unit will be based on.
3. Specify the existing time unit that the special unit will be based on.
4. Calculate and specify the volume flow or GSV conversion factor. This value is used to calculate the special unit from the base mass unit and the base time unit. Use the following equations:

$$x[\text{BaseUnit(s)}] = y[\text{SpecialUnit(s)}]$$

$$\text{ConversionFactor} = \frac{x[\text{BaseUnit(s)}]}{y[\text{SpecialUnit(s)}]}$$

5. Assign a name to the new special unit for volume or GSV flow.
6. Assign a name to the unit to be used for the associated volume or GSV totalizer and inventory.

Example

You want to measure the volume flow in pints per second.

1. Set the base volume unit to gallons (gal).
2. Set the base time unit to seconds (sec).
3. Calculate and set the conversion factor:

$$1\text{gal} = 8\text{pints}$$

$$0.126 = \frac{1}{8}$$

4. Set the unit name as desired, e.g., *pts/sec*.
5. Set the totalizer and inventory name as desired, e.g., *pints*.
6. Configure the transmitter to use this measurement unit for volume flow.

4.7 Configuring density measurement

The density measurement parameters control how the flowmeter measures and reports density. You must configure:

- Density measurement units
- Density cutoff
- Density damping
- Slug flow parameters

Note: If you use the display, you can configure only the density measurement unit.

4.7.1 Density measurement units

The default density measurement unit is g/cm3. See Table 4-6 for a complete list of density measurement units.

Table 4-6 Density measurement units

Density unit			
Display	**Communicator**	**ProLink II**	**Unit description**
SGU	SGU	SGU	Specific gravity unit (not temperature-corrected)
G/CM3	g/Cucm	g/cm3	Grams per cubic centimeter
G/L	g/L	g/l	Grams per liter
G/ML	g/mL	g/ml	Grams per milliliter
KG/L	kg/L	kg/l	Kilograms per liter
KG/M3	kg/Cum	kg/m3	Kilograms per cubic meter
LB/GAL	lb/gal	lbs/Usgal	Pounds per U.S. gallon
LB/CUF	lb/Cuft	lbs/ft3	Pounds per cubic foot
LB/CUI	lb/CuIn	lbs/in3	Pounds per cubic inch
ST/CUY	STon/Cuyd	sT/yd3	Short ton per cubic yard

Configuration

To configure the density measurement unit:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Density**.
- Using ProLink II, click **ProLink > Configuration > Density**.
- Using the display, see Figure 2-13.

4.7.2 Density cutoff

If the density measurement drops below the configured density cutoff, the transmitter will report a value of 0 for density.

Note the following:

- The density cutoff is applied to the volume (liquid) measurement. If the density drops below its configured cutoff value, the volume flow rate will go to zero.
- The density cutoff is not applied to the GSV measurement. The measured density values are used in GSV calculations.

Configuration

To configure the density cutoff:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Density**.
- Using ProLink II, click **ProLink > Configuration > Density**.

Note: You cannot configure the density cutoff with the display.

4.7.3 Density damping

Before configuring density damping, review the information in Section 4.10.

Configuration

To configure density damping:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Density**.
- Using ProLink II, click **ProLink > Configuration > Density**.

Note: You cannot configure density damping with the display.

4.7.4 Slug flow parameters

Slugs – gas in a liquid process or liquid in a gas process – occasionally appear in some applications. The presence of slugs can significantly affect the process density reading. The slug flow parameters can help the transmitter suppress extreme changes in process variables, and can also be used to identify process conditions that require correction.

Slug flow parameters are as follows:

- *Low slug flow limit* – the point below which a condition of slug flow will exist. Typically, this is the lowest density point in your process's normal density range. Default value is 0.0 g/cm^3; range is 0.0–10.0 g/cm^3.
- *High slug flow limit* – the point above which a condition of slug flow will exist. Typically, this is the highest density point in your process's normal density range. Default value is 5.0 g/cm^3; range is 0.0–10.0 g/cm^3.
- *Slug flow duration* – the number of seconds the transmitter waits for a slug flow condition (*outside* the slug flow limits) to return to normal (*inside* the slug flow limits).

If the transmitter detects slug flow:

- A slug flow alarm is posted immediately.
- During the slug duration period, the transmitter holds the mass flow rate at the last measured pre-slug value, independent of the mass flow rate measured by the sensor. All outputs that report mass flow rate and all internal calculations that include mass flow rate will use this value.
- If slugs are still present after the slug duration period expires, the transmitter forces the mass flow rate to 0, independent of the mass flow rate measured by the sensor. All outputs that report mass flow rate and all internal calculations that include mass flow rate will use 0.
- When process density returns to a value within the slug flow limits, the slug flow alarm is cleared and the mass flow rate reverts to the actual measured value.

Note: The slug flow limits must be entered in g/cm^3, even if another unit has been configured for density. Slug flow duration is entered in seconds.

Note: Raising the low slug flow limit or lowering the high slug flow limit will increase the possibility of slug flow conditions. Conversely, lowering the low slug flow limit or raising the high slug flow limit will decrease the possibility of slug flow conditions.

Note: If slug flow duration is set to 0, the mass flow rate will be forced to 0 as soon as slug flow is detected.

Configuration

To configure slug flow parameters:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Density**.
- Using ProLink II, click **ProLink > Configuration > Density**.

Note: You cannot configure slug flow parameters with the display.

4.8 Configuring temperature measurement

The temperature measurement parameters control how the flowmeter measures and reports temperature. You must configure:

- Temperature measurement units
- Temperature damping

Note: If you use the display, you can configure only the temperature measurement unit.

4.8.1 Temperature measurement units

The default temperature measurement unit is °C. See Table 4-7 for a complete list of temperature measurement units.

Table 4-7 **Temperature measurement units**

Temperature unit			
Display	**Communicator**	**ProLink II**	**Unit description**
°C	degC	°C	Degrees Celsius
°F	degF	°F	Degrees Fahrenheit
°R	degR	°R	Degrees Rankine
°K	Kelvin	°K	Kelvin

Configuration

To configure the temperature measurement unit:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Temperature**.
- Using ProLink II, click **ProLink > Configuration > Temperature**.
- Using the display, see Figure 2-13.

4.8.2 Temperature damping

Before configuring temperature damping, review the information in Section 4.10.

Configuration

To configure temperature damping:

- Using the Communicator, select **Detailed Setup > Config Fld Dev Var > Temperature**.
- Using ProLink II, click **ProLink > Configuration > Temperature**.

Note: You cannot configure temperature damping with the display.

4.9 Configuring pressure compensation

The Model 2200S transmitter can compensate for the effect of pressure on the sensor flow tubes. *Pressure effect* is defined as the change in sensor flow and density sensitivity due to process pressure change away from calibration pressure.

Note: Pressure compensation is optional. Perform this procedure only if required by your application.

The Model 2200S transmitter supports only static pressure compensation; i.e., the external pressure is a known static value.

4.9.1 Pressure correction factors

When configuring pressure compensation, you must provide the flow calibration pressure – the pressure at which the sensor was calibrated (which therefore defines the pressure at which there will be no effect on the calibration factor). Enter 20 PSI unless the calibration document for your sensor indicates a different calibration pressure.

Two additional pressure correction factors may be configured: one for flow and one for density. These are defined as follows:

- Flow factor – the percent change in the flow rate per psi
- Density factor – the change in fluid density, in g/cm^3/psi

Not all sensors or applications require pressure correction factors. For the pressure correction values to be used, obtain the pressure effect values from the product data sheet for your sensor, then reverse the signs (e.g., if the pressure effect is 0.000004, enter a pressure correction factor of –0.000004).

4.9.2 Configuration procedure

To enable and configure pressure compensation:

- With the Communicator, see Figure 4-3.
- With ProLink II, see Figure 4-4.

Note: You cannot configure pressure compensation with the display.

Figure 4-3 Configuring pressure compensation with the Communicator

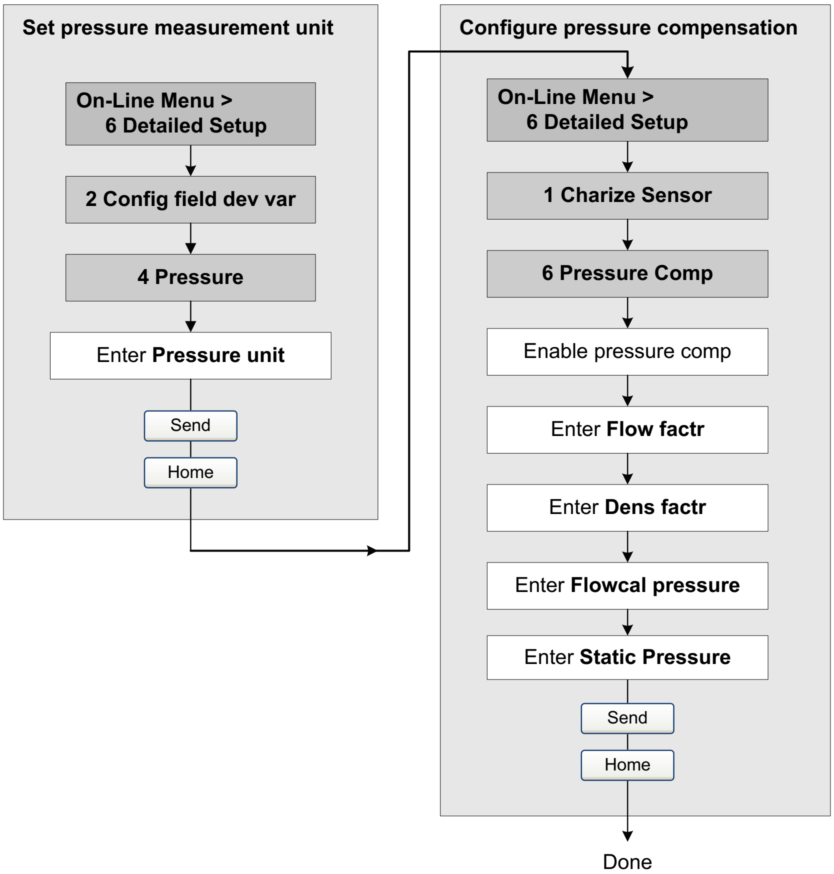
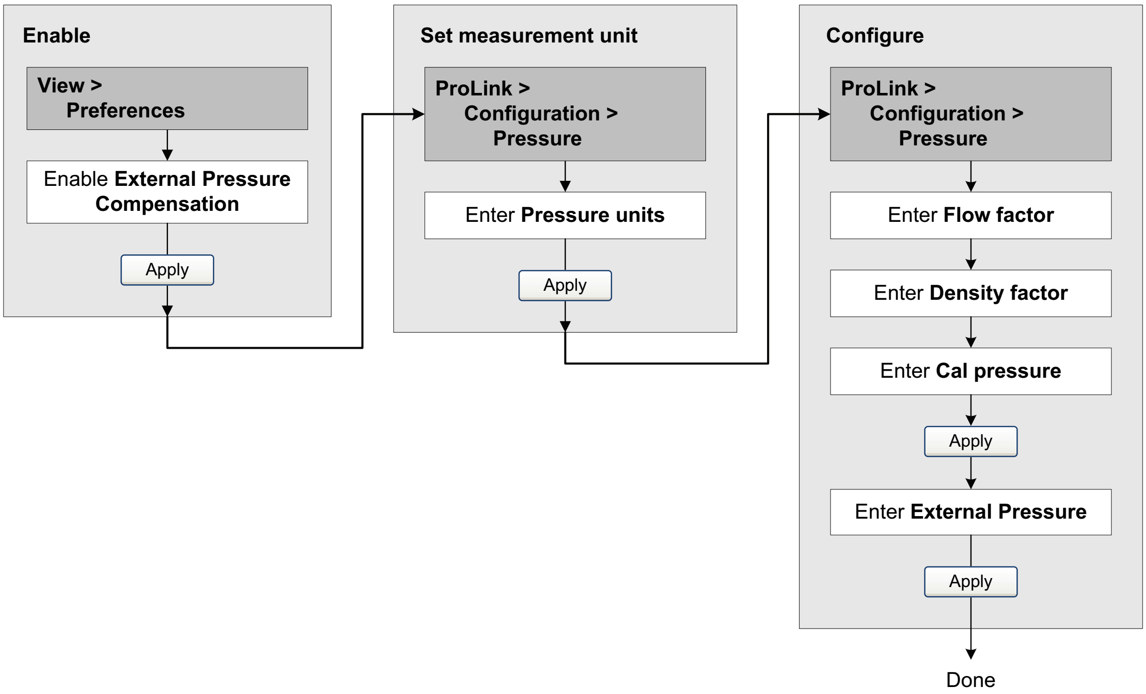


Figure 4-4 **Configuring pressure compensation with ProLink II**



4.10 Damping

Damping helps the transmitter smooth out small, rapid measurement fluctuations. A damping value specifies the period of time, in seconds, over which the process variable value will change to reflect 63% of the change in the actual process.

- A high damping value makes the output appear to be smoother because the output must change slowly.
- A low damping value makes the output appear to be more erratic because the output changes more quickly.

Damping can be configured for flow, density, and temperature (see Sections 4.3.2, 4.7.3, and 4.8.2.).

When you specify a new damping value, it is automatically rounded down to the nearest valid damping value. Valid damping values are listed in Table 4-8.

Note: For gas applications, Micro Motion recommends a minimum flow damping value of 2.56.

Before setting the damping values, review the following sections for information on how the damping values interact with other transmitter measurements and parameters.

Table 4-8 **Valid damping values**

Process variable	Valid damping values
Flow (mass and volume)	0, 0.04, 0.08, 0.16, ... 40.96
Density	0, 0.04, 0.08, 0.16, ... 40.96
Temperature	0, 0.6, 1.2, 2.4, 4.8, ... 76.8

4.10.1 Damping and volume measurement

When configuring damping values, note the following:

- Liquid volume flow is derived from mass and density measurements; therefore, any damping applied to mass flow and density will affect liquid volume measurement.
- Gas standard volume flow is derived from mass flow measurement, but not from density measurement. Therefore, only damping applied to mass flow will affect gas standard volume measurement.

Be sure to set damping values accordingly.

4.10.2 Interaction with the Added Damping parameter

The mA output has a damping parameter called Added Damping. If damping is set to non-zero value for flow, density, or temperature, the same process variable is assigned to the mA output, and Added Damping is also set to a non-zero value, the effect of damping the process variable is calculated first, and the added damping calculation is applied to the result of that calculation.

See Section 6.2.4 for more information on the Added Damping parameter.

Chapter 5
Configuring Operational Parameters

5.1 Overview

The operational parameters control the behavior of the transmitter and flowmeter system. The following parameters can be configured:

- Display parameters – see Section 5.2
- Fault handling parameters – see Section 5.3

In addition, this chapter provides information on sensor parameters (see Section 5.4) and device parameters (see Section 5.5). These parameters do not affect measurement or operation, but may be useful for administration.

Before beginning configuration, ensure that you have made an administrative connection to the transmitter and that you are complying with all applicable safety requirements.

5.2 Configuring the display

You can configure a variety of parameters to control display behavior and operator actions at the display.

5.2.1 Update period

The Update Period parameter controls how often the display is refreshed with current data. The default is 200 milliseconds; the range is 100 milliseconds to 10,000 milliseconds (10 seconds).

Configuration

To configure Update Period:

- Using the Communicator, select **Detailed Setup > Display Setup.**
- Using ProLink II, click **ProLink > Configuration > Display**.
- Using the display, see Figure 2-14.

5.2.2 Display language

The display language can be set to English, French, German, or Spanish. Other languages may be available, depending on date of purchase.

Configuration

To configure the display language:

- Using the Communicator, select **Detailed Setup > Display Setup.**
- Using ProLink II, click **ProLink > Configuration > Display**.
- Using the display, see Figure 2-14.

5.2.3 Display variables and display precision

The display can scroll through up to 15 process variables in any order. You can configure the process variables to be displayed and the order in which they should appear.

Auto Scroll may or may not be enabled:

- If Auto Scroll is enabled, each configured display variable will be shown for the number of seconds specified for Scroll Rate.
- Whether Auto Scroll is enabled or not, the operator can manually scroll through the configured display variables by pressing **Scroll**.

Additionally, you can configure display precision for each display variable. Display precision controls the number of digits to the right of the decimal place shown on the display. Precision can be set to any value from 0 to 5.

Note: The display precision does not affect the precision of the value as stored, processed, or reported via the mA output or digital communications.

Note: The display is capable of displaying special measurement units. If you have defined a special measurement unit, it will be listed for selection.

Table 5-1 shows an example of a display variable configuration. Notice that you can repeat variables, and you can also specify None for any display variable except Display Var 1. For information on how the display variables will appear on the display, see Appendix C.

Table 5-1 Example of a display variable configuration

Display variable	Process variable
Display variable 1(1)	Mass flow
Display variable 2	Mass totalizer
Display variable 3	Volume flow
Display variable 4	Volume totalizer
Display variable 5	Density
Display variable 6	Temperature
Display variable 7	External temperature
Display variable 8	External pressure
Display variable 9	Mass flow
Display variable 10	None
Display variable 11	None
Display variable 12	None
Display variable 13	None
Display variable 14	None
Display variable 15	None

(1) Display variable 1 cannot be set to None.

Configuration

To configure the display variables and display precision:

- Using the Communicator, select **Detailed Setup > Display Setup.**
- Using ProLink II, click **ProLink > Configuration > Display**.
- Using the display, see Figure 2-14.

5.2.4 Enabling and disabling display functions

Table 5-2 lists the configurable display functions and describes their behavior when enabled (shown) or disabled (hidden).

Do not enable display functions that require use of the display buttons if you do not want the operator to remove the transmitter housing cover. To access the display buttons, the transmitter housing cover must be removed.

If operators must be able to view multiple process variables without using the display buttons, be sure to enable Auto Scroll. If you do not, the operator must remove the transmitter housing cover to press Scroll.

If operators must be able to view the active alarms without using the display buttons, be sure to enable both Auto Scroll and Alarm Menu. If you do not, the operator must remove the transmitter housing cover to enter the alarm menu.

Table 5-2 Display functions

Parameter	Uses display buttons?	Enabled (shown)	Disabled (hidden)
Totalizer Start/Stop	Yes	• Operators can start or stop totalizers using the display buttons.	• Operators cannot start or stop totalizers using the display buttons.
Totalizer Reset	Yes	• Operators can reset the mass and volume totalizers using the display buttons.	• Operators cannot reset the mass and volume totalizers using the display buttons.
Auto Scroll	No	• The display automatically scrolls through the list of display variables at a configurable rate. • If Alarm Menu is enabled, active alarms(1) are listed after the display variables. See the example later in this section.	• Operators must **Scroll** to view the display variables. • Active alarms are not displayed.
Off-line Menu	Yes	• Operators can access the off-line menu (zero, simulation, and configuration).	• Operators cannot access the off-line menu.
Off-line Password	Yes	• Operators must use a password to access the off-line menu.	• Operators can access the off-line menu without a password.
Alarm Menu	Yes	• Operators can access the alarm menu (viewing and acknowledging alarms). • If Auto Scroll is enabled, active alarms(1) will be listed after the display variables. See the example later in this section.	• Operators cannot access the alarm menu. • Active alarms are not displayed.
Acknowledge All Alarms	Yes	• Operators are able to acknowledge all current alarms at once.	• Operators must acknowledge alarms individually.

(1) Only alarms configured with severity level of Fault or Informational are listed. Alarms are listed by alarm code. Alarms configured with a severity level of Ignore are not listed.

Note the following:

- If you use the display to disable access to the off-line menu, the off-line menu will disappear as soon as you exit the menu system. If you want to re-enable access, you must use ProLink II or the Communicator.
- Scroll Rate is used to control the speed of scrolling when Auto Scroll is enabled. Scroll Rate defines how long each display variable (see Section 5.2.3) will be shown on the display. The time period is defined in seconds; e.g., if Scroll Rate is set to 10, each display variable will be shown on the display for 10 seconds.

  If you are using the Communicator or the display to configure the display functions, you must enable Auto Scroll before you can configure Scroll Rate.
- The Off-line Password prevents unauthorized users from gaining access to the off-line menu. The password can contain up to four numbers.

  If you are using the Communicator or the display to configure the display functions, you must enable the Off-line Password before you can configure it.
- The level of alarm information available from the display is controlled by the combination of Auto Scroll and Alarm Menu, as shown in Table 5-3 and the example following the table.

Table 5-3 Alarm information available from the display

Auto Scroll	Alarm Menu	Display behavior
Enabled	Enabled	• Flashes ALM_F if an alarm with severity level of Fault is active. • Flashes ALM_I if an alarm with severity level of Informational is active but no Fault alarm is active. • Takes no action for alarms with severity level of Ignore. • Displays alarm codes for all active Fault and Informational alarms after scrolling through display variables.
	Disabled	• Flashes ALM_F if an alarm with severity level of Fault is active. • Flashes ALM_I if an alarm with severity level of Informational is active but no Fault alarm is active. • Takes no action for alarms with severity level of Ignore. • Operator has no access to detailed alarm information from the display.
Disabled	Enabled	• Flashes ALM_F if an alarm with severity level of Fault is active. • Flashes ALM_I if an alarm with severity level of Informational is active but no Fault alarm is active. • Takes no action for alarms with severity level of Ignore. • Operator can access list of active alarm codes: - By using the alarm menu - By manually scrolling to the alarm portion of the display list
	Disabled	• Flashes ALM_F if an alarm with severity level of Fault is active. • Flashes ALM_I if an alarm with severity level of Informational is active but no Fault alarm is active. • Takes no action for alarms with severity level of Ignore. • Operator has no access to detailed alarm information from the display.

Example	
	Case 1: Operators do not need to know which alarms are active. There are no special requirements for configuring Auto Scroll and Alarm Menu. The display will indicate when alarms are active. Information on specific alarms can be retrieved via the Communicator, ProLink II, or the host.
	Case 2: Operators must be able to view the list of active alarms at the device. Operators are allowed to remove the transmitter housing cover. There are no special requirements for configuring Auto Scroll and Alarm Menu. The display will indicate when alarms are active, and the operator can use the alarm menu to see the list of specific alarms.
	Case 3: Operators must be able to view the list of active alarms at the device. Operators are not allowed to remove the transmitter housing cover. To configure this functionality: 1. Enable Auto Scroll. 2. Enable Alarm Menu.

Configuration

To enable and disable display functions:

- Using the Communicator, select **Detailed Setup > Display Setup.**
- Using ProLink II, click **ProLink > Configuration > Display**.
- Using the display, see Figure 2-14.

5.3 Configuring fault handling

The Model 2200S transmitter performs self-diagnostics during operation. If the device detects certain events or conditions, the configured fault handling is implemented. Fault handling may include:

- Performing the mA output fault action and the digital communications fault action, and showing alarm information on the display
- Posting an alarm to the active alarm log

Status alarm severity controls which of these methods is used.

Last measured value timeout is used to delay the mA output fault action, for certain faults only. The digital communications fault action is always performed immediately.

5.3.1 Status alarm severity

Status alarms are classified into three levels of severity. The *severity level* controls transmitter behavior when the alarm condition occurs. See Table 5-4.

Table 5-4 **Status alarm severity levels**

Severity level	Transmitter action
Fault	If this condition occurs, the alarm status flags are set, ALM_F flashes on the display, the alarm is posted to the active alarm log, and the configured fault actions are performed.
Informational	If this condition occurs, the alarm status flags are set, ALM_I flashes on the display, and the alarm is posted to the active alarm log, but fault actions are not performed.
Ignore	If this condition occurs, the alarm status flags are set, but no entry is added to the active alarm log, the display does not show an alarm, and no fault actions are performed.

You can change the default severity level for some alarms. For example:

- The default severity level for Alarm A020 (calibration factors unentered) is **Fault**, but you can change the severity level to either **Informational** or **Ignore**.
- The default severity level for Alarm A102 (drive over-range) is **Informational**, but you can change the severity level to either **Ignore** or **Fault**.

For a list of all status alarms, default severity levels, and whether or not you can change the severity level, see Table 5-5. (For more information on status alarms, including possible causes and troubleshooting suggestions, see Table 10-3.)

Table 5-5 **Status alarms and severity levels**

Alarm code	Communicator message / ProLink II message	Default severity	Configurable	Affected by LMV Timeout
A001	EEprom Checksum Error (Core Processor)	Fault	No	No
	(E)EPROM Checksum Error (CP)			
A002	RAM Test Error (Core Processor)	Fault	No	No
	RAM Error (CP)			
A003	Sensor Not Responding (No Tube Interrupt)	Fault	Yes	Yes
	Sensor Failure			
A004	Temperature sensor out of range	Fault	No	Yes
	Temperature Sensor Failure			
A005	Input Over-Range	Fault	Yes	Yes
	Input Overrange			
A006	Transmitter Not Characterized	Fault	Yes	No
	Not Configured			
A008	Density Outside Limits	Fault	Yes	Yes
	Density Overrange			
A009	Transmitter Initializing/Warming Up	Fault	Yes	No
	Transmitter Initializing/Warming Up			
A010	Calibration Failure	Fault	No	No
	Calibration Failure			
A011	Excess Calibration Correction, Zero too Low	Fault	Yes	No
	Zero Too Low			
A012	Excess Calibration Correction, Zero too High	Fault	Yes	No
	Zero Too High			

Table 5-5 Status alarms and severity levels *continued*

Alarm code	Communicator message / ProLink II message	Default severity	Configurable	Affected by LMV Timeout
A013	Process too Noisy to Perform Auto Zero / Zero Too Noisy	Fault	Yes	No
A014	Transmitter Failed / Transmitter Failed	Fault	No	No
A016	Line RTD Temperature Out-Of-Range / Line RTD Temperature Out-of-Range	Fault	Yes	Yes
A017	Meter RTD Temperature Out-Of-Range / Meter RTD Temperature Out-of-Range	Fault	Yes	Yes
A020	Calibration Factors Unentered / Calibration Factors Unentered (FlowCal)	Fault	Yes	No
A021	Unrecognized/Unentered Sensor Type / Incorrect Sensor Type (K1)	Fault	No	No
A029	Internal Communication Failure / PIC/Daughterboard Communication Failure	Fault	No	No
A030	Hardware/Software Incompatible / Incorrect Board Type	Fault	No	No
A031	Undefined / Low Power	Fault	No	No
A033	Tube Not Full / Tube Not Full	Fault	No	Yes
A100	Primary mA Output Saturated / Primary mA Output Saturated	Info	Yes(1)	No
A101	Primary mA Output Fixed / Primary mA Output Fixed	Info	Yes(1)	No
A102	Drive Over-Range / Drive Overrange	Info	Yes	No
A104	Calibration-In-Progress / Calibration in Progress	Info	Yes(1)	No
A105	Slug Flow / Slug Flow	Info	Yes	No
A106	Burst Mode Enabled / Burst Mode Enabled	Info	Yes(1)	No
A107	Power Reset Occurred / Power Reset Occurred	Ignore	Yes	No
A132	Simulation Mode Active / Simulation Mode Active	Info	Yes(1)	No

(1) Can be set to either Info or Ignore, but cannot be set to Fault.

Configuration

To configure status alarm severity:

- Using the Communicator, select **Diag/Service > Config Alarms > Write Severity.**
- Using ProLink II, click **ProLink > Configuration > Alarm**.

Note: You cannot configure status alarm severity with the display.

5.3.2 Last measured value (LMV) timeout

By default, the transmitter immediately performs the configured mA output fault action as soon as a fault is detected.

- For certain faults only, you can delay the mA fault action by changing the Last Measured Value Timeout (LMV Timeout) to a nonzero value. During the timeout period, the transmitter continues to report its last valid measurement.
- For other faults, the mA fault action is performed immediately.

Note: For all faults, the digital communications fault action is performed immediately.

For information on which faults are affected by LMV Timeout, see Table 5-5.

Configuration

To configure LMV Timeout:

- Using the Communicator, select **Detailed Setup > Config Outputs > Channel Setup > AO Setup > AO1 Fault Setup**.
- Using ProLink II, click **ProLink > Configuration > Analog Output**.

Note: You cannot configure LMV Timeout with the display.

5.4 Configuring sensor parameters

The sensor parameters are used to describe the sensor component of your flowmeter. They are not used in transmitter processing, and are not required. The following sensor parameters can be configured:

- Serial number
- Sensor material
- Liner material
- Flange

Configuration

To configure sensor parameters:

- Using the Communicator, select **Detailed Setup > Device Information**.
- Using ProLink II, click **ProLink > Configuration > Sensor**.

Note: You cannot configure sensor parameters with the display.

5.5 Configuring device parameters

The device parameters are used to describe the flowmeter as a system. Device parameters are listed and defined in Table 5-6.

Note: The HART device ID, which is displayed in some menus, can be set only once, and is usually set at the factory to the device serial number. If the HART device ID has not been set, its value is 0. On a multidrop network, the HART device ID must be a unique value.

Table 5-6 Device settings

Parameter	Description
Descriptor	Any user-supplied description. Not used in transmitter processing, and not required. Maximum length: 16 characters.
Message	Any user-supplied message. Not used in transmitter processing, and not required. Maximum length: 32 characters.
Date	Any user-selected date. Not used in transmitter processing, and not required.

Configuration

To configure device parameters:

- Using the Communicator, select **Detailed Setup > Device Information**.
- Using ProLink II, click **ProLink > Configuration > Device**.

Note: You cannot configure device parameters with the display.

If you are entering a date:

- With ProLink II, use the left and right arrows at the top of the calendar to select the year and month, then click on a date.
- With a Communicator, enter a value in the form *mm/dd/yyyy.*

Commissioning

Operation

Maintenance and Troubleshooting

Appendices

Chapter 6
Integrating the Meter with the Control System

6.1 Overview

This chapter discusses the following topics and tasks:

- Configuring the mA output – see Section 6.2
- Configuring digital communications – see Section 6.3

Before beginning configuration, make an administrative connection to the transmitter and ensure that you are complying with all applicable safety requirements.

6.2 Configuring the mA output

The mA output is used to report a process variable. The mA output parameters control how the process variable is reported.

Table 6-1 lists the parameters that must be set for the mA output, and shows the names used for each parameter by the display, the Communicator, and ProLink II.

Table 6-1 mA output configuration parameters

	Parameter name		
Parameter	**Display**	**Communicator**	**ProLink II**
Process variable	SRC	PV	Primary variable
Range	12 mA	PV LRV	Lower range value
	20 mA	PV URV	Upper range value
AO cutoff	Not accessible	PV AO cutoff	AO cutoff
Added damping	Not accessible	PV AO added damp	AO added damp
Fault action	Not accessible	AO1 fault indicator	AO fault action
Fault value	Not accessible	mA1 fault value	AO fault level

Note: If you use the display, you can configure only the process variable, LRV, and URV.

For details on mA output parameters, see Sections 6.2.1 through 6.2.4.

6.2.1 Process variable

Table 6-2 lists the process variables that can be assigned to the mA output as the primary variable.

Table 6-2 mA output process variable options

	Process variable code		
Process variable	**Display**	**Communicator**	**ProLink II**
Mass flow rate	MFLOW	Mass flo	Mass Flow
Volume flow rate	VFLOW	Vol flo	Vol Flow
Gas standard volume flow rate	GSV F	Gas vol flo	Gas Std Vol Flow Rate
Temperature	TEMP	Temp	Temp
Density	DENS	Dens	Density
Drive gain	DGAIN	Drive gain	Drive Gain

Note: The process variable assigned to the mA output is always the PV (primary variable) defined for HART communications. You can specify this process variable either by configuring the mA output or by configuring the PV (see Section 6.3.3). If you change the process variable assigned to the mA output, the PV assignment is changed automatically, and vice versa.

Configuration

To configure the mA output process variable:

- Using the Communicator, select **Detailed Setup > Config Outputs > Channel Setup > AO Setup**.
- Using ProLink II, click **ProLink > Configuration > Analog Output**.
- Using the display, see Figure 2-13.

6.2.2 mA output scale (LRV and URV)

The mA output represents the assigned process variable along a linear scale that ranges from 12 to 20 mA. You must specify:

- The lower range value (LRV) – the value of the process variable that will be represented by a transmitter output of 12 mA
- The upper range value (URV) – the value of the process variable that will be represented by a transmitter output of 20 mA

Note: If the Micro Motion adapter-barrier is installed, the LRV will be represented by a transmitter output of 12 mA and an adapter-barrier output of 4 mA. The URV is not affected.

Note the following:

- The URV can be set below the LRV; for example, the URV can be set to 0 and the LRV can be set to 100.
- Each process variable has its own LRV and URV. The transmitter stores the site-specified LRV and URV settings for each process variable. When the process variable assignment is changed, the LRV and URV are reset to the corresponding stored values. If you change the process variable assignment, be sure to verify the LRV and URV settings before resuming operation.

Default LRV and URV settings are listed in Table 6-3.

Table 6-3 Default LRV and URV settings

Process variable	LRV	URV
Mass flow	–200.000 g/s	+200.000 g/s
Volume flow (liquid)	–0.200 l/s	+0.200 l/s
Gas standard volume flow	–423.78 SCFM	+423.78 SCFM
Density variables	0.000 g/cm^3	10.000 g/cm^3
Temperature	–240.000 °C	+450.000 °C
Drive gain	0.000%	100.000%

Configuration

To configure the mA output scale:

- Using the Communicator, select **Detailed Setup > Config Outputs > Channel Setup > AO Setup**.
- Using ProLink II, click **ProLink > Configuration > Analog Output**.
- Using the display, see Figure 2-13.

Enter values in the measurement units that are configured for the assigned process variable.

6.2.3 AO cutoff

The AO (analog output) cutoff specifies the lowest mass flow or volume flow value that will be reported through the mA output. Any mass flow or volume flow values below the AO cutoff will be reported as zero.

The AO cutoff can be configured only if the process variable assigned to the mA output is mass flow, volume flow, or GSV flow. If a non-flow process variable has been assigned to the mA output, the AO Cutoff menu option is not available.

Note: For most applications, the default AO cutoff is used. Contact Micro Motion customer support before changing the AO cutoff.

Multiple cutoffs

Cutoffs can also be configured for the mass flow and volume flow process variables (see Sections 4.4.2 and 4.6.1). If mass flow or volume flow has been assigned to the mA output, a non-zero value is configured for the flow cutoff, and the AO cutoff is also configured, the cutoff occurs at the highest setting, as shown in the following examples.

Example

Configuration:

- mA output process variable: Mass flow
- AO Cutoff: 10 g/sec
- Mass Flow Cutoff: 15 g/sec

As a result, if the mass flow rate drops below 15 g/sec, the mA output will report zero flow.

Example	Configuration: • mA output process variable: Mass flow • AO Cutoff: 15 g/sec • Mass Flow Cutoff: 10 g/sec As a result, if the mass flow rate drops below 15 g/sec, the mA output will report zero flow.

Configuration

To configure the AO cutoff:

- Using the Communicator, select **Detailed Setup > Config Outputs > Channel Setup > AO Setup**.
- Using ProLink II, click **ProLink > Configuration > Analog Output**.

Note: You cannot configure the AO cutoff with the display.

Enter the AO cutoff value in the measurement unit that is configured for the assigned process variable.

6.2.4 Added damping

A *damping* value is a period of time, in seconds, over which the process variable value will change to reflect 63% of the change in the actual process. Damping helps the transmitter smooth out small, rapid measurement fluctuations:

- A high damping value makes the output appear to be smoother because the output must change slowly.
- A low damping value makes the output appear to be more erratic because the output changes more quickly.

The Added Damping parameter specifies damping that will be applied to the mA output. It affects the measurement of the process variable assigned to the mA output.

Note: For most applications, the default added damping value is used. Contact Micro Motion customer support before changing the Added Damping parameter.

Multiple damping parameters

Damping can also be configured for the flow (mass and volume), density, and temperature process variables (see Sections). If one of these process variables has been assigned to an mA output, its damping is set to a non-zero value, and Added Damping is also set to a non-zero value, the effect of damping the process variable is calculated first, and the added damping calculation is applied to the result of that calculation. See the following example.

Example	Configuration: • Flow Damping: 1 • mA output process variable: Mass flow • Added Damping: 2 As a result, a change in mass flow 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.

Configuration

To configure Added Damping:

- Using the Communicator, select **Detailed Setup > Config Outputs > Channel Setup > AO Setup**.
- Using ProLink II, click **ProLink > Configuration > Analog Output**.

Note: You cannot configure Added Damping with the display.

6.2.5 mA output fault action and fault value

The Fault Action parameter specifies the state to which the mA output will be forced if the transmitter encounters an internal fault condition. Options are shown in Table 6-4.

Table 6-4 mA output fault actions and values

Fault action	Output scale	Fault output value
Upscale	N/A	21–24 mA (user-configurable; default: 22 mA)
Downscale	12–20 mA	10.5–11.8 mA (user-configurable; default: 11.0 mA)
	4–20 mA	1.0–3.6 mA (user-configurable; default: 2.0 mA)
Internal zero	N/A	Goes to the mA output level associated with a process variable value of 0 (zero), as determined by URV and LRV values.
None	N/A	Tracks data for the assigned process variable; no fault action

When configuring fault behavior, ensure that the configured fault action does not cause measurement error or process upset, and that your control system can recognize fault conditions. For fault indication, use the appropriate combination of mA output fault action, digital communications fault action, and checking status via digital communications (e.g., HART command 48).

If you set the mA Output Fault Action to None, be sure to set the Digital Communications Fault Action to None (see Section 6.3.1). If you do not, the mA output will not report actual process data, and this may result in measurement error or unintended consequences for your process.

Commissioning
Operation
Maintenance and Troubleshooting
Appendices

Effects of mA output fault action on transmitter behavior

If the transmitter is operating near the limit of its power requirement:

- And mA Fault Action is set to Upscale, if a fault occurs, the upscale (>20 mA) fault level may cause the transmitter to oscillate between the A031 alarm (low power) and a no-alarm state.
- And mA Fault Action is set to Downscale, if a fault occurs, power to the transmitter may fall below the transmitter's minimum requirements, causing the transmitter to shut down. When sufficient power is restored, the transmitter will spontaneously restart.

If the power supply to the transmitter is within the ranges specified in the transmitter installation manual, these conditions should not occur.

mA output fault action delay

By default, the transmitter immediately performs the mA fault action when a fault is encountered. You can delay the mA fault action by changing LMV Timeout. See Section 5.3.2.

Fault indication with the mA output

Depending on your process and control system, you may be able to use the mA fault action as a fault indicator. If you choose to do this, be sure that your control system recognizes the configured fault value as a fault.

If mA Fault Action is set to None, make sure that a fault detection method is in place, e.g., checking status via digital communications.

Configuration

To configure the mA output fault action and fault value:

- Using the Communicator, select **Detailed Setup > Config Outputs > Channel Setup > AO Setup**.
- Using ProLink II, click **ProLink > Configuration > Analog Output**.

Note: You cannot configure fault action and fault value with the display.

6.3 Configuring digital communications

The digital communications parameters control how the transmitter will communicate using digital communications. The following digital communications parameters can be configured:

- Digital Communications Fault Action
- HART Address
- Software Tag (HART tag)
- Loop Current Mode
- Burst Mode
- PV, SV, TV, and QV assignments

Note: See Section 3.3 for information on setting the HART address and the software tag.

6.3.1 Digital communications fault action

The Digital Communications Fault Action parameter specifies the values that will be reported via digital communications if the transmitter encounters an internal fault condition. Table 6-5 lists the options for Digital Communications Fault Action.

Table 6-5 Digital communications fault actions and values

Fault Action code		
Communicator	**ProLink II**	**Fault output value**
Upscale	Upscale	• Process variables indicate the value is greater than the upper sensor limit. • Totalizers stop incrementing.
Downscale	Downscale	• Process variables indicate the value is less than the lower sensor limit. • Totalizers stop incrementing.
IntZero-All 0	Zero	• Flow rates go to the value that represents a flow rate of 0 (zero). • Density and temperature reported as 0. • Drive gain reported as measured. • Totalizers stop incrementing.
Not-a-Number	Not-A-Number (NAN)	• Process variables report IEEE NAN. • Drive gain reported as measured. • Modbus scaled integers report **Max Int**. • Totalizers stop incrementing.
IntZero-Flow 0	Flow to Zero	• Flow rates reported as 0. • Other process variables reported as measured. • Totalizers stop incrementing.
None	None (default)	• All process variables reported as measured. • Totalizers increment if started.

If you set the mA Output Fault Action to None (see Section 6.2.5), be sure to set the Digital Communications Fault Action to None. If you do not, the mA output will not report actual process data, and this may result in measurement error or unintended consequences for your process.

Configuration

To configure the digital communications fault action:

- Using the Communicator, select **Detailed Setup > Config Outputs > Comm Fault Ind**.
- Using ProLink II, click **ProLink > Configuration > Device**.

Note: You cannot configure Digital Communications Fault Action with the display.

6.3.2 Loop current mode

The Loop Current Mode parameter is used to fix or unfix the mA output:

- If the Loop Current Mode parameter is disabled, the mA output from the transmitter is fixed at 12 mA and therefore cannot be used to report process data. If the Micro Motion adapter-barrier is installed, the mA output will appear to be fixed at 4 mA.
- If the Loop Current Mode parameter is enabled, the mA output will report process data as configured.

Note: Whenever you use ProLink II to set the HART address to 0, ProLink II also enables the Loop Current Mode parameter (places a check in the checkbox). Whenever you use ProLink II to set the HART address to any other value, ProLink II also disables the Loop Current Mode parameter. Be sure to verify the Loop Current Mode setting after you configure the transmitter's HART address.

Note: Whenever you use the Communicator to set the HART address to 0, Loop Current Mode is automatically enabled. Whenever you use the Communicator to set the HART address to any other value, Loop Current Mode is automatically disabled. If you need to change this, first set the HART address as required, then use ProLink II to configure Loop Current Mode.

Configuration

To configure the Loop Current Mode parameter:

- Using ProLink II, click **ProLink > Configuration > Device**.

Note: You cannot configure Loop Current Mode with the display or the Communicator.

6.3.3 PV, SV, TV, and QV assignments

In the transmitter, four variables are defined for HART communications: the PV (primary variable), the SV (secondary variable), the TV (tertiary variable), and the QV (quaternary variable). A process variable such as mass flow is assigned to each HART variable.

The values of the assigned process variables can be reported or read in several ways:

- The PV is automatically reported through the mA output. It can also be queried via digital communications or reported via burst mode. If you change the PV, the process variable assigned to the mA output is changed automatically, and vice versa. See Section 6.2.1.
- The SV, TV, and QV are not reported through an output. They can be queried via digital communications or reported via burst mode.

Table 6-7 lists the valid assignments for the PV, SV, TV, and QV on the Model 2200S transmitter.

Table 6-6 Process variable assignments for PV, SV, TV, and QV

Process variable	PV	SV	TV	QV
Mass flow rate	✓	✓	✓	✓
Volume flow rate	✓	✓	✓	✓
Temperature	✓	✓	✓	✓
Density	✓	✓	✓	✓
Gas standard volume flow rate	✓	✓	✓	✓
Drive gain	✓	✓	✓	✓
Mass total		✓	✓	✓
Volume total		✓	✓	✓
Mass inventory		✓	✓	✓
Volume inventory		✓	✓	✓
Board temperature		✓	✓	✓

Table 6-6 Process variable assignments for PV, SV, TV, and QV *continued*

Process variable	PV	SV	TV	QV
Gas standard volume inventory		✓	✓	✓
Gas standard volume total		✓	✓	✓
LPO amplitude		✓	✓	✓
RPO amplitude		✓	✓	✓
Raw tube frequency		✓	✓	✓
Live zero		✓	✓	✓

Configuration

To configure the PV, SV, TV, and QV assignments:

- Using the Communicator:
  - To configure the PV, assign the desired process variable to the mA output. See Section 6.2.1
  - To configure the SV, TV, and QV, select **Detailed Setup > Config Outputs > HART Output**.
- Using ProLink II, click **ProLink > Configuration > Variable Mapping**.

6.3.4 Burst mode

Burst mode is a specialized mode of communication during which the transmitter regularly broadcasts HART digital information over the mA output. Burst mode is ordinarily disabled, and should be enabled only if another device on the network requires burst mode communication.

Note: If burst mode is enabled, HART/Bell 202 communications via a HART modem (as required by ProLink II) may be very slow, or the HART connection may fail completely. If either of these occurs, disable burst mode, use a communications tool that does not require a HART modem (i.e., the Communicator), try a HART modem from a different vendor, or try a USB HART modem. Ensure that RTS line control is managed by the modem.

Configuration

To configure burst mode:

1. Navigate to the correct menu:
   - If you are using the Communicator, select **Detailed Setup > Config Outputs > HART Output**.
   - If you are using ProLink II, click **ProLink > Configuration > Device**.

Note: You cannot configure burst mode with the display.

2. Enable burst mode.
3. Specify the Burst Mode Output. Options are described in Table 6-7.
4. If you specified **Transmitter vars** or **Fld dev var** in Step 3, specify the four process variables to be sent in each burst.

Table 6-7 Burst Mode Output options

Parameter		
ProLink II label	**Communicator label**	**Definition**
Primary variable	PV	The transmitter repeats the primary variable (in measurement units) in each burst (e.g., 14.0 g/s, 13.5 g/s, 12.0 g/s).
PV current & % of range	% range/current	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).(1)
Dynamic vars & PV current(2)	Process variables/current	The transmitter sends PV, SV, TV, and quaternary variable (QV) values in measurement units and the PV's actual milliamp reading in each burst (e.g., 50 lb/min, 23 °C, 50 lb/min, 0.0023 g/cm^3, 11.8 mA).(1)
Transmitter vars	Fld dev var	The transmitter sends four process variables in each burst. See Step 4.

(1) If the Micro Motion adapter-barrier is installed, the mA value will be converted to the 4–20 mA output scale at the adapter-barrier.

(2) This burst mode setting is typically used with the HART Tri-Loop™ signal converter. See the Tri-Loop manual for additional information.

Chapter 7
Testing and Moving to Production

7.1 Overview

This chapter contains information and procedures that may be useful for testing the flowmeter before moving it into production. The following topics are discussed:

- Zeroing the flowmeter – see Section 7.2
- Loop testing – see Section 7.3
- Trimming the mA output – see Section 7.4
- Using sensor simulation to test the system – see Section 7.5
- Backing up the configuration – see Section 7.6
- Write-protecting the configuration – see Section 7.7

Before performing any of the procedures in this chapter, make an administrative connection to the transmitter and ensure that you are complying with all applicable safety requirements.

7.2 Flowmeter zero

Zeroing the flowmeter establishes the flowmeter's point of reference when there is no flow. The meter was zeroed at the factory, and should not require a field zero. However, you may wish to perform a field zero to meet local requirements or to confirm the factory zero.

When you zero the flowmeter, you may need to adjust the zero time parameter. *Zero time* is the amount of time the transmitter takes to determine its zero-flow reference point. The default zero time is 20 seconds.

- A *long* zero time may produce a more accurate zero reference but is more likely to result in a zero failure. This is due to the increased possibility of noisy flow, which causes incorrect calibration.
- A *short* zero time is less likely to result in a zero failure but may produce a less accurate zero reference.

For most applications, the default zero time is appropriate.

Note: Do not zero the flowmeter if a high-severity alarm is active. Correct the problem, then zero the flowmeter. You may zero the flowmeter if a low-severity alarm is active. See Section 8.6 for information on viewing transmitter status and alarms.

If the zero procedure fails, two recovery functions are provided:

- Restore Prior Zero
- Restore Factory Zero

If desired, you can use one of these functions to return the meter to operation while you are troubleshooting the cause of the zero failure (see Section 10.6). Availability of these functions depends on the tool you are using to zero the flowmeter:

- If you are using the Communicator or the display, only Restore Factory Zero is available.
- If you are using ProLink II, both Restore Prior Zero and Restore Factory Zero are available.

7.2.1 Preparing for zero

To prepare for the zero procedure:

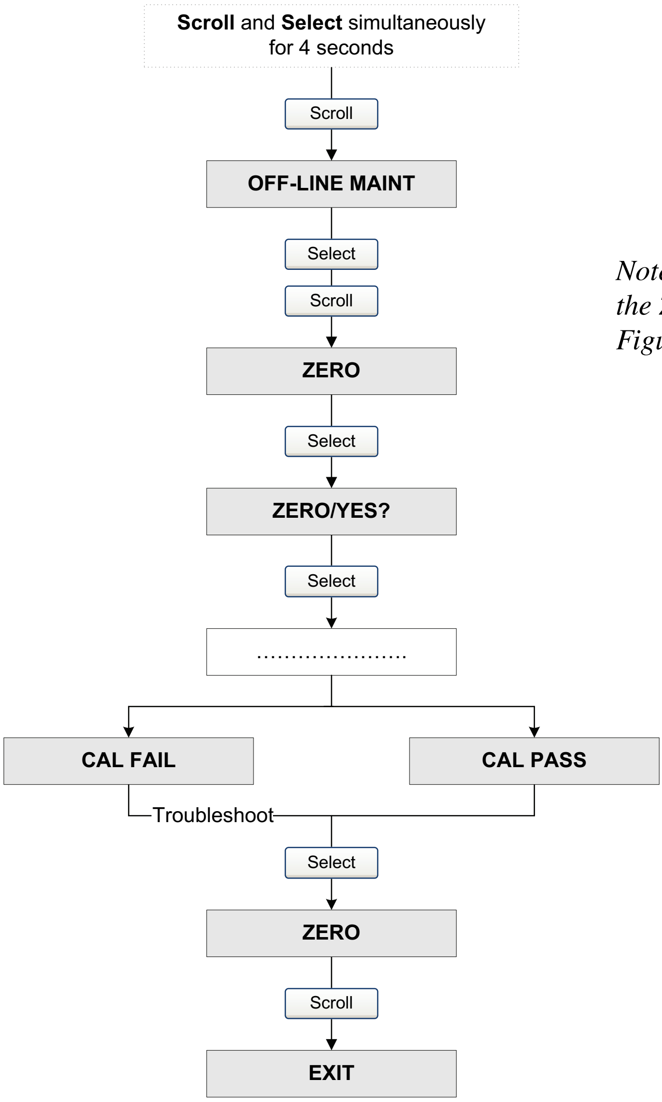
1. Apply power to the flowmeter. Allow the flowmeter to warm up for approximately 20 minutes.
2. Run the process fluid through the sensor until the sensor temperature reaches the normal process operating temperature.
3. Close the shutoff valve downstream from the sensor.
4. Ensure that the sensor is completely filled with fluid.
5. Ensure that the process flow has completely stopped. **CAUTION! Ensure that there is no fluid flowing through the sensor while zero calibration is in process. If there is, the calibration results may be inaccurate, resulting in inaccurate process measurement.**

7.2.2 Performing the zero procedure

To zero the flowmeter:

- Using the display, see Figure 7-1.
- Using the Communicator, see Figure 7-2.
- Using ProLink II, see Figure 7-3.

Figure 7-1 **Display – Flowmeter zero procedure**



Note: For a complete presentation of the Zero menu structure, see Figure 2-16.

Figure 7-2 Communicator – Flowmeter zero procedure

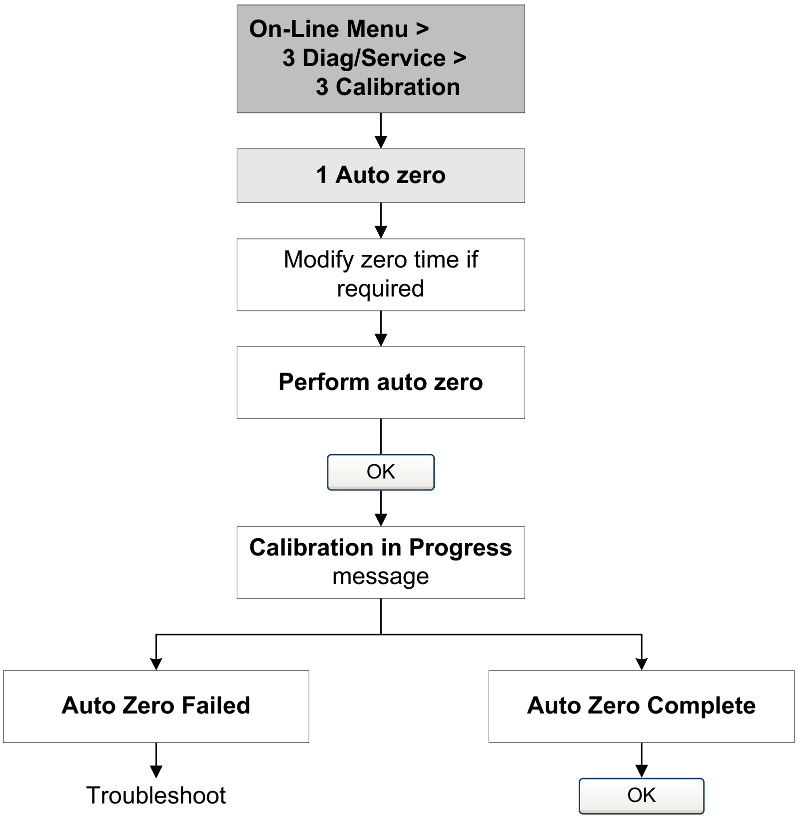
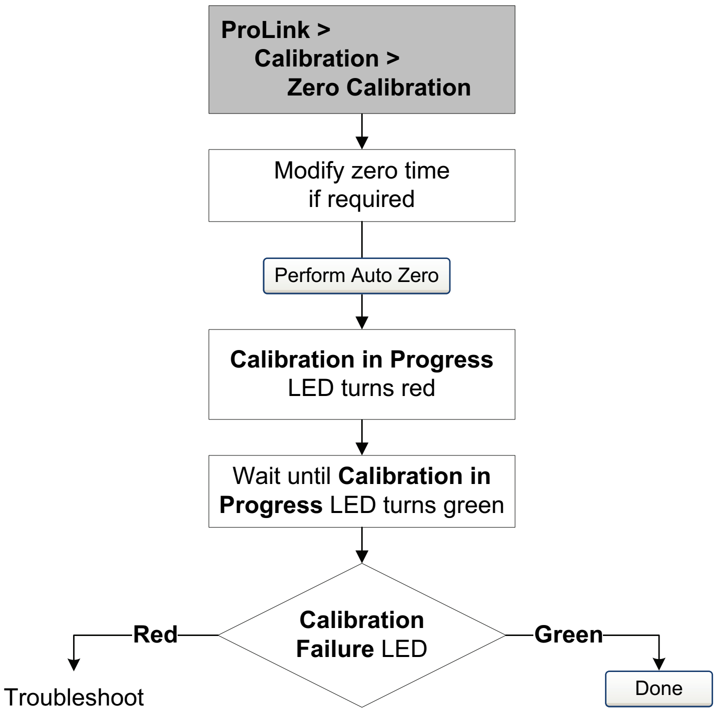


Figure 7-3 ProLink II – Flowmeter zero procedure



7.3 Loop testing

A *loop test* is a means to:

- Verify that the mA output is being sent by the transmitter and received accurately by the receiving devices
- Determine whether or not you need to trim the mA output

Note the following:

- During the loop test, the transmitter's mA output will not report process data. **CAUTION! Do not use the mA output for process control while you are performing the loop test.**
- If you are using ProLink II or the Communicator, enter the fixed value in the scale that you specified for the mA measurement point. If you specified "Don't Know":
  - If you are using ProLink II, enter the desired value in one scale and the tool will display the equivalent value in the other scale.
  - If you are using the Communicator, you must specify the mA measurement point before you can continue.
- The mA reading does not need to be exact. You will correct differences when you trim the mA output. See Section 7.4.

To perform a loop test:

- Using the display, see Figure 7-4.
- Using the Communicator, see Figure 7-5.
- Using ProLink II, see Figure 7-6.

Figure 7-4 Display – Loop test procedure

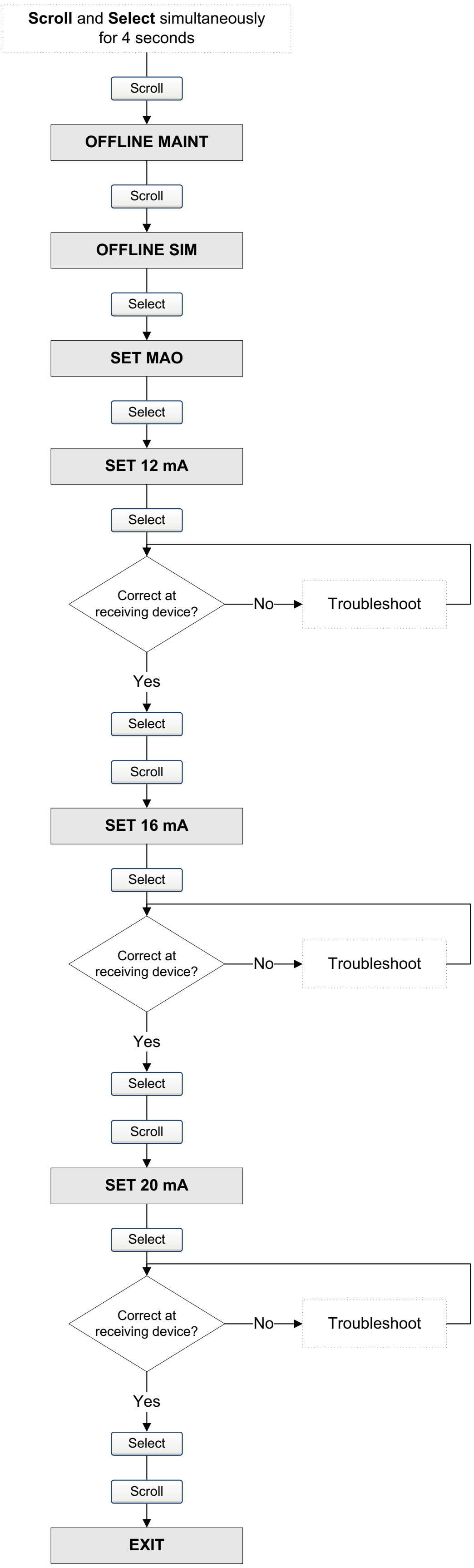


Figure 7-5 Communicator – Loop test procedure

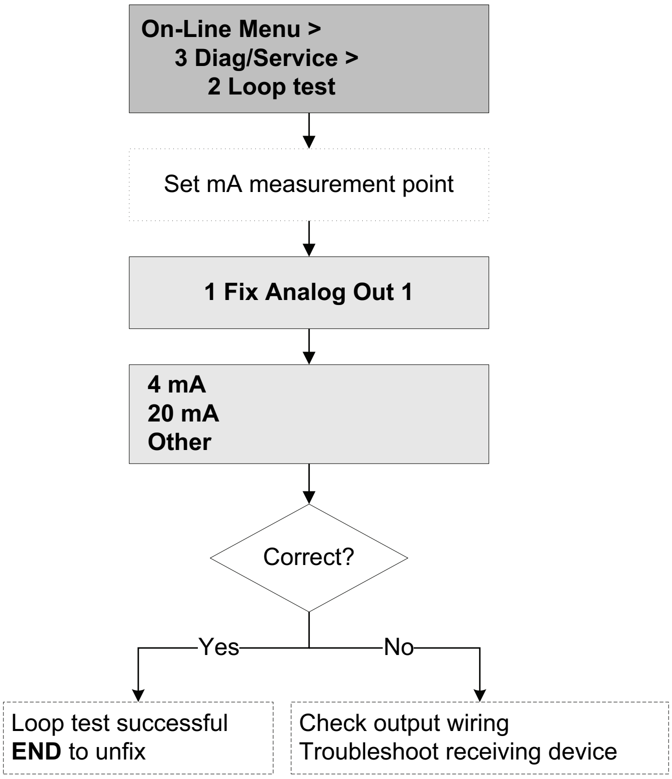
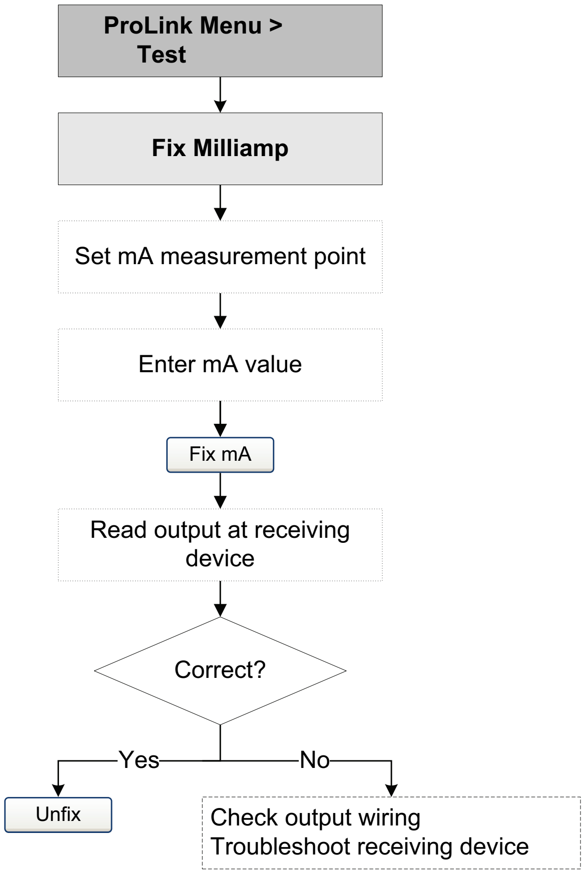


Figure 7-6 **ProLink II – Loop test procedure**



7.4 Trimming the milliamp output

Trimming the mA output creates a common measurement range between the transmitter and the device that receives the mA output. For example, a transmitter might send a 12 mA signal that the receiving device reports incorrectly as 12.2 mA. If the transmitter output is trimmed correctly, it will send a signal appropriately compensated to ensure that the receiving device actually indicates a 12 mA signal.

Note: If a barrier or the Micro Motion adapter-barrier is installed, the mA output trim procedure can be extended to include additional trimming and calibration. See Section 7.4.2.

You must trim the mA output at both the 12 mA and 20 mA points to ensure appropriate compensation across the entire output range.

7.4.1 Basic mA output trim

To trim the output:

- Using the Communicator, see Figure 7-7.
- Using ProLink II, see Figure 7-8.

Additionally, if you are using a Communicator, you can perform a scaled AO trim. The scaled AO trim is used when the reference meter's low and high values are not 4 and 20 mA. To perform a scaled AO trim, see Figure 7-9.

Note the following:

- During the trim, the transmitter's mA output will not report process data. **CAUTION! Do not use the mA output for process control while you are performing the trim.**
- Enter the measured value in the same scale that you specified for the mA measurement point. If you specified "Don't Know":
  - If you are using ProLink II, enter the measured value in one scale and the tool will display the equivalent value in the other scale.
  - If you are using the Communicator, you must specify the mA measurement point before you can continue.
- Any trimming performed on the output should not exceed ± 200 microamps. If more trimming is required, contact Micro Motion customer support.
- If you are using the Communicator, the receiving device value can contain up to two decimal places.

Figure 7-7 Communicator – mA output trim procedure

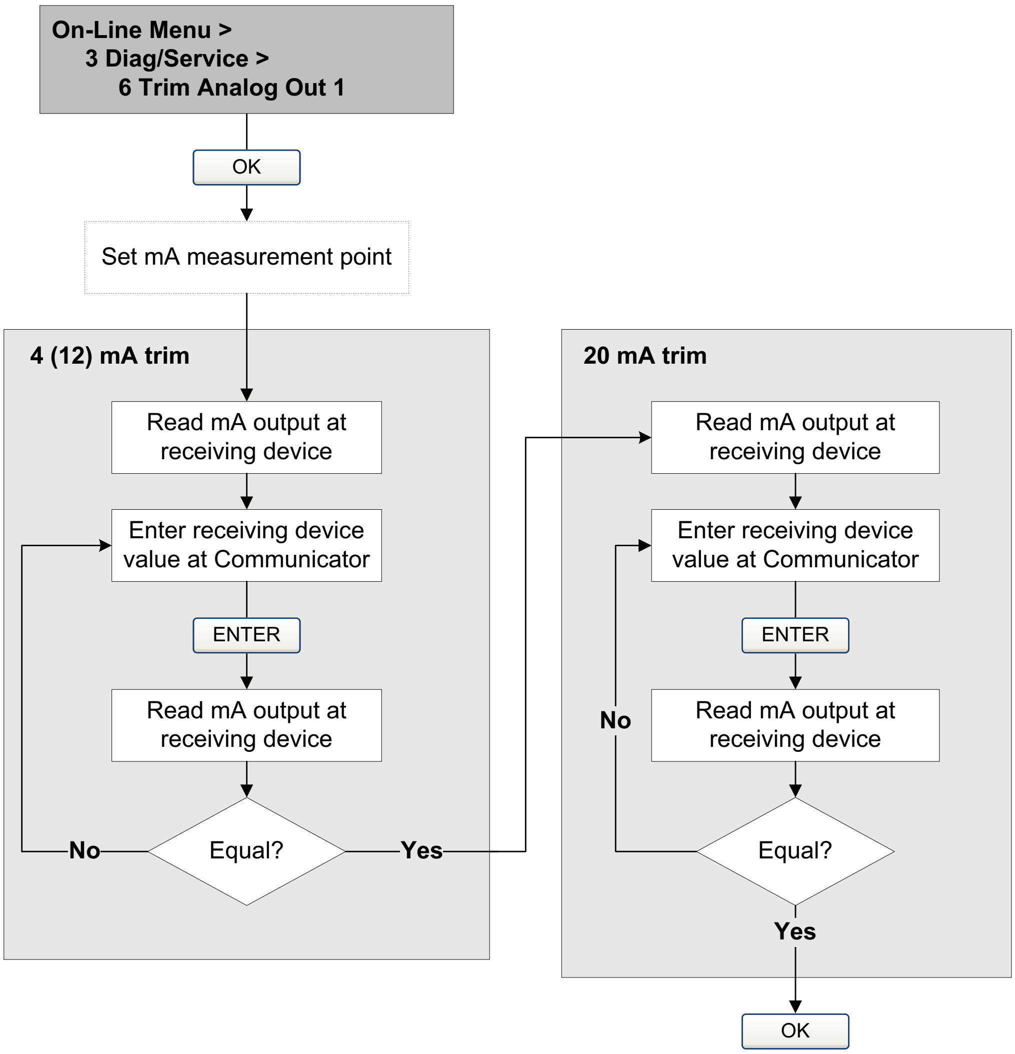


Figure 7-8 **ProLink II – mA output trim procedure**

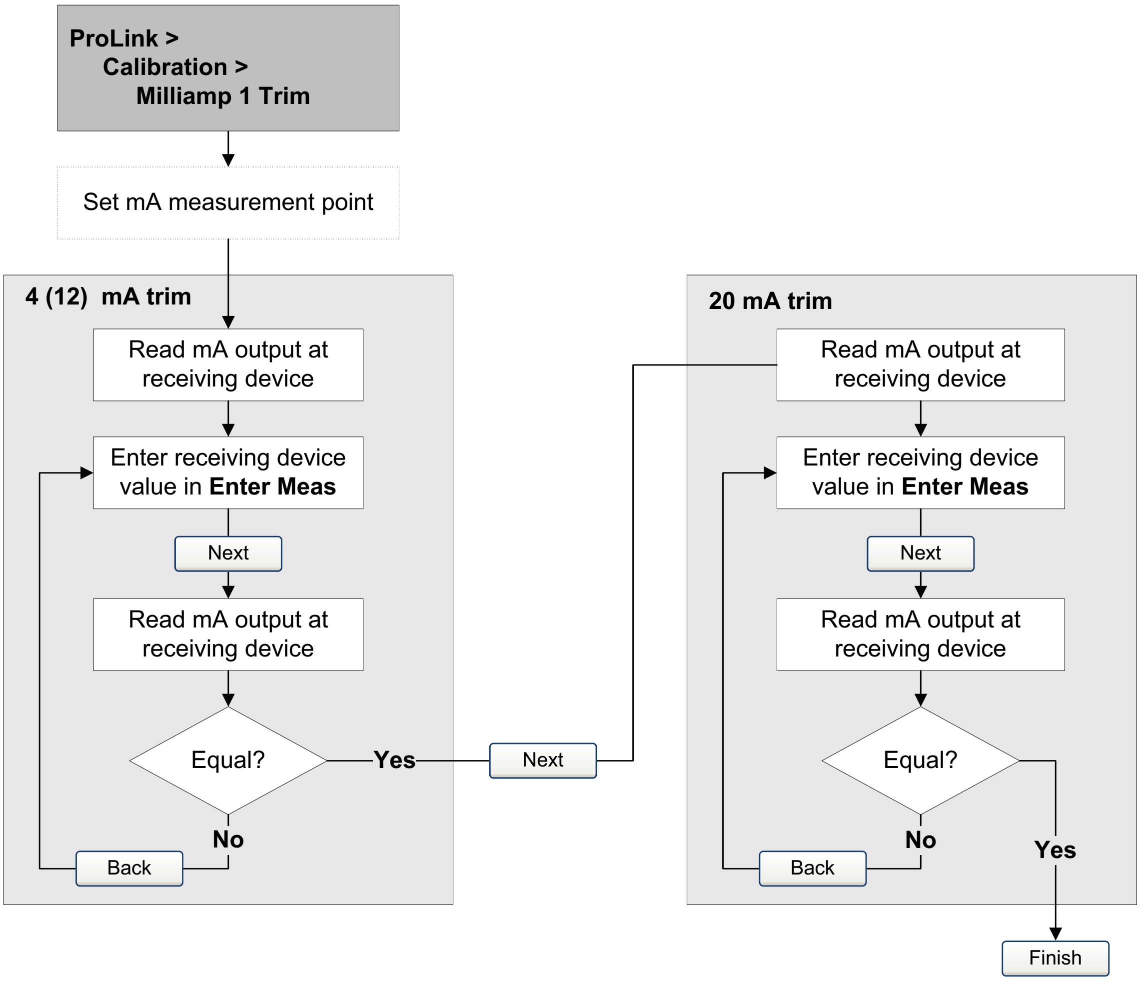
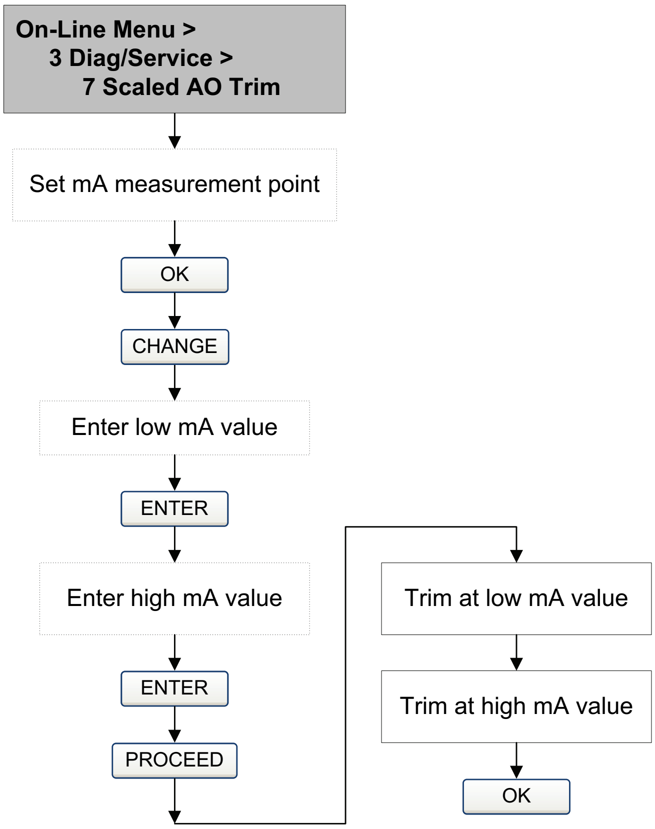


Figure 7-9 Communicator – Scaled AO trim procedure



7.4.2 Expanded mA output trim

Adapt the following procedure as required for your installation:

1. Trim the mA output at the Model 2200S transmitter as described in Section 7.4.1. Use a milliamp measurement point between the Model 2200S transmitter and the I.S. barrier or the Micro Motion adapter-barrier (i.e., mA Measurement Point = 12–20 mA).
2. At the transmitter, fix the mA output to 12 mA, then check the mA reading at the host.
3. At the transmitter, fix the mA output to 20 mA, then check the mA reading at the host.
4. If the mA readings at the host do not meet accuracy requirements:
   - If you have an third-party barrier, troubleshoot the barrier installation and wiring.
   - If you have the Micro Motion adapter-barrier, calibrate the adapter-barrier. Instructions are provided in the manual entitled *Micro Motion Model 2200S Transmitters: Installation Manual*.

7.5 Using sensor simulation to test, tune, and troubleshoot the system

Sensor simulation allows you to tell the transmitter to behave as if it were receiving specific values for mass flow, temperature, and density from the sensor. You can use sensor simulation for a variety of purposes:

- Testing and verifying the flowmeter's response to a variety of process conditions without having to create those conditions in the real world.
- Analyzing the system's response to various process conditions.
- Tuning the loop.
- Locating problems. For example, signal oscillation or noise is a common occurrence. The source could be the PLC, the meter, improper grounding, or a number of other factors. By setting up simulation to output a flat signal, then checking the signal at various points between the transmitter and the receiving device, you can determine the point at which the noise is introduced.

When sensor simulation is enabled, it affects all analog and digital outputs, and therefore affects all calculations that include these values. It does not change any diagnostic values. **CAUTION! Be sure that your process is prepared to handle the consequences of your simulation setup.**

To set up sensor simulation, follow the steps below:

1. If you are using:
   - The Communicator, refer to Figure 2-9.
   - ProLink II, refer to Figure 2-4.
2. Enable sensor simulation mode.
3. For mass flow:
   a. Specify the type of simulation you want: fixed value, triangular wave, or sine wave.
   b. Enter the required values.
      - If you specified fixed value simulation, enter a fixed value.
      - If you specified triangular wave or sine wave simulation, enter a minimum amplitude, maximum amplitude, and period.
4. Repeat Step 3 for temperature and density.

Be sure to disable simulation mode when the tests are complete.

7.6 Backing up and restoring the configuration

If you are using ProLink II, you can copy the configuration dataset to a file on your PC. The configuration dataset can be restored from the PC to the transmitter if required.

To copy the configuration dataset to a file on your PC:

1. Connect to the transmitter using ProLink II.
2. Select **File > Load from Xmtr to File**.
3. Specify the name and location of the backup file.

To restore the configuration dataset:

1. Connect to the transmitter using ProLink II.
2. Select **File > Send to Xmtr from File**.
3. Specify the name and location of the backup file.

7.7 Write-protecting the configuration

To prevent unintended changes to the transmitter configuration, you can write-protect the configuration.

To write-protect the configuration using ProLink II:

1. Click **ProLink > Configuration > Device**.
2. Enable write-protection.

To write-protect the configuration using the Communicator:

1. Select **Diag/Service > Perform Diagnostic Action**.
2. Select **Enable Write Protect**.

To write-protect the configuration using the display:

1. Enter the display menu system.
2. Enter the off-line maintenance menu.
3. Select the Config menu and scroll to **Lock**.
4. Enable the Lock option.

Note: To disable write-protection, see Section 3.5.1.

Chapter 8
Operating the Transmitter

8.1 Overview

This chapter describes how to use the transmitter in everyday operation. The following topics and procedures are discussed:

- Interpreting mA output data – see Section 8.3
- Recording process variables – see Section 8.4
- Viewing process variables – see Section 8.5
- Viewing and acknowledging status alarms – see Section 8.6
- Viewing and controlling the totalizers and inventories – see Section 8.7

Note: All ProLink II procedures provided in this section assume that your computer is already connected to the transmitter and you have established communication. All ProLink II procedures also assume that you are complying with all applicable safety requirements. See Appendix D for more information.

Note: If you are using AMS, the interface is similar to the ProLink II interface described in this chapter.

Note: All Communicator key sequences in this section assume that you are starting from the "Online" menu. See Appendix E for more information.

8.2 Warm-up delay

If you have just powered up the flowmeter, the transmitter may not be warmed up sufficiently, and may exhibit minor instability or inaccuracy. If you observe this, wait approximately ten minutes. If the condition does not disappear, follow normal troubleshooting procedures.

8.3 Interpreting mA output data

Verify that the host or mA receiving device is interpreting the mA signal correctly: scaled either from 12–20 mA or from 4–20 mA. If the host is receiving a 12–20 mA signal, you may want to configure it to rescale the input to 4–20 mA. For more information, see Section 3.4.

⚠ **Be sure to interpret and rescale process data reported via the mA output as appropriate to your installation. If you do not, you may experience measurement error and unintended consequences for your process.**

Note: If you are reading process data from the display, or if you are reading process data remotely using HART digital communications, the mA output scale does not affect process values.

8.4 Recording process variables

Micro Motion suggests that you make a record of the process variables listed below, under normal operating conditions. This will help you recognize when the process variables are unusually high or low, and may help in fine-tuning transmitter configuration.

Record the following process variables:

- Flow rate
- Density
- Temperature
- Tube frequency
- Pickoff voltage
- Drive gain

For information on using this information in troubleshooting, see Section 10.13.

8.5 Viewing process variables

You can view process variables with the display (if your transmitter has a display), ProLink II, or the Communicator.

8.5.1 With the display

If the transmitter has a display, the **Process variable** line on the LCD panel shows the configured display variables, and the **Units of measure** line shows the measurement unit for that process variable.

Auto Scroll may or may not be enabled:

- If Auto Scroll is enabled, each configured display variable will be shown for the number of seconds specified for Scroll Rate.
- Whether Auto Scroll is enabled or not, the operator can manually scroll through the configured display variables by pressing **Scroll**.

If more than one line is required to describe the display variable, the **Units of measure** line alternates between the measurement unit and the additional description. For example, if the LCD is displaying a mass inventory value, the **Units of measure** line alternates between the measurement unit (for example, **G**) and the name of the inventory (for example, **MASSI**).

For a list of the codes and abbreviations used on the display, see Appendix C.

Process variable values are displayed using either standard decimal notation or exponential notation:

- Values smaller than 100,000,000 are displayed in decimal notation (e.g., **1234567.89**).
- Values greater than 100,000,000 are displayed using exponential notation (e.g., **1.000E08**).
  - If the value is less than the precision configured for that process variable, the value is displayed as **0** (i.e., there is no exponential notation for fractional numbers).
  - If the value is too large to be displayed with the configured precision, the displayed precision is reduced (i.e., the decimal point is shifted to the right) as required so that the value can be displayed.

8.5.2 With ProLink II

To view process variables with ProLink II:

1. The **Process Variables** window opens automatically when you first connect to the transmitter.
2. If you have closed the **Process Variables** window:
   a. Open the **ProLink** menu.
   b. Select **Process Variables**.

8.5.3 With the Communicator

To view process variables with the Communicator:

1. Select **Process Variables > View fld dev vars**.
2. Scroll through the list of process variables by pressing **Down Arrow**.

If your Communicator is graphics-enabled, you can view a line graph of the PV, SV, TV, and QV process variables. To do this, select **3**. Note the following:

- Graphs are not available for totalizer and inventory process variables.
- Only line graphs are available. Other graphics types are not implemented.
- The Communicator provides several functions for manipulating the graph, such as panning and zooming. These functions are implemented.

See the Communicator documentation for additional instructions on using the graphics function.

8.6 Viewing and acknowledging status alarms

Specific process or flowmeter conditions cause status alarms.

Note: For detailed information on status alarms, including possible causes and troubleshooting suggestions, see Table 10-3.

8.6.1 About status alarms

Each status alarm has an alarm code.

Status alarms are classified into three severity levels: Fault, Information, and Ignore. Severity level controls how the transmitter responds to the alarm condition.

Note: Some status alarms can be reclassified, i.e., configured for a different severity level. For information on configuring severity level, see Section 5.3.1.

The transmitter maintains two status flags for each alarm:

- The first status flag indicates “active” or “inactive.”
- The second status flag indicates “acknowledged” or “unacknowledged.”

When the transmitter detects an alarm condition:

- Its status flags are set as follows:
  - The first status flag is set to “active.”
  - The second status flag is set to “unacknowledged.”
- The transmitter checks severity level for the specific alarm:
  - For Fault alarms, an alarm record is written to the active alarm log and the configured fault actions are performed (after the LMV Timeout has expired, if applicable).
  - For Informational alarms, an alarm record is written to the active alarm log, but fault actions are not performed. Both the mA output and digital communications behave as if no fault was active.
  - For Ignore alarms, no alarm record is written to the active alarm log and fault actions are not performed. Both the mA output and digital communications behave as if no fault was active.

When the transmitter detects that the alarm condition has cleared:

- The first status flag is set to “inactive.”
- The second status flag is not changed.
- The mA output and digital communications return to normal operation (Fault alarms only).

Operator action is required to return the second status flag to “acknowledged.” Alarm acknowledgment is not necessary.

8.6.2 With the display

Depending on your display configuration:

- You can use the process variable display to determine if an unidentified Fault or Informational alarm is active. No alarm codes are provided.
- You can view the list of active Fault and Informational alarms from the process variable display. This list identifies alarms by alarm code.
- You can use the display alarm menu to view active and unacknowledged Fault and Informational alarms, and you can acknowledge single alarms or all alarms.

If a Fault or Informational alarm is active, the display flashes the term **ALM_F** or **ALM_I** alternately with the unit of measure. If both a Fault alarm and an Informational alarm are active, **ALM_F** is displayed.

If the Alarm Menu display function is enabled:

- If one or more Fault and Informational alarm is active, the alarm codes are appended to the list of display variables. Then:
  - If Auto Scroll is enabled, alarm codes for the active alarms are shown automatically as the display scrolls through the list.
  - Whether or not Auto Scroll is enabled, the operator can manually scroll to the alarm portion of the display list by pressing **Scroll**. The transmitter housing cover must be removed. **WARNING! If the transmitter is in a Division 2 or Zone 2 area, do not remove the transmitter housing cover. Use another method to view active alarms.**
- If no Fault or Informational alarm is active, the display flashes the term **NO ALARM** at the end of the display variables.

Note: Unacknowledged alarms are not listed at the end of the display variables.

To view or acknowledge status alarms using the display menus, see the menu flowchart in Figure 2-17. Note that the Acknowledge All Alarms display function may be enabled or disabled. If disabled, the Acknowledge All Alarms screen is not displayed and alarms must be acknowledged individually.

8.6.3 With ProLink II

ProLink II provides two ways to view status alarm information:

- The Status window displays the current status of all possible alarms, including Ignore alarms. A green LED indicates "inactive" and a red LED indicates "active." The acknowledgment status bit is not shown, and you cannot acknowledge alarms from the Status window. Alarms are organized into three categories: Critical, Informational, and Operational.
- The Alarm Log window lists all active and all inactive but unacknowledged Fault and Information alarms. The transmitter automatically filters out Ignore alarms. A green LED indicates "inactive but unacknowledged" and a red LED indicates "active." Alarms are organized into two categories: High Priority and Low Priority. You can view and acknowledge alarms from the Alarm Log window.

Note: The location of alarms in the Status window or the Alarm Log window is not affected by the configured alarm severity. Alarms are predefined as Critical, Informational, or Operational, or as High Priority or Low Priority.

To use the Status window:

1. Click **ProLink**.
2. Select **Status**.
3. Alarms are displayed on three panels: Critical, Informational, and Operational.

   To view the indicators in a category, click on the tab.

   - A tab is red if one or more status indicators in that category is on.
   - Within the tabs, active status alarms are shown by red status indicators.

To use the Alarm Log window:

1. Click **ProLink**.
2. Select **Alarm Log**. Entries in the alarm log are divided into two categories: High Priority and Low Priority, corresponding to the default Fault and Information alarm severity levels. Within each category:
   - All active alarms are listed with a red status indicator.
   - All alarms that are "cleared but unacknowledged" are listed with a green status indicator.
3. For each alarm that you want to acknowledge, check the **ACK** checkbox.

8.6.4 With the Communicator

The Communicator allows you to perform the following actions related to status alarms:

- View a list of active status alarms
- Acknowledge a single status alarm
- Acknowledge all status alarms at once
- View the alarm event log

To view all active Fault and Information alarms, you can use either of the following methods:

- Select **Diag/Service > Test/Status > View Status**, then press **OK** to cycle through a list of active alarms.
- Select **Process Variables > View Status**, then press **OK** to cycle through a list of active alarms.

Note: The transmitter automatically filters out Ignore alarms.

To acknowledge a single alarm, select **Diag/Service > Alarm Config > Acknowledge Selected Alarm**, then enter the alarm code.

To acknowledge all alarms with one action, select **Diag/Service > Perform Diagnostic Action > Acknowledge All Alarms**. You do not need to enter alarm codes.

The alarm event log contains one record for each of the fifty most recent active Fault and Information status alarms. Ignore alarms are not listed. Each record contains:

- The alarm code
- The alarm status (e.g., cleared but unacknowledged)
- The timestamp, which is the number of seconds that this alarm has been active, while the transmitter has been powered on.

Note: The timestamp value is not reset during a transmitter power cycle. To reset this value, you must perform a master reset or use a Modbus command. Contact Micro Motion customer support.

To view records in the alarm event log, select **Diag/Service > Alarm Config > Alarm Event Log**.

To clear the alarm log, select **Diag/Service > Perform Diagnostic Action > Reset Alarm Log**.

8.7 Using the totalizers and inventories

The *totalizers* keep track of the total amount of mass or volume measured by the transmitter over a period of time. The totalizers can be started and stopped, and the totals can be viewed and reset.

The *inventories* track the same values as the totalizers, but inventory values can be reset separately. This allows you to keep a running total of mass or volume across multiple resets.

8.7.1 Viewing current totals for totalizers and inventories

You can view current totals for the totalizers and inventories with the display, ProLink II, or the Communicator.

With the display

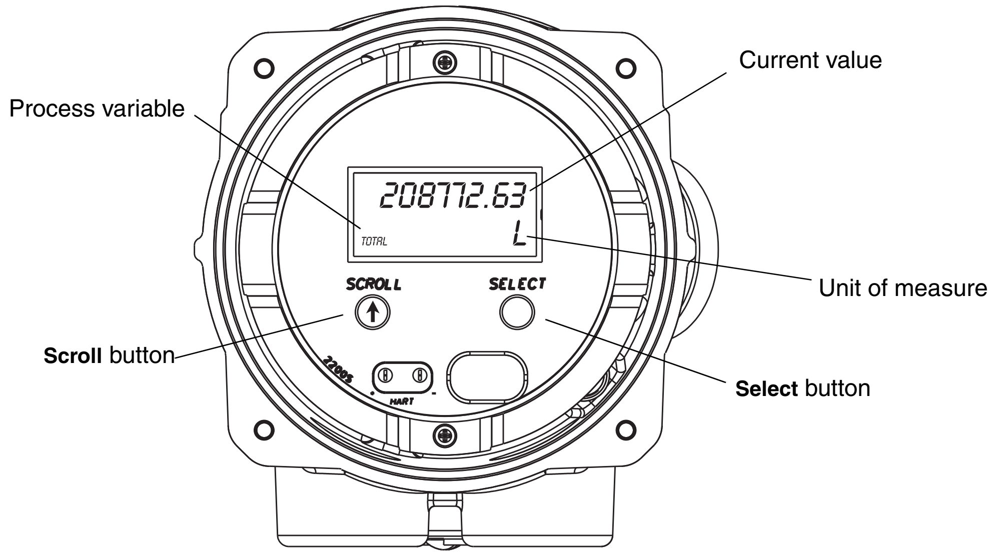
Note: You cannot view current totals with the display unless the total has been configured as a display variable. See Section 5.2.3.

1. To view totalizer values, wait or **Scroll** until the process variable **TOTAL** appears and the units of measure are:
   - For the mass totalizer, mass units (e.g., kg, lb)
   - For the volume totalizer, volume units (e.g., gal, cuft, scf, nm3)

   See Figure 8-1. Read the current value from the top line of the display.
2. To view inventory values, wait or **Scroll** until the process variable **TOTAL** appears and:
   - For the mass inventory, the word **MASSI** (Mass Inventory) begins to alternate with the units of measure
   - For the volume inventory, the word **LVOLI** (Line Volume Inventory) begins to alternate with the units of measure
   - For gas volume inventory, the word **GSVI** (Gas Standard Volume Inventory) begins to alternate with the units of measure

   See Figure 8-1. Read the current value from the top line of the display.

Figure 8-1 Totalizer values on display



With ProLink II

To view current totals for the totalizers and inventories with ProLink II:

1. Click **ProLink**.
2. Select **Process Variables** or **Totalizer Control**.

With the Communicator

To view current totals for the totalizers and inventories with the Communicator:

1. Select **Process Variables > View fld dev vars**.
2. Scroll through the list of process variables by pressing **Down Arrow**.
3. Press the number corresponding to the totalizer or inventory you wish to view, or highlight it in the list and press **Right Arrow**.

8.7.2 Controlling totalizers and inventories

Table 8-1 shows all of the totalizer and inventory functions and which configuration tools you can use to control them.

Table 8-1 Totalizer and inventory control methods

Function name	Display	Communicator	ProLink II
Start/stop all totalizers and inventories	Yes(1)	Yes	Yes
Reset mass totalizer value only	Yes(1)	Yes	Yes
Reset volume totalizer only	Yes(1)	Yes	Yes
Simultaneously reset all totalizer values	Yes(1)	Yes	Yes
Simultaneously reset all inventory values	No	No	Yes(2)
Reset mass inventory value only	No	No	Yes(2)
Reset volume inventory value only	No	No	Yes(2)

(1) If enabled. See Section 5.2.4.
(2) If enabled in the ProLink II Preferences window.

With the display

Table 8-2 shows how you can control the totalizers and inventories with the display.

Table 8-2 Totalizer and inventory control with the display

To accomplish this	Press this sequence of buttons
Stop all totalizers and inventories(1)	• **Scroll** until a totalizer value appears (the word **TOTAL** appears in the lower left corner of the display). It does not matter whether the total is mass or volume. • **Select.** • **Scroll** until **STOP** appears beneath the current totalizer value. • **Select** (**YES** alternates with **STOP**). • **Select** (all totalizers and inventories stop). • **Scroll** to **EXIT**.
Start all totalizers and inventories(1)	• **Scroll** until a totalizer value appears (the word **TOTAL** appears in the lower left corner of the display). It does not matter whether the total is mass or volume. • **Select.** • **Scroll** until **START** appears beneath the current totalizer value. • **Select** (**YES** alternates with **START**). • **Select** (all totalizers and inventories start). • **Scroll** to **EXIT**. • **Select.**
Reset mass totalizer(1)	• **Scroll** until the mass totalizer value appears. • **Select.** • **Scroll** until **RESET** appears beneath the current totalizer value. • **Select** (**YES** alternates with **RESET**). • **Select** (mass totalizer resets). • **Scroll** to **EXIT**. • **Select.**
Reset volume (liquid or gas) totalizer(1)	• **Scroll** until the volume totalizer value appears. • **Select.** • **Scroll** until **RESET** appears beneath the current totalizer value. • **Select** (**YES** alternates with **RESET**). • **Select** (volume totalizer resets). • **Scroll** to **EXIT**. • **Select.**

(1) This feature may be enabled or disabled. See Section 5.2.4.

With ProLink II

Table 8-3 shows how you can control the totalizers and inventories using ProLink II.

Table 8-3 Totalizer and inventory control with ProLink II

To accomplish this	On the totalizer control screen...
Stop all totalizers and inventories	Click **Stop**
Start all totalizers and inventories	Click **Start**
Reset mass totalizer	Click **Reset Mass Total**
Reset volume totalizer	Click **Reset Volume Total**
Simultaneously reset all totalizers	Click **Reset**
Simultaneously reset all inventories(1)	Click **Reset Inventories**
Reset mass inventory only(1)	Click **Reset Mass Inventory**
Reset volume (liquid or gas) inventory only(1)	Click **Reset Volume Inventory** or **Reset Gas Volume Inventory**

(1) If enabled in the ProLink II Preferences window.

To enable inventory reset using ProLink II:

1. Click **View > Preferences**.
2. Check the **Enable Inventory Totals Reset** checkbox.
3. Click **Apply**.

To get to the Totalizer Control screen:

1. Click **ProLink**.
2. Select **Totalizer Control**.

With the Communicator

Table 8-4 shows how you can control the totalizers and inventories with the Communicator.

Table 8-4 Totalizer and inventory control with a Communicator

To accomplish this	Press this sequence of buttons
Stop all totalizers and inventories	**Process Variables > Totalizer cntrl > Stop totalizer**
Start all totalizers and inventories	**Process Variables > Totalizer cntrl > Start totalizer**
Reset mass totalizer	**Process Variables > Totalizer cntrl > Reset mass total**
Reset volume totalizer	**Process Variables > Totalizer cntrl > Reset volume total**
Reset all totalizers	**Process Variables > Totalizer cntrl > Reset all totals**

Chapter 9
Measurement Performance

9.1 Overview

This chapter describes the following procedures:

- Meter validation and adjusting meter factors – see Section 9.3
- Density calibration – see Section 9.4
- Temperature calibration – see Section 9.5

Before performing the procedures in this chapter, make an administrative connection to the transmitter and ensure that you are complying with all applicable safety requirements.

9.2 Meter validation and calibration

The Model 2200S transmitter supports the following procedures for the evaluation and adjustment of measurement performance:

- Meter validation – confirming performance by comparing the sensor's measurements to a primary standard
- Calibration – establishing the relationship between a process variable (flow, density, or temperature) and the signal produced by the sensor

These procedures are discussed and compared in Sections 9.2.2 and 9.2.3. Before performing any of these procedures, review these sections to ensure that you will be performing the appropriate procedure for your purposes.

9.2.1 Meter validation and meter factors

Meter validation compares a measurement value reported by the transmitter with an external measurement standard. Meter validation requires one data point.

Note: For meter validation to be useful, the external measurement standard must be more accurate than the sensor. See the sensor's product data sheet for its accuracy specification.

If the transmitter's mass flow, volume flow, or density measurement is significantly different from the external measurement standard, you may want to adjust the corresponding meter factor. A meter factor is the value by which the transmitter multiplies the process variable value. The default meter factors are 1.0, resulting in no difference between the data retrieved from the sensor and the data reported externally.

Meter factors are typically used for proving the flowmeter against a Weights & Measures standard. You may need to calculate and adjust meter factors periodically to comply with regulations.

9.2.2 Calibration

The flowmeter measures process variables based on fixed points of reference. Calibration adjusts those points of reference. Three types of calibration can be performed:

- Zero, or no flow (see Section 7.2)
- Density calibration
- Temperature calibration

Density and temperature calibration require two data points (low and high) and an external measurement for each. Calibration produces a change in the offset and/or the slope of the line that represents the relationship between process density and the reported density value, or the relationship between process temperature and the reported temperature value.

Note: For density or temperature calibration to be useful, the external measurements must be accurate.

Micro Motion flowmeters with the Model 2200S transmitter are calibrated at the factory, and normally do not need to be calibrated in the field. Calibrate the flowmeter only if you must do so to meet regulatory requirements. Contact Micro Motion before calibrating your flowmeter.

Micro Motion recommends using meter validation and meter factors, rather than calibration, to prove the meter against a regulatory standard or to correct measurement error.

9.2.3 Comparison and recommendations

When choosing between meter validation and calibration, consider the following factors:

- Process interruption
  - Meter validation does not interrupt the process.
  - Calibration requires process down-time. In addition, density and temperature calibration require replacing the process fluid with low-density and high-density fluids, or low-temperature and high-temperature fluids.
- External measurement requirements
  - Zero calibration does not require external measurements.
  - Density calibration, temperature calibration, and meter validation require external measurements. For good results, the external measurement must be highly accurate.
- Measurement adjustment
  - Meter validation does not change flowmeter internal measurement in any way. If you decide to adjust a meter factor as a result of a meter validation procedure, only the reported measurement is changed – the base measurement is not changed. You can always reverse the change by returning the meter factor to its previous value.
  - Calibration changes the transmitter's interpretation of process data, and accordingly changes the base measurement. If you perform a zero calibration, you can return to the previous zero or the factory zero. However, if you perform a density calibration or a temperature calibration, you cannot return to the previous calibration factors unless you have manually recorded them.

9.3 Performing meter validation

To perform meter validation:

1. Determine the meter factor(s) to use. You may set any combination of the mass flow, volume flow, and density meter factors.

   Note that all three meter factors are independent:

   - The mass flow meter factor affects only the value reported for mass flow.
   - The density meter factor affects only the value reported for density.
   - The volume flow meter factor affects only the value reported for volume flow.

   Therefore, 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.

2. Calculate the meter factor as follows:

   a. Sample the process fluid and record the process variable value reported by the flowmeter.

   b. Measure the sample using an external standard.

   c. Calculate the new meter factor using the following formula:

$$\text{NewMeterFactor} = \text{ConfiguredMeterFactor} \times \frac{\text{ExternalStandard}}{\text{ActualFlowmeterMeasurement}}$$

   If you are calculating the volume flow meter factor, note that proving 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 sampling and measurement is to calculate the volume flow meter factor from the density meter factor. This method provides partial correction by adjusting for any portion of the total offset that is caused by density measurement offset. Use this method only when a volume flow reference is not available, but a density reference is available. To use this method:

   a. Calculate the meter factor for density, using the preceding formula.

   b. Calculate the volume flow meter factor from the density meter factor, as shown below:

$$\text{MeterFactor}_{\text{Volume}} = \frac{1}{\text{MeterFactor}_{\text{Density}}}$$

Note: This equation is mathematically equivalent to the equation shown below. You may use whichever equation you prefer.

$$\text{MeterFactor}_{\text{Volume}} = \text{ConfiguredMeterFactor}_{\text{Density}} \times \frac{\text{Density}_{\text{Flowmeter}}}{\text{Density}_{\text{ExternalStandard}}}$$

3. Ensure that the meter factor is between **0.8** and **1.2**, inclusive. If the calculated meter factor is outside these limits, contact Micro Motion customer service.

4. Configure the meter factor in the transmitter. To configure meter factors:

   - Using ProLink II, see Figure 2-3.
   - Using the Communicator, see Figure 2-8.
   - Using the display menus, see Figure 2-13.

Example	The flowmeter is installed and proved for the first time. The flowmeter mass measurement is 250.27 lb; the reference device measurement is 250 lb. A mass flow meter factor is determined as follows: $$MeterFactor_{MassFlow} = 1 \times \frac{250}{250.27} = 0.9989$$ The first mass flow meter factor is 0.9989. One year later, the flowmeter is proved again. The flowmeter mass measurement is 250.07 lb; the reference device measurement is 250.25 lb. A new mass flow meter factor is determined as follows: $$MeterFactor_{MassFlow} = 0.9989 \times \frac{250.25}{250.07} = 0.9996$$ The new mass flow meter factor is 0.9996.

9.4 Performing density calibration

Density calibration includes the following calibration points:

- D1 calibration (low-density)
- D2 calibration (high-density)

You must perform both calibrations without interruption, in order.

Note: Before performing the calibration, record your current calibration parameters. If you are using ProLink II, you can do this by saving the current configuration to a file on the PC. If the calibration fails, restore the known values.

You can calibrate for density with ProLink II or the Communicator.

9.4.1 Preparing for density calibration

Before beginning density calibration, review the requirements in this section.

Sensor requirements

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.

Density calibration fluids

D1 and D2 density calibration require a D1 (low-density) fluid and a D2 (high-density) fluid. You may use air and water.

9.4.2 Density calibration procedures

To perform a D1 and D2 density calibration:

- With the Communicator, see Figure 9-1.
- With ProLink II, see Figure 9-2.

Figure 9-1 **D1 and D2 density calibration – Communicator**

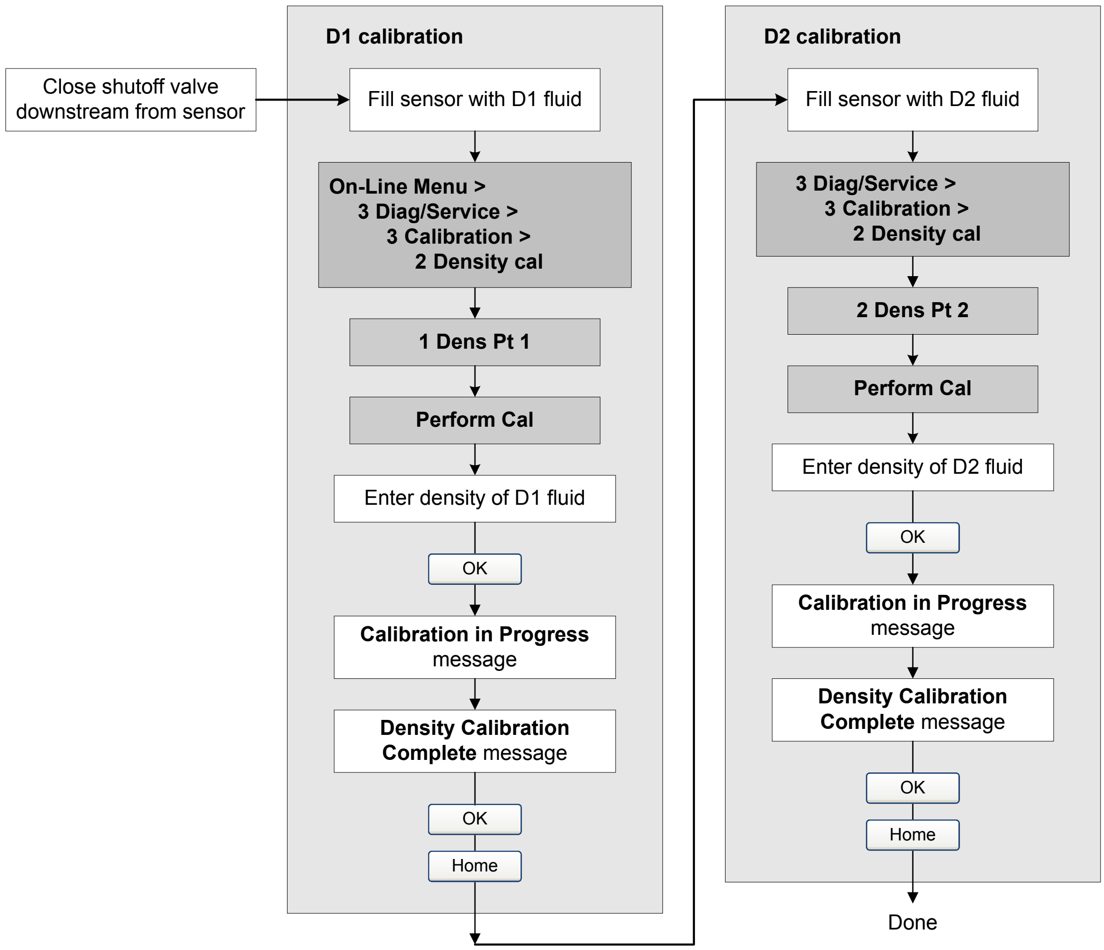
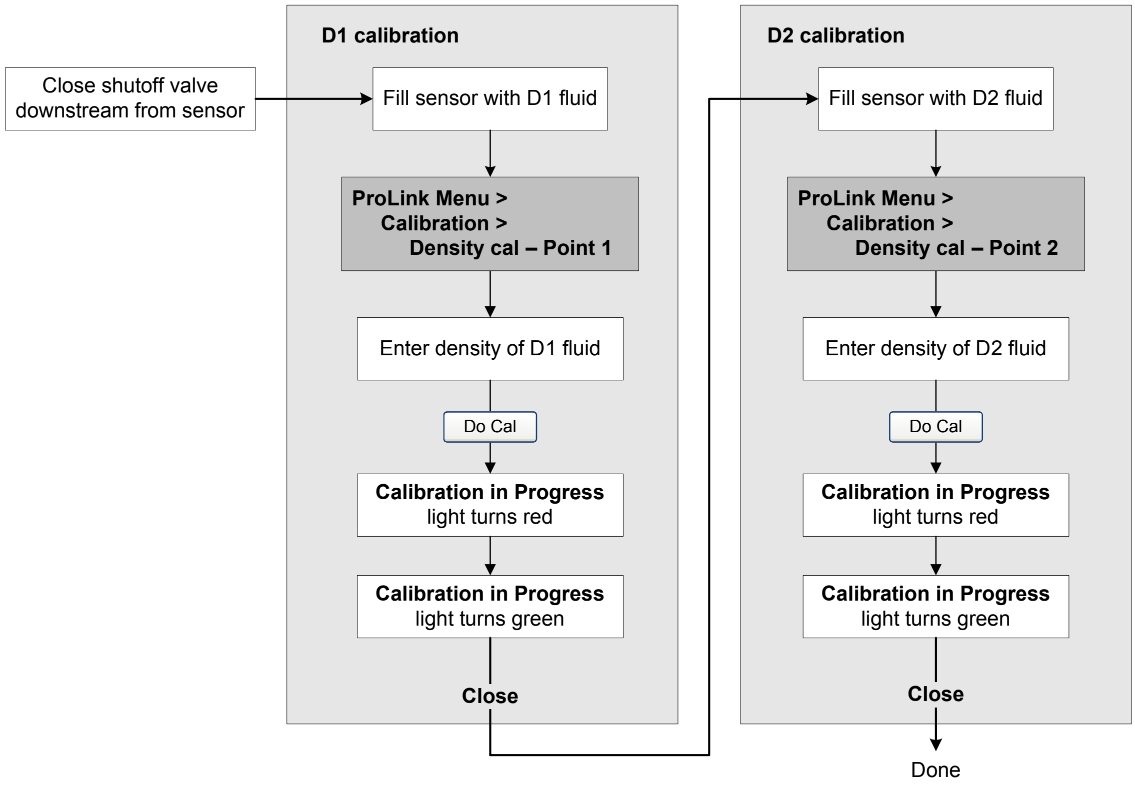


Figure 9-2 D1 and D2 density calibration – ProLink II



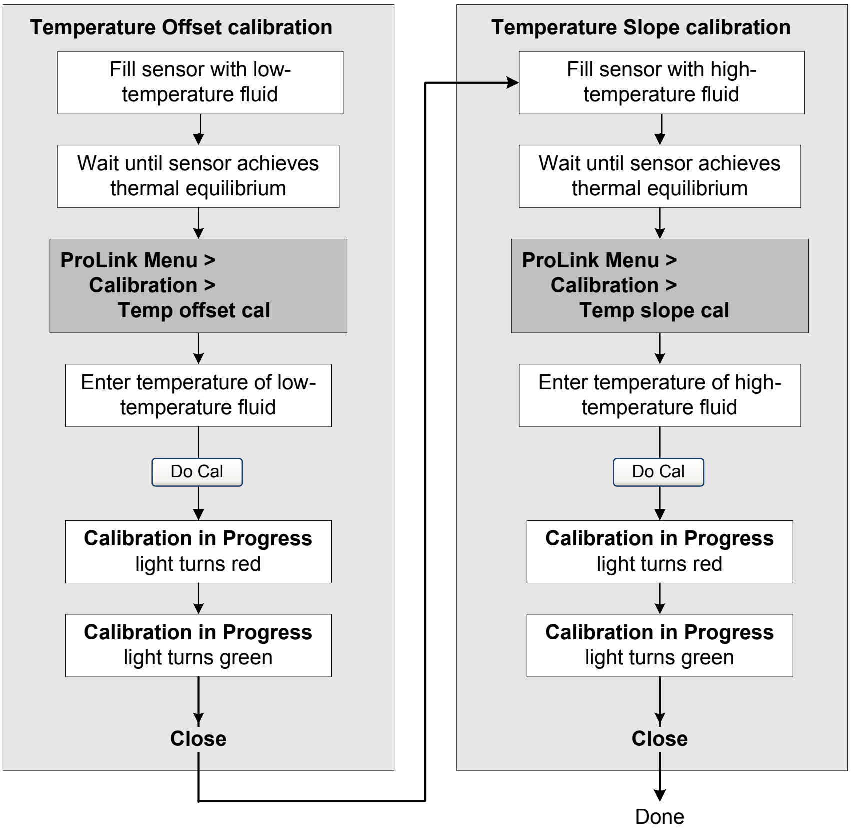
9.5 Performing temperature calibration

Temperature calibration is a two-part procedure: temperature offset calibration and temperature slope calibration. The entire procedure must be completed without interruption.

Note: 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.

You can calibrate for temperature with ProLink II software. See Figure 9-3.

Figure 9-3 Temperature calibration – ProLink II



Chapter 10
Troubleshooting

10.1 Overview

This chapter describes guidelines and procedures for troubleshooting the flowmeter. The information in this chapter will enable you to:

- Categorize the problem
- Determine whether you are able to correct the problem
- Take corrective measures (if possible)
- Contact the appropriate support agency

Note: All ProLink II procedures provided in this section assume that your computer is already connected to the transmitter and you have established communication. All ProLink II procedures also assume that you are complying with all applicable safety requirements. See Appendix D for more information.

Note: All Communicator key sequences in this section assume that you are starting from the "Online" menu. See Appendix E for more information.

10.2 Guide to troubleshooting topics

Refer to Table 10-1 for a list of troubleshooting topics discussed in this chapter.

Table 10-1 Troubleshooting topics and locations

Section	Topic
Section 10.4	*Transmitter does not operate*
Section 10.5	*Transmitter does not communicate*
Section 10.6	*Zero or calibration failure*
Section 10.7	*Low power and mA fault action*
Section 10.8	*Fault conditions*
Section 10.9	*HART output problems*
Section 10.10	*I/O problems*
Section 10.11	*Sensor simulation mode*
Section 10.12	*Status alarms*
Section 10.13	*Checking process variables*
Section 10.14	*Diagnosing wiring problems*
Section 10.14.1	*Checking the power supply wiring*
Section 10.14.2	*Checking grounding*
Section 10.14.3	*Checking the HART communication loop*
Section 10.15	*Checking the communication device*

Table 10-1 Troubleshooting topics and locations *continued*

Section	Topic
Section 10.16	*Checking the output wiring and receiving device*
Section 10.17	*Checking slug flow*
Section 10.18	*Checking output saturation*
Section 10.19	*Checking the HART address and Loop Current Mode parameter*
Section 10.20	*Checking the flow measurement configuration*
Section 10.21	*Checking the characterization*
Section 10.22	*Checking the calibration*
Section 10.23	*Checking the test points*
Section 10.24	*Checking sensor circuitry*

10.3 Micro Motion customer service

To speak to a customer service representative, contact the Micro Motion customer service department. Contact information is provided in Section 1.8.

Before contacting Micro Motion customer service, review the troubleshooting information and procedures in this chapter, and have the results available for discussion with the technician.

10.4 Transmitter does not operate

If the transmitter does not operate at all (i.e., the transmitter is not receiving power and cannot communicate), perform all of the procedures in Section 10.14.

If the procedures do not indicate a problem with the electrical connections, contact the Micro Motion customer service department.

10.5 Transmitter does not communicate

If the transmitter does not appear to be communicating, the wiring may be faulty or the communications device may be incompatible.

- For HART network communications, perform the procedures in Section 10.14.3.
- For communication using a communication device, check the wiring and the communication device. See Appendix D for ProLink II, or Appendix E for the 375 Field Communicator.

If you can read data from the transmitter but cannot write data (e.g., you cannot start, stop or reset totalizers or change transmitter configuration), check to see if the transmitter is write-protected, and disable write-protection if required.

10.6 Zero or calibration failure

If a zero or calibration procedure fails, the transmitter will send a status alarm indicating the cause of failure. See Section 10.12 for specific remedies for status alarms indicating calibration failure.

10.7 Low power and mA fault action

If the A031 (low power) alarm appears and disappears frequently, check the mA Fault Action setting and the power supply to the transmitter. If the transmitter is operating near the limit of its power requirement, and mA Fault Action is set to Upscale, the mA output will be set to a high value when the alarm occurs, and the extra power may be enough to correct the problem temporarily.

If the transmitter is spontaneously powering down and restarting, check the mA Fault Action setting and the power supply to the transmitter. If the transmitter is operating near the limit of its power requirement and mA Fault Action is set to Downscale, the mA output will be set to a low value when the alarm occurs, and the drop in power may be enough to cause a powerdown.

To correct these problems:

- Increase the power supply to the transmitter if possible. Ensure that the transmitter is operating within the range specified in the transmitter installation manual.
- Remove gas from the process fluid.

10.8 Fault conditions

If the mA output or digital communications is performing its fault action, determine the exact nature of the fault by viewing the status alarms. Once you have identified the status alarm(s) associated with the fault condition, refer to Section 10.12.

Some fault conditions can be corrected by cycling power to the transmitter. A power cycle can clear the following:

- Loop test
- Zero failure
- Stopped internal totalizer

10.9 HART output problems

HART output problems include inconsistent or unexpected behavior that does not trigger status alarms. For example, the Communicator might show incorrect units of measure or respond sluggishly. If you experience HART output problems:

- Verify that the transmitter configuration is correct.
- If Burst Mode is enabled:
  - Consider disabling Burst Mode.
  - Use a different communication tool.
  - Try a different modem. Consider a USB HART modem.
  - Ensure that the modem is controlling the RTS line.

If you discover that the configuration is incorrect, change the necessary transmitter settings.

If you confirm that all the settings are correct, but the unexpected outputs continue, the transmitter or sensor could require service. See Section 10.3.

10.10 I/O problems

If you are experiencing problems with the mA output, use Table 10-2 to identify an appropriate remedy. Simulation mode may also be helpful (see Section 10.11).

Table 10-2 I/O problems and remedies

Symptom	Possible cause	Possible remedy
No output Loop test failed	Power supply problem	• Check power supply and power supply wiring. See Section 10.14.1.
mA output < 4 mA	Process condition below LRV	• Verify process. • Change the LRV. See Section 6.2.2.
	Fault condition if fault action is set to internal zero or downscale	• Check the fault action settings to verify whether or not the transmitter is in a fault condition. See Section 6.2.5. • If a fault condition is present, see Section 10.8.
	Open in wiring	• Verify all connections.
	Bad mA receiving device	• Check the mA receiving device or try another mA receiving device. See Section 10.16. • Perform output simulation to locate the problem. See Section 10.11.
	Bad output circuit	• Measure DC voltage across output to verify that output is active. • Perform output simulation to locate the problem. See Section 10.11.
	Output not powered	• Check transmitter wiring. See the transmitter installation manual.
Constant mA output	Non-zero HART address	• Set HART address to 0 or enable the Loop Current Mode parameter. See Section 10.19.
	Output is fixed in a test mode	• Exit output from test mode. See Section 7.3.
	Zero calibration failure	• Cycle power. • Stop flow and rezero. See Section 7.2.
mA output consistently out of range	Fault condition if fault indicator is set to upscale or downscale	• Check the fault indicator settings to verify whether or not the transmitter is in a fault condition. See Section 6.2.5. • If a fault condition is present, see Section 10.8.
	LRV and URV not set correctly	• Check the LRV and URV. See Section 10.20.
Consistently incorrect mA measurement	Scaling mismatch between transmitter and host.	• Ensure that the host is scaled for either 12–20 mA input or 4–20 mA input, as appropriate to your installation. See Section 8.3.
	Output not trimmed correctly	• Trim the output. See Section 7.4.
	Incorrect flow measurement unit configured	• Verify flow measurement unit configuration. See Section 10.20.
	Incorrect process variable configured	• Verify process variable assigned to mA output. See Section 6.2.1.
	LRV and URV not set correctly	• Check the LRV and URV. See Section 10.18.
mA reading correct at low currents but wrong at higher currents	mA loop resistance may be too high	• Verify mA output load resistance is below maximum supported load (see installation transmitter manual).

10.11 Sensor simulation mode

Sensor simulation mode allows you to set values for mass flow, density, and temperature. The transmitter will then behave as though it was receiving those values from the sensor. Sensor simulation mode can be useful in a variety of troubleshooting situations. See Section 7.5 for information on setting up and using sensor simulation mode.

10.12 Status alarms

Status alarms can be viewed with the display, ProLink II, or the Communicator. A list of status alarms with the message displayed, possible causes, and suggested remedies is provided in Table 10-3.

Note: The display lists only the alarm code.

Note: Status alarms are not listed for alarms with Alarm Severity = Ignore, even if the alarm condition is active. See Section 5.3.1 for information on configuring status alarm severity.

Before troubleshooting status alarms, first acknowledge all alarms (see Section 8.6). This will remove inactive alarms from the list so that you can focus troubleshooting efforts on active alarms.

Table 10-3 Status alarms and remedies

Alarm code	Communicator ProLink II	Cause	Suggested remedy
A001	EEprom Checksum Error (Core Processor) (E)EPROM Checksum Error (CP)	An uncorrectable checksum mismatch has been detected.	• Cycle power to the flowmeter. • The flowmeter might need service. Contact Micro Motion.
A002	RAM Test Error (Core Processor) RAM Error (CP)	ROM checksum error or a RAM location cannot be written to.	• Cycle power to the flowmeter. • The flowmeter might need service. Contact Micro Motion.
A003	Sensor Not Responding (No Tube Interrupt) Sensor Failure	Continuity failure of drive circuit, LPO, or RPO, or LPO-RPO mismatch when driving.	• Check for slug flow. See Section 10.17. • Check the test points. See Section 10.23. • Check the sensor circuitry. See Section 10.24. • Check sensor tubes for plugging. • If the problem persists, contact Micro Motion.
A004	Temperature sensor out of range Temperature Sensor Failure	Combination of A16 and A17	• Check the sensor RTD circuitry. See Section 10.24. • Verify that process temperature is within range of sensor and transmitter. • If the problem persists, contact Micro Motion.
A005	Input Over-Range Input Overrange	The measured flow has exceeded the maximum flow rate of the sensor ($\Delta T > 200\ \mu s$)	• If other alarms are present (typically, A003, A006, A008, A102, or A105), resolve those alarm conditions first. If the A005 alarm persists, continue with the suggestions here. • Verify process and check for slug flow. See Section 10.17. • Check the test points. See Section 10.23. • Check the sensor circuitry. See Section 10.24. • Check the sensor tubes for erosion. • If the problem persists, contact Micro Motion.
A006	Transmitter Not Characterized Not Configured	Combination of A020 and A021	• Check the characterization. Specifically, verify the FCF and K1 values. See Section 4.2. • If the problem persists, contact Micro Motion.

Table 10-3 Status alarms and remedies *continued*

Alarm code	Communicator / ProLink II	Cause	Suggested remedy
A008	Density Outside Limits Density Overrange	The measured density has exceeded 0–10 g/cm^3	• If other alarms are present (typically, A003, A006, A102, or A105), resolve those alarm conditions first. If the A008 alarm persists, continue with the suggestions here. • Verify process. Check for air in the flow tubes, tubes not filled, foreign material in tubes, or coating in tubes. • Check for slug flow. See Section 10.17. • Check the sensor circuitry. See Section 10.24. • Verify calibration factors in transmitter configuration. See Section 4.2. • Check the test points. See Section 10.23. • If the problem persists, contact Micro Motion.
A009	Transmitter Initializing/Warming Up Transmitter Initializing/Warming Up	Transmitter in power-up mode.	• Allow the flowmeter to warm up (approximately 30 seconds). The error should disappear once the flowmeter is ready for normal operation. • If alarm does not clear, make sure that the sensor is completely full or completely empty. • Check the sensor circuitry. See Section 10.24.
A010	Calibration Failure Calibration Failure	Mechanical zero: The resulting zero was greater than 3 µs. Temperature/Density Cals: many possible causes.	• If alarm appears during a transmitter zero, ensure that there is no flow through the sensor, then retry. • Cycle power to the flowmeter, then retry. • If appropriate, restore the factory zero to return the flowmeter to operation.
A011	Excess Calibration Correction, Zero too Low Zero Too Low	See A10	• Ensure that there is no flow through the sensor, then retry. • Cycle power to the flowmeter, then retry. • If appropriate, restore the factory zero to return the flowmeter to operation.
A012	Excess Calibration Correction, Zero too High Zero Too High	See A10	• Ensure that there is no flow through the sensor, then retry. • Cycle power to the flowmeter, then retry. • If appropriate, restore the factory zero to return the flowmeter to operation.
A013	Process too Noisy to Perform Auto Zero Zero Too Noisy	See A10.	• Remove or reduce sources of electromechanical noise, then retry. Sources of noise include: - Mechanical pumps - Pipe stress at sensor - Electrical interference - Vibration effects from nearby machinery • Cycle power to the flowmeter, then retry. • If appropriate, restore the factory zero to return the flowmeter to operation.
A014	Transmitter Failed Transmitter Failed	Many possible causes.	• Cycle power to the flowmeter. • The transmitter might need service. Contact Micro Motion.
A016	Line RTD Temperature Out-Of-Range Line RTD Temperature Out-of-Range	The value computed for the resistance of the Line RTD is outside limits	• Check the sensor RTD circuitry. See Section 10.24. • Verify that process temperature is within range of sensor and transmitter. • If the problem persists, contact Micro Motion.
A020	Calibration Factors Unentered Calibration Factors Unentered (FlowCal)	The flow calibration factor and/or K1 has not been entered since the last master reset.	• Check the characterization. Specifically, verify the FCF and K1 values. See Section 4.2. • If the problem persists, contact Micro Motion.

Table 10-3 Status alarms and remedies *continued*

Alarm code	Communicator / ProLink II	Cause	Suggested remedy
A021	Unrecognized/ Unentered Sensor Type Incorrect Sensor Type (K1)	The sensor is recognized as a straight tube but the K1 value indicates a curved tube, or vice versa.	• Check the characterization. Specifically, verify the FCF and K1 values. See Section 4.2. • Check the sensor RTD circuitry. See Section 10.24. • If the problem persists, contact Micro Motion.
A029	Internal Communication Failure PIC/Daughterboard Communication Failure	Transmitter electronics failure	• Cycle power to the flowmeter. • Contact Micro Motion.
A030	Hardware/Software Incompatible Incorrect Board Type	The loaded software is not compatible with the programmed board type.	• Contact Micro Motion.
A031	Undefined Low Power	The transmitter is not receiving enough power.	• Check power supply to transmitter. See Section 10.14.1. • If the alarm is appearing and disappearing frequently, check the mA Fault Action setting. If it is set to Upscale: consider a lower setting for fault level, consider changing the fault action to another setting (e.g., Internal Zero), or consider increasing the power supply to the transmitter. See Section 10.7.
A033	Tube Not Full Tube Not Full	No signal from LPO or RPO, suggesting that sensor tubes are not vibrating.	• Verify process. Check for air in the flow tubes, tubes not filled, foreign material in tubes, or coating in tubes.
A100	Primary mA Output Saturated Primary mA Output Saturated	The calculated amount of current output is outside of the linear range.	• See Section 10.18.
A101	Primary mA Output Fixed Primary mA Output Fed	Non-zero HART address configured, or user has fixed the mA output.	• Check the HART address. If non-zero, enable Loop Current Mode parameter. See Section 10.19. • Exit mA output trim. See Section 7.4. • Exit mA output loop test. See Section 7.3. • Check to see if the output has been fixed via digital communication.
A102	Drive Over-Range Drive Overrange	The drive power (current/voltage) is at its maximum	• Excessive drive gain. See Section 10.23.2. • Check the sensor circuitry. See Section 10.24. • If this is the only active alarm, it can be ignored. If desired, reconfigure the alarm severity to Ignore (see Section 5.3.1).
A104	Calibration-In-Progress Calibration in Progress	A calibration procedure is in progress.	• Allow the flowmeter to complete calibration. • For zero calibration procedures, you may abort the calibration, set the zero time parameter to a lower value, and restart the calibration.
A105	Slug Flow Slug Flow	The density has exceeded the user-defined slug (density) limits.	• See Section 10.17.

Table 10-3 Status alarms and remedies *continued*

Alarm code	Communicator / ProLink II	Cause	Suggested remedy
A106	Burst Mode Enabled	Device is in HART burst mode.	• No action required. • If desired, reconfigure the alarm severity to Ignore (see Section 5.3.1).
	Burst Mode Enabled/AI or AO Simulate Active		
A107	Power Reset Occurred	The transmitter has been restarted.	• No action required. • If desired, reconfigure the alarm severity to Ignore (see Section 5.3.1).
	Power Reset Occurred		
A132	Simulation Mode Active	Simulation mode is enabled.	• Disable sensor simulation. See Section 7.5.
	Simulation Mode Active		

10.13 Checking process variables

Micro Motion suggests that you make a record of the process variables listed below, under normal operating conditions. This will help you recognize when the process variables are unusually high or low.

- Flow rate
- Density
- Temperature
- Tube frequency
- Pickoff voltage
- Drive gain

For troubleshooting, check the process variables under both normal flow and tubes-full no-flow conditions. Except for flow rate, you should see little or no change between flow and no-flow conditions. If you see a significant difference, record the values and contact Micro Motion customer service for assistance.

Unusual values for process variables may indicate a variety of different problems. Table 10-4 lists several possible problems and suggested remedies.

Table 10-4 Process variables problems and remedies

Symptom	Cause	Suggested remedy
Steady non-zero flow rate under no-flow conditions	Misaligned piping (especially in new installations)	• Correct the piping.
	Open or leaking valve	• Check or correct the valve mechanism.
	Bad sensor zero	• Rezero the flowmeter. See Section 7.2.

Table 10-4 Process variables problems and remedies *continued*

Symptom	Cause	Suggested remedy
Erratic non-zero flow rate under no-flow conditions	Leaking valve or seal	• Check pipeline.
	Slug flow	• See Section 10.17.
	Plugged flow tube	• Check drive gain and tube frequency. Purge the flow tubes.
	Incorrect sensor orientation	• Sensor orientation must be appropriate to process fluid. See the installation manual for your sensor.
	Wiring problem	• Check the sensor circuitry. See Section 10.24.
	Vibration in pipeline at rate close to sensor tube frequency	• Check environment and remove source of vibration.
	Damping value too low	• Check configuration. See Section 4.10.
	Mounting stress on sensor	• Check sensor mounting. Ensure: - Sensor is not being used to support pipe. - Sensor is not being used to correct pipe misalignment. - Sensor is not too heavy for pipe.
	Sensor cross-talk	• Check environment for sensor with similar (±0.5 Hz) tube frequency.
Erratic non-zero flow rate when flow is steady	Slug flow	• See Section 10.17.
	Damping value too low	• Check configuration. See Section 4.10.
	Plugged flow tube	• Check drive gain and tube frequency. Purge the flow tubes.
	Excessive or erratic drive gain	• See Section 10.23.2
	Output wiring problem	• Verify wiring between transmitter and receiving device. See the installation manual for your transmitter.
	Problem with receiving device	• Test with another receiving device.
	Wiring problem	• Check the sensor circuitry. See Section 10.24.
Inaccurate flow rate or batch total	Bad flow calibration factor	• Verify characterization. See Section 4.2.
	Inappropriate measurement unit	• Check configuration. See Section 10.20.
	Bad sensor zero	• Rezero the flowmeter. See Section 7.2.
	Bad density calibration factors	• Verify characterization. See Section 4.2.
	Bad flowmeter grounding	• See Section 10.14.2.
	Slug flow	• See Section 10.17.
	Problem with receiving device	• See Section 10.16.
	Wiring problem	• Check the sensor circuitry. See Section 10.24.

Table 10-4 Process variables problems and remedies *continued*

Symptom	Cause	Suggested remedy
Inaccurate density reading	Problem with process fluid	• Use standard procedures to check quality of process fluid.
	Bad density calibration factors	• Verify characterization. See Section 4.2.
	Wiring problem	• Check the sensor circuitry. See Section 10.24.
	Bad flowmeter grounding	• See Section 10.14.2.
	Slug flow	• See Section 10.17.
	Sensor cross-talk	• Check environment for sensor with similar (±0.5 Hz) tube frequency.
	Plugged flow tube	• Check drive gain and tube frequency. Purge the flow tubes.
	Incorrect sensor orientation	• Sensor orientation must be appropriate to process fluid. See the installation manual for your sensor.
	RTD failure	• Check for alarm conditions and follow troubleshooting procedure for indicated alarm.
	Physical characteristics of sensor have changed	• Check for corrosion, erosion, or tube damage.
Temperature reading significantly different from process temperature	RTD failure	• Check for alarm conditions and follow troubleshooting procedure for indicated alarm.
Temperature reading slightly different from process temperature	Sensor leaking heat	• Insulate the sensor.
Unusually high density reading	Plugged flow tube	• Check drive gain and tube frequency. Purge the flow tubes.
	Incorrect K2 value	• Verify characterization. See Section 4.2.
Unusually low density reading	Slug flow	• See Section 10.17.
	Incorrect K2 value	• Verify characterization. See Section 4.2.
Unusually high tube frequency	Sensor erosion	• Contact Micro Motion.
Unusually low tube frequency	Plugged flow tube, corrosion, or erosion	• Purge the flow tubes.
Unusually low pickoff voltages	Several possible causes	• See Section 10.23.3.
Unusually high drive gain	Several possible causes	• See Section 10.23.2.

10.14 Diagnosing wiring problems

Use the procedures in this section to check the transmitter installation for wiring problems.

10.14.1 Checking the power supply wiring

To check the power supply wiring:

1. Verify that the power supply wires are making good contact, and are not clamped to the wire insulation.
2. Verify that the supply voltage to the loop is in conformance with the power supply requirements specified in the transmitter installation manual.

10.14.2 Checking grounding

The sensor / transmitter assembly must be grounded. See your sensor installation manual for grounding requirements and instructions.

10.14.3 Checking the HART communication loop

To check the HART communication loop:

1. Verify that the loop wires are connected as shown in the wiring diagrams in the transmitter installation manual.
2. If a barrier or the Micro Motion adapter-barrier is installed:
   - Ensure that the active/passive power configuration of the barrier matches the wiring. If external power is being used, verify the power supply to the barrier.
   - Test HART communications on both sides of the barrier, and verify that the barrier is capable of passing HART communication signals.
3. If you are connecting directly to the HART clips, ensure that there is no loop resistance on these terminals.

If your HART network is more complex than the wiring diagrams in the transmitter installation manual, either:

- Contact Micro Motion.
- Contact the HART Communication Foundation or refer to the *HART Application Guide*, available from the HART Communication Foundation on the Internet at www.hartcomm.org.

10.15 Checking the communication device

Ensure that your communication device is compatible with your transmitter.

Communicator

The 375 Field Communicator is required, and must contain the appropriate device description. The device description for the Model 2400S transmitter with analog outputs is as follows:

Micro Motion 2200S Analog dev rev 1 DD rev 1

To check the device descriptions:

1. Turn on the Communicator, but do not connect it to the transmitter.
2. When the words **No device found** appear, press **OK**.
3. Select **OFFLINE**.

4. Select **New Configuration**.
5. Select **Micro Motion**.
6. Ensure that the required device description is listed.

If the correct device description is not found, a Generic Device menu is displayed. Contact Micro Motion to obtain the correct device description.

ProLink II

ProLink II v2.8 or later is required. To check the version of ProLink II:

1. Start ProLink II.
2. Open the **Help** menu.
3. Click on **About ProLink**.

10.16 Checking the output wiring and receiving device

If you receive an inaccurate mA reading, there may be a problem with the output wiring, the output scaling, or the receiving device.

- Check the output level at the transmitter.
- Review the information on mA output scales (see Section 3.4) and verify that the receiving device is programmed to interpret the mA output correctly.
- Check the wiring between the transmitter and the receiving device, including all wiring at the I.S. barrier or Micro Motion adapter-barrier (if applicable).
- If an I.S. barrier or Micro Motion adapter-barrier is installed, test the signal between the transmitter and the barrier, then between the barrier and the receiving device.
- If required, trim the mA output or calibrate the barrier.
- Try a different receiving device.
- Use sensor simulation to locate the problem. See Section 10.11.

10.17 Checking slug flow

A slug flow alarm is posted whenever the measured process density is outside the configured slug flow limits (i.e., density is higher or lower than the configured normal range). Slug flow is typically caused by gas in a liquid process or liquid in a gas process. See Section 4.7.4 for a discussion of slug flow functionality.

If slug flow occurs:

- Check the process for cavitation, flashing, or leaks.
- Change the sensor orientation.
- Monitor density.
- If desired, enter new slug flow limits (see Section 4.7.4).
  - Raising the low slug flow limit or lowering the high slug flow limit will increase the possibility of slug flow conditions.
  - Lowering the low slug flow limit or raising the high slug flow limit will decrease the possibility of slug flow conditions.
- If desired, increase slug duration (see Section 4.7.4).

10.18 Checking output saturation

If an output variable exceeds the upper range limit or goes below the lower range limit, the transmitter produces an output saturation alarm. The alarm can mean:

- The process is outside normal operational limits.
- Sensor flow tubes are not filled with process fluid.
- Sensor flow tubes are plugged.

If an output saturation alarm occurs:

- Check the process.
- Bring the flow rate within the sensor limit.
- Check the sensor:
  - Ensure that flow tubes are full.
  - Purge flow tubes.
- Verify or change the mA URV and LRV (see Section 6.2.2).

10.19 Checking the HART address and Loop Current Mode parameter

If the transmitter's HART address is set to a non-zero number, the mA output may be fixed at 4 mA. In this situation:

- The primary mA output will not report process variable data.
- The primary mA output will not indicate fault conditions.

To resolve this problem, try the following:

- Enable the Loop Current Mode parameter. See Section 6.3.2.
- Set the HART address to 0. See Section 3.3.

10.20 Checking the flow measurement configuration

If the transmitter appears to be operating correctly but the flow data is unexpected:

- Ensure that the transmitter is using the measurement unit that the remote device is expecting. Check the abbreviations; for example, *g/min* represents grams per minute, not gallons per minute.
- Ensure that your receiving device is scaling the mA data appropriately: either from 12 to 20 mA or from 4 to 20 mA. See Section 3.4.
- Ensure that the LRV and URV are set correctly for your process and receiving device. See Section 6.2.2.

10.21 Checking the characterization

A transmitter that is incorrectly characterized for its sensor might produce inaccurate output values. Both the K1 and FCF values must be appropriate for the sensor. If these values are incorrect, the sensor may not drive correctly or may send inaccurate process data.

If you discover that any of the characterization parameters are wrong, perform a complete characterization. See Section 4.2.

10.22 Checking the calibration

Improper calibration can cause the transmitter to send unexpected output values. If the transmitter appears to be operating correctly but sends inaccurate output values, an improper calibration may be the cause.

Micro Motion calibrates every transmitter at the factory. Therefore, you should suspect improper calibration only if the transmitter has been calibrated after it was shipped from the factory. Before performing a calibration, consider meter validation or meter verification and select the appropriate procedure (see Section 9.2). Contact Micro Motion customer service for assistance.

10.23 Checking the test points

Some status alarms that indicate a sensor failure or overrange condition can be caused by problems other than a failed sensor. You can diagnose sensor failure or overrange status alarms by checking the flowmeter test points. The *test points* include left and right pickoff voltages, drive gain, and tube frequency. These values describe the current operation of the sensor.

10.23.1 Obtaining the test points

You can obtain the test points with a Communicator or ProLink II.

With a Communicator

To obtain the test points with a Communicator:

1. Select **Diag/Service**.
2. Select **Test Points**.
3. Record the values displayed for **Drive**, **LPO**, **RPO**, and **Tube**

With ProLink II

To obtain the test points with ProLink II:

1. Select **Diagnostic Information** from the **ProLink** menu.
2. Record the values displayed for **Tube Frequency**, **Left Pickoff**, **Right Pickoff**, and **Drive Gain**.

10.23.2 Drive gain problems

Problems with drive gain can appear in several different forms:

- Saturated or excessive (near 100%) drive gain
- Erratic drive gain (e.g., rapid shifting from positive to negative)
- Negative drive gain

See Table 10-5 for a list of possible problems and remedies.

Table 10-5 Drive gain problems, causes, and remedies

Cause	Possible remedy
Excessive slug flow	• See Section 10.17.
Entrained air	• Correct the process.
Cavitation or flashing	• Increase inlet or back pressure at the sensor. • If a pump is located upstream from the sensor, increase the distance between the pump and sensor.
Plugged flow tube	• Purge the flow tubes.
Mechanical binding of sensor tubes	• Ensure sensor tubes are free to vibrate. Possible problems include: - Pipe stress. Check for pipe stress and eliminate if present. - Lateral tube shift due to hammer effect. If this is a possibility, contact Micro Motion. - Warped tubes caused by overpressurization. If this is a possibility, contact Micro Motion.
Incorrect sensor type configured	• Verify sensor type configuration, then verify sensor characterization. See Section 4.2.
Open drive or left pickoff sensor coil	• Contact Micro Motion.
Drive board or module failure, cracked flow tube, or sensor imbalance	• Contact Micro Motion.

10.23.3 Low pickoff voltage

Low pickoff voltage can be caused by several problems. See Table 10-6.

Table 10-6 Low pickoff voltage causes and remedies

Cause	Possible remedy
Slug flow	• See Section 10.17.
No tube vibration in sensor	• Check for plugging.
Moisture in the sensor electronics	• Eliminate the moisture in the sensor electronics.
Damaged sensor	• Ensure sensor is free to vibrate (no mechanical binding). Possible problems include: - Pipe stress. Check for pipe stress and eliminate if present. - Lateral tube shift due to hammer effect. If this is a possibility, contact Micro Motion. - Warped tubes caused by overpressurization. If this is a possibility, contact Micro Motion. • Test sensor circuitry. See Section 10.24. • Contact Micro Motion.

10.24 Checking sensor circuitry

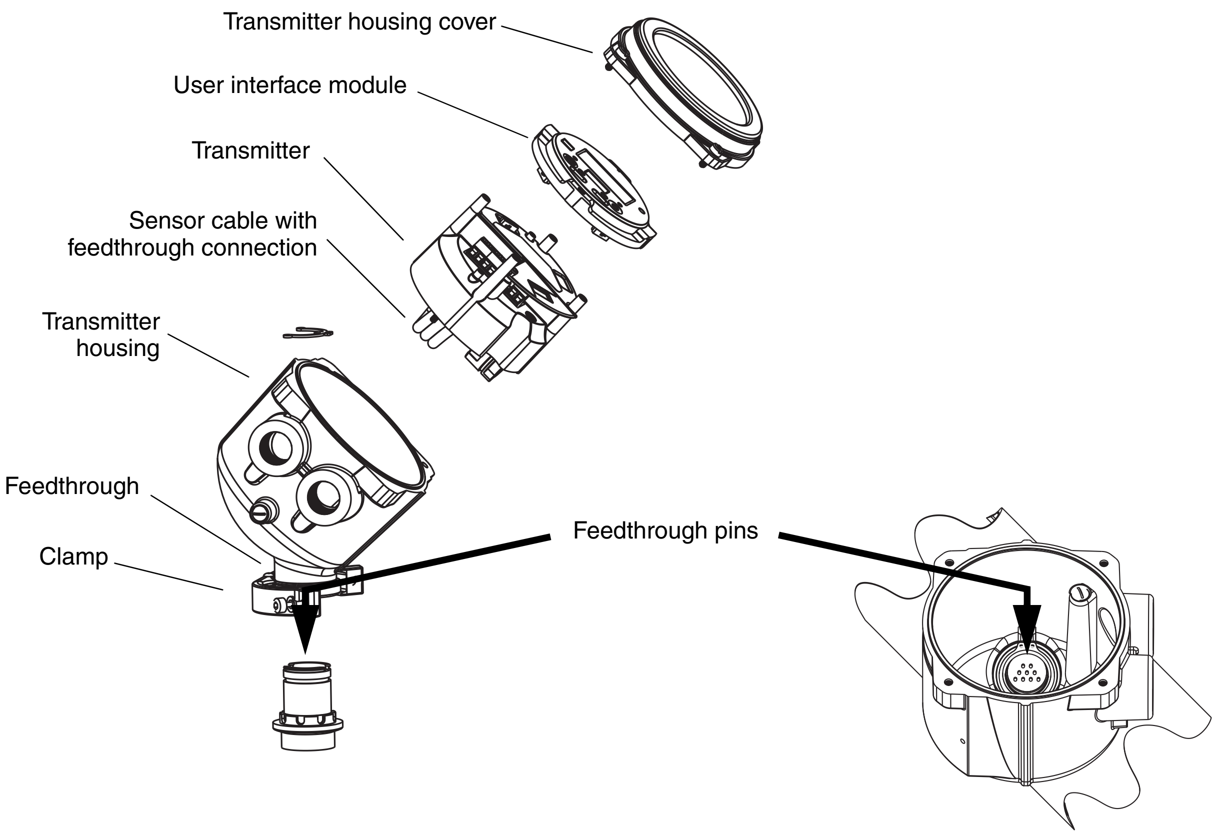
Problems with sensor circuitry can cause several alarms, including sensor failure and a variety of out-of-range conditions. Testing involves:

- Inspecting the cable that connects the transmitter to the sensor
- Measuring the resistances of the sensor's pin pairs and RTDs
- Ensuring that the circuits are not shorted to each other or to the sensor case

Note: To check the sensor circuitry, you must remove the transmitter from the sensor. Before performing this test, ensure that all other applicable diagnostics have been performed. Diagnostic capabilities of the Model 2200S transmitter have been greatly enhanced, and may provide more useful information than these tests.

1. Power down the transmitter.
2. If the transmitter is in a hazardous environment, wait five minutes.
3. To access the sensor cable and feedthrough:
   a. Referring to Figure 10-1, loosen the four captive user interface cover screws and remove the transmitter housing cover.
   b. Loosen the two captive user interface screws.
   c. Gently lift the user interface module, disengaging it from the connector on the transmitter.
   d. Disconnect the I/O wires from the I/O terminals (terminals 1–4).
   e. Loosen the Warning flap screw, raise the Warning flap, and disconnect the power wires from the power terminals.
   f. Two captive screws (2.5 mm hex head) hold the transmitter in the housing. Loosen the screws and gently lift the transmitter away from the housing. Allow the transmitter to hang temporarily.
   g. Ensure that the cable is fully plugged in and making a good connection. If it was not, reseat the cable, reassemble the transmitter and sensor, and check operation.
   h. Unplug the cable from the feedthrough by pinching the wings on the sensor connection, then pulling the connector away from the feedthrough. Set the transmitter aside.
   i. Check the cable for any signs of damage.

Figure 10-1 **Accessing the feedthrough pins**



4. Using a digital multimeter (DMM), check the sensor internal resistances for each flowmeter circuit. Table 10-7 defines the flowmeter circuits and the resistance range for each. Refer to Figure 10-2 to identify the feedthrough pins. For each circuit, place the DMM leads on the pin pairs and record the values.

Note: In order to access all feedthrough pins, you may need to remove the clamp and rotate the transmitter to a different position.

In this test:

- There should be no open circuits, i.e., no infinite resistance readings.
- Nominal resistance values vary 40% per 100 °C. However, confirming an open or shorted circuit is more important than any slight deviation from the resistance values shown here.
- The LPO and RPO circuit readings should be the same or very close (± 10%).
- The readings across pin pairs should be steady.
- Actual resistance values depend on the sensor model and date of manufacture. Contact Micro Motion for more detailed data.

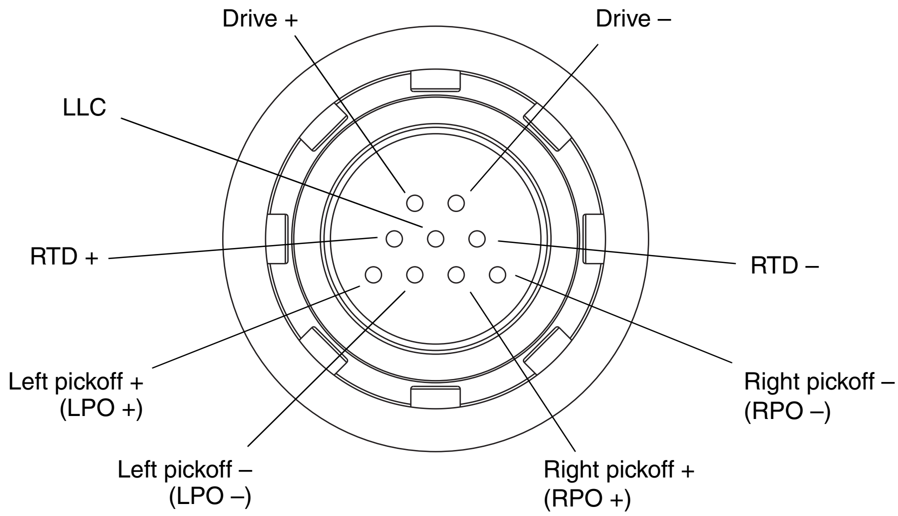
If a problem appears, or if any resistance is out of range, contact Micro Motion.

Table 10-7 Nominal resistance ranges for flowmeter circuits

Circuit	Pin pairs	Nominal resistance range(1)
Drive	Drive + and –	8–1500 Ω
Left pickoff	Left pickoff + and –	16–1000 Ω
Right pickoff	Right pickoff + and –	16–1000 Ω
Flow tube temperature sensor	RTD + and RTD –	100 Ω at 0 °C + 0.38675 Ω / °C
LLC/RTD		
• T-Series sensors	RTD – and composite RTD	300 Ω at 0 °C + 1.16025 Ω / °C
• CMF400 I.S. sensors	RTD – and fixed resistor	39.7–42.2 Ω
• F300 sensors	RTD – and fixed resistor	44.3–46.4 Ω
• All other sensors	RTD – and LLC	0

(1) Actual resistance values depend on the sensor model and date of manufacture. Contact Micro Motion for more detailed data.

Figure 10-2 Feedthrough pins



5. Using the DMM, check each pin as follows:
   a. Check between the pin and the sensor case.
   b. Check between the pin and other pins as described below:
      - Drive + against all other pins except Drive –
      - Drive – against all other pins except Drive +
      - Left pickoff + against all other pins except LPO –
      - Left pickoff – against all other pins except LPO +
      - Right pickoff + against all other pins except RPO –
      - Right pickoff – against all other pins except RPO +
      - RTD + against all other pins except RTD – and LLC/RTD
      - RTD – against all other pins except RTD + and LLC/RTD
      - LLC/RTD against all other pins except RTD + and RTD –

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 or a short between pins. See Table 10-8 for possible causes and solutions. If the problem is not resolved, contact Micro Motion.

Table 10-8 Sensor and cable short to case causes and remedies

Cause	Possible remedy
Moisture inside the transmitter housing	• Make sure that the transmitter housing is dry and no corrosion is present.
Liquid or moisture inside the sensor case	• Contact Micro Motion.
Internally shorted feedthrough (sealed passage for wiring from sensor to transmitter)	• Contact Micro Motion.
Faulty cable connecting sensor to transmitter	• Visually inspect the cable for damage. To replace cable, contact Micro Motion.

To return to normal operation:

1. Reach inside the transmitter housing and install the transmitter's sensor connection onto the feedthrough:
   a. Rotate the connector until it engages the pins.
   b. Push down until the wings engage and the red color is no longer visible.
2. Replace the transmitter in the transmitter housing, and tighten the screws.
3. Reconnect the I/O wires.
4. Reconnect the power wires, lower the Warning flap, and tighten the Warning flap screw.
5. Plug the user interface module onto the transmitter. There are four possible positions; select the position that is most convenient.
6. Tighten the user interface screws.
7. Replace the user interface cover on the user interface module, and tighten the screws.

Appendix A
Default Values and Ranges

A.1 Overview

This appendix provides information on the default values for most transmitter parameters. Where appropriate, valid ranges are also defined.

These default values represent the transmitter configuration after a master reset. Depending on how the transmitter was ordered, certain values may have been configured at the factory.

A.2 Most frequently used defaults and ranges

The table below contains the default values and ranges for the most frequently used transmitter settings.

Table A-1 Transmitter default values and ranges

Type	Setting	Default	Range	Comments
Flow	Flow direction	Forward		
	Flow damping	0.64 sec	0.0 – 60.0 sec	User-entered value is corrected to nearest lower value in list of preset values. For gas applications, Micro Motion recommends a minimum value of 2.56.
	Mass flow units	g/s		
	Mass flow cutoff	0.0 g/s		Recommended setting is 5% of the sensor's rated maximum flowrate.
	Volume flow type	Liquid		
	Volume flow units	L/s		
	Volume flow cutoff	0.0 L/s	0.0 – *x* L/s	*x* is obtained by multiplying the flow calibration factor by 0.2, using units of L/s.
	GSV cutoff	0.0		
Meter factors	Mass factor	1.00000		
	Density factor	1.00000		
	Volume factor	1.00000		

Table A-1 Transmitter default values and ranges *continued*

Type	Setting	Default	Range	Comments
Density	Density damping	1.28 sec	0.0 – 60.0 sec	User-entered value is corrected to nearest value in list of preset values.
	Density units	g/cm^3		
	Density cutoff	0.2 g/cm^3	0.0 – 0.5 g/cm^3	
	D1	0.00000		
	D2	1.00000		
	K1	1000.00		
	K2	50,000.00		
	FD	0.00000		
	Temp Coefficient	4.44		
Slug flow	Slug flow low limit	0.0 g/cm^3	0.0 – 10.0 g/cm^3	
	Slug flow high limit	5.0 g/cm^3	0.0 – 10.0 g/cm^3	
	Slug duration	0.0 sec	0.0 – 60.0 sec	
Temperature	Temperature damping	4.8 sec	0.0 – 80.0 sec	User-entered value is corrected to nearest lower value in list of preset values.
	Temperature units	Deg C		
	Temperature calibration factor	1.00000T0.0000		
T-Series sensor	D3	0.00000		
	D4	0.00000		
	K3	0.00000		
	K4	0.00000		
	FTG	0.00000		
	FFQ	0.00000		
	DTG	0.00000		
	DFQ1	0.00000		
	DFQ2	0.00000		
Special units	Base mass unit	g		
	Base mass time	sec		
	Mass flow conversion factor	1.00000		
	Base volume unit	L		
	Base volume time	sec		
	Volume flow conversion factor	1.00000		
	Base GSV time	min		
	Base GSV unit	SCF		
	GSV conversion factor	1.00000		
Variable mapping	Primary variable	Mass flow		
	Secondary variable	Density		
	Tertiary variable	Mass flow		
	Quaternary variable	Volume flow		

Table A-1 Transmitter default values and ranges *continued*

Type	Setting	Default	Range	Comments
mA output	Primary variable	Mass flow		
	LRV	–200.00000 g/s		Automatically reset when primary variable is reset.
	URV	200.00000 g/s		Automatically reset when primary variable is reset.
	AO cutoff	0.00000 g/s		
	AO added damping	0.00000 sec	0 – 440 seconds	
	Fault action	Downscale		
	AO fault level – downscale	2.0 mA	1.0 – 3.6 mA	
	AO fault level – upscale	22 mA	21.0 – 24.0 mA	
	Last measured value timeout	0.00 sec		
Display	Update period	200 milliseconds	100 – 10,000 milliseconds	
	Variable 1	Mass flow rate		
	Variable 2	Mass total		
	Variable 3	Volume flow rate		
	Variable 4	Volume total		
	Variable 5	Density		
	Variable 6	Temperature		
	Variable 7	Drive gain		
	Variable 8–15	None		
	Alarm menu	Enabled		
	Offline password	1234		
	Auto scroll	Disabled		
	Auto scroll rate	10 sec		

Appendix B
Flowmeter Installation Types and Components

B.1 Overview

This appendix provides illustrations of transmitter components and wiring, for use in troubleshooting. For detailed information on installation and wiring procedures, see the transmitter installation manual.

B.2 Transmitter components

The Model 2200S transmitter can be either integral-mount or extended-mount.

- Figure B-1 shows an exploded view of the Model 2200S transmitter and its components, integral-mount.
- Figure B-2 shows the extended-mount option.

Figure B-1 Model 2200S transmitter – Integral-mount, exploded view

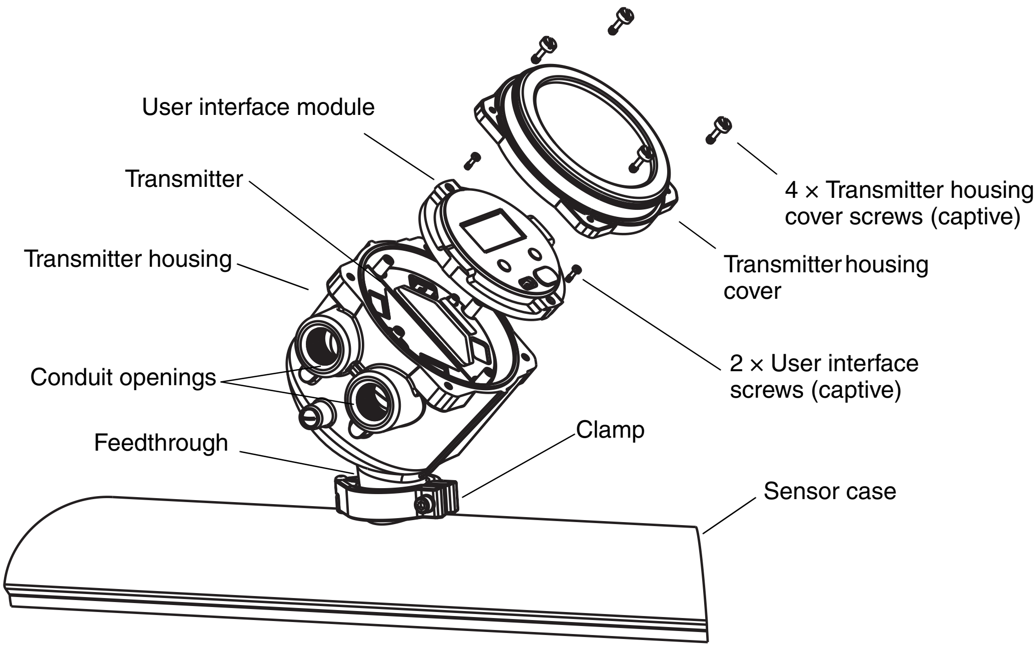
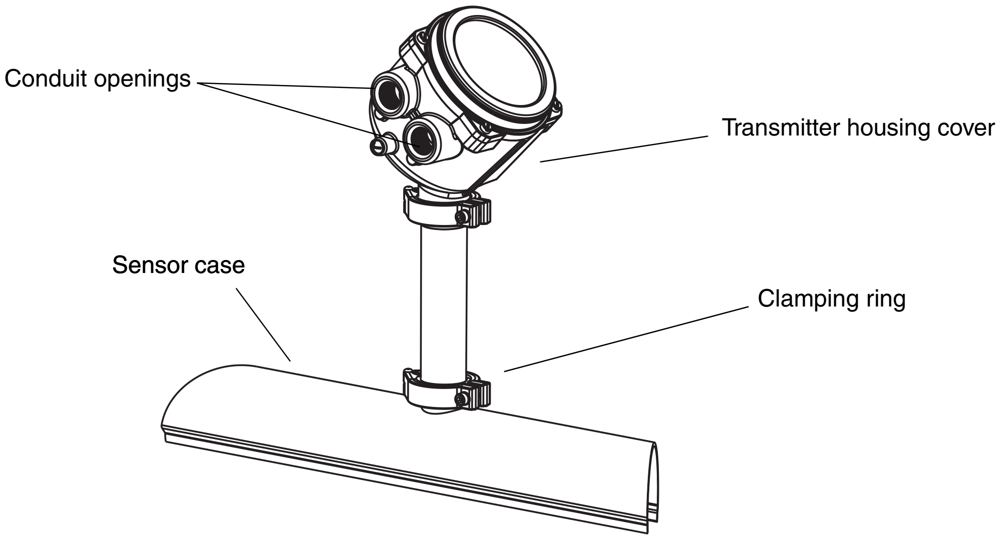


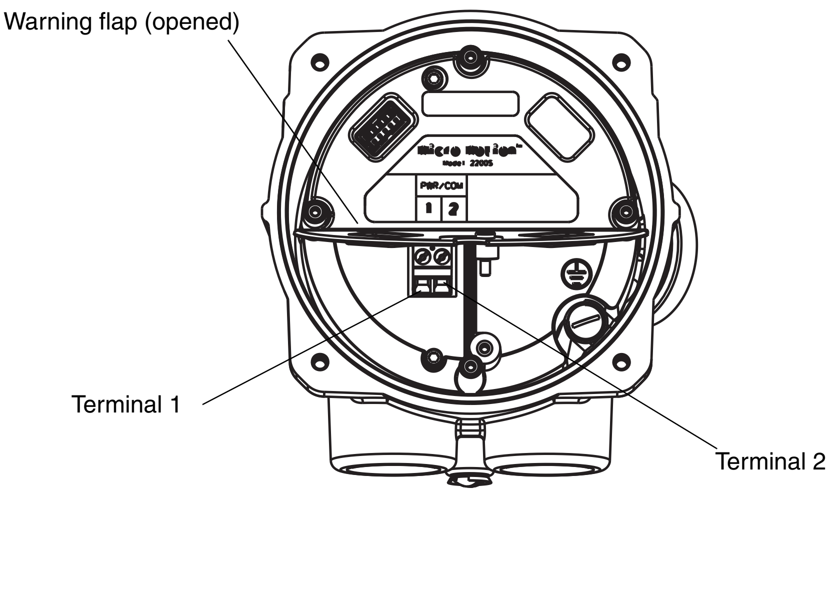
Figure B-2 Model 2200S transmitter – Extended-mount



B.3 Terminal diagrams

Figure B-3 shows the transmitter's wiring terminals. These terminals are used for both power supply and I/O. They are beneath the Warning flap. The transmitter housing cover and the Warning flap screw must be removed to access the wiring terminals.

Figure B-3 Wiring terminals



Appendix C
Model 2200S Display and User Interface

C.1 Overview

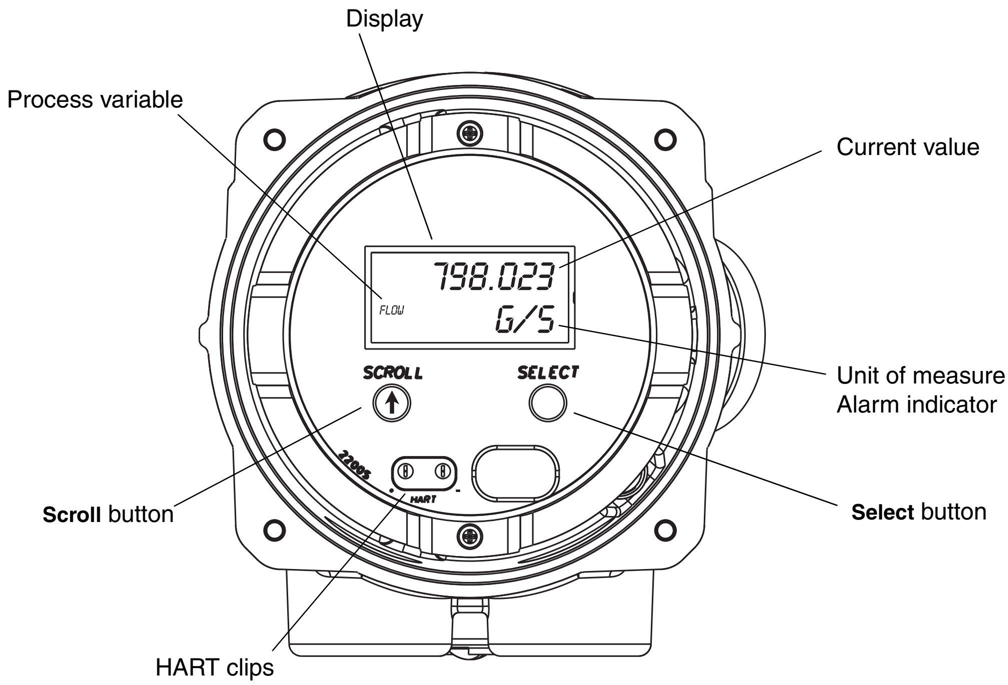
This appendix describes the display user interface of the Model 2200S transmitter. The following topics are discussed:

- Identifying the components of the user interface – see Section C.2
- Removing and replacing the transmitter housing cover – see Section C.3
- Using the display – see Section C.4
- Codes and abbreviations used by the display – see Section C.5

C.2 Identifying the components of the user interface

The user interface of the Model 2200S transmitter is shown in Figure C-1. The transmitter housing cover has been removed.

Figure C-1 User interface



The user interface components have the following functions:

- Display – displays process data
- **Scroll** and **Select** buttons – used to navigate the display and the display menu system
- HART clips – used to make a HART administrative connection to the transmitter, typically from ProLink II or the Communicator

C.3 Removing and replacing the transmitter housing cover

For some procedures, you must remove the transmitter housing cover. To remove the transmitter housing cover:

1. Remove power from the unit.
2. Loosen the four captive screws.
3. Lift the transmitter housing cover away from the transmitter.

When replacing the transmitter housing cover, be sure to tighten the screws so that no moisture can enter the transmitter housing.

C.4 Using the display, the buttons, and the display menu system

For information on reading process variables values from the display, see Section 8.5.1.

For information on reading alarm information from the display, see Section 8.6.2.

In general:

- The **Scroll** button moves to the next item in the display menu.
- The **Select** button selects the current item for use.

To use the buttons:

1. Remove the transmitter housing cover, as described in Section C.3.
2. Press the button. You will see the result of your action on the display. There is no other confirmation.

C.4.1 Accessing the display menu system

To access the display menu system:

1. Press **Scroll** and **Select** simultaneously for four seconds.
2. If the off-line password has been enabled, the word **CODE?** appears at the top of the password screen. Enter the digits of the password one at a time by using **Scroll** to choose a number and **Select** to move to the next digit.

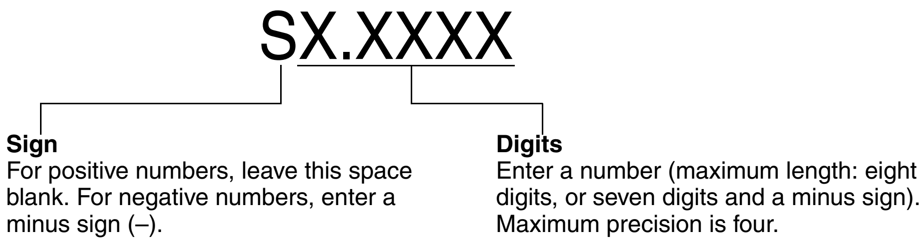
Note: If you encounter the off-line password screen but do not know the password, wait 60 seconds without pressing a button. The password screen will time out automatically and you will be returned to the previous screen.

Depending on the display configuration, you will be taken to either the alarm menu or the off-line maintenance menu. The structure of the display menu system is provided in Figures 2-10 through 2-17.

C.4.2 Entering floating-point values from the display menus

Certain configuration values, such as meter factors or output ranges, are entered as floating-point values. When you first enter the configuration screen, the value is displayed in decimal notation (as shown in Figure C-2) and the active digit is flashing.

Figure C-2 **Numeric values in decimal notation**



To change the value:

1. **Select** to move one digit to the left. From the leftmost digit, a space is provided for a sign. The sign space wraps back to the rightmost digit.
2. **Scroll** to change the value of the active digit: **1** becomes **2**, **2** becomes **3**, ..., **9** becomes **0**, **0** becomes **1**. For the rightmost digit, an **E** option is included to switch to exponential notation.

To change the sign of a value:

1. **Select** to move to the space that is immediately left of the leftmost digit.
2. Use **Scroll** to specify – (for a negative value) or [blank] (for a positive value).

In decimal notation, you can change the position of the decimal point up to a maximum precision of four (four digits to the right of the decimal point). To do this:

1. **Select** until the decimal point is flashing.
2. **Scroll.** This removes the decimal point and moves the cursor one digit to the left.
3. **Select** to move one digit to the left. As you move from one digit to the next, a decimal point will flash between each digit pair.
4. When the decimal point is in the desired position, **Scroll.** This inserts the decimal point and moves the cursor one digit to the left.

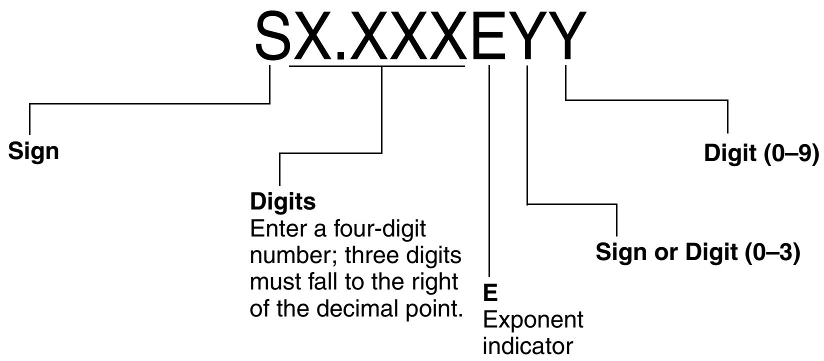
To change from decimal to exponential notation (see Figure C-3):

1. **Select** until the rightmost digit is flashing.
2. **Scroll** to **E**, then **Select**. The display changes to provide two spaces for entering the exponent.
3. To enter the exponent:
   a. **Select** until the desired digit is flashing.
   b. **Scroll** to the desired value. You can enter a minus sign (first position only), values between 0 and 3 (for the first position in the exponent), or values between 0 and 9 (for the second position in the exponent).
   c. **Select**.

Note: When switching between decimal and exponential notation, any unsaved edits are lost. The system reverts to the previously saved value.

Note: While in exponential notation, the positions of the decimal point and exponent are fixed.

Figure C-3 Numeric values in exponential notation



To change from exponential to decimal notation:

1. **Select** until the **E** is flashing.
2. **Scroll** to **d**.
3. **Select**. The display changes to remove the exponent.

To exit the menu:

- If the value has been changed, **Select** and **Scroll** simultaneously until the confirmation screen is displayed.
  - **Select** to apply the change and exit.
  - **Scroll** to exit without applying the change.
- If the value has not been changed, **Select** and **Scroll** simultaneously until the previous screen is displayed.

C.5 Codes and abbreviations

Table C-1 lists and defines the codes and abbreviations that are used for display variables.

Table C-2 lists and defines the codes and abbreviations that are used in the off-line menu.

Note: These tables do not list terms that are spelled out completely, or codes that are used to identify measurement units. For the codes that are used to identify measurement units, see Chapter 4.

Table C-1 Codes used for display variables

Code or abbreviation	Definition	Comment or reference
AVE_D	Average density	
AVE_T	Average temperature	
BRD T	Board temperature	
DGAIN	Drive gain	
GSV F	Gas standard volume flow	
GSV I	Gas standard volume flow inventory	
LPO_A	Left pickoff amplitude	
LVOLI	Volume inventory	
LZERO	Live zero flow	
MASSI	Mass inventory	
MTR T	Case temperature	
PWRIN	Input voltage	Refers to power input to the core processor
RPO A	Right pickoff amplitude	
TUBEF	Raw tube frequency	
WTAVE	Weighted average	

Table C-2 Codes used in off-line menu

Code or abbreviation	Definition	Comment or reference
ACK	Display Ack All menu	
ACK ALARM	Acknowledge alarm	
ACK ALL	Acknowledge all	
AO	Analog output	
ADDR	Address	
CAL	Calibrate	
CH A	Channel A	
CHANGE PASSW	Change password	Change the password required for access to display functions
CONFG	Configuration	
CORE	Core processor	
CUR Z	Current zero	
DENS	Density	
DRIVE%, DGAIN	Drive gain	
DISBL	Disable	**Select** to disable
DSPLY	Display	

Commissioning Operation Maintenance and Troubleshooting Appendices

Table C-2 Codes used in off-line menu *continued*

Code or abbreviation	Definition	Comment or reference
ENABL	Enable	**Select** to enable
EXTRN	External	
FAC Z	Factory zero	
FCF	Flow calibration factor	
FLDIR	Flow direction	
FLSWT, FL SW	Flow switch	
GSV	Gas standard volume	
GSV T	Gas standard volume total	
INTRN	Internal	
IO	Inputs/outputs	
LANG	Display language	
MAO	mA output	
MASS	Mass flow	
MFLOW	Mass flow	
MSMT	Measurement	
MTR F	Meter factor	
OFF-LINE MAINT	Off-line maintenance menu	
OFFLN	Display off-line menu	
PRESS	Pressure	
r.	Revision	
SENSR	Sensor	
SIM	Simulation	
SPECL	Special	
SrC	Source	Variable assignment for outputs
TEMPR	Temperature	
VER	Version	
VFLOW	Volume flow	
VOL	Volume or volume flow	
XMTR	Transmitter	

Appendix D
Connecting with ProLink II Software

D.1 Overview

ProLink II is a Windows-based configuration and management tool for Micro Motion transmitters. It provides complete access to transmitter functions and data.

This chapter provides basic information for connecting ProLink II to your transmitter. The following topics and procedures are discussed:

- Requirements – see Section D.2
- Configuration upload/download – see Section D.3
- Connecting to a Model 2200S transmitter – see Section D.4

The instructions in this manual assume that users are already familiar with ProLink II software. For more information on using ProLink II, see the ProLink II manual. The manual is available on the Micro Motion web site (www.micromotion.com).

Menu flowcharts for using ProLink II with the Model 2200S transmitter are provided in Figures 2-2 through 2-4.

D.2 Requirements

ProLink II v2.8 or later is required. In addition, you must have either the ProLink II installation kit appropriate to your PC and connection type, or the equivalent equipment. See the ProLink II manual or quick reference guide for details.

D.3 Configuration upload/download

ProLink II provides a configuration upload/download function which allows you to save configuration sets to your PC. This allows:

- Easy backup and restore of transmitter configuration
- Easy replication of configuration sets

Micro Motion recommends that all transmitter configurations be downloaded to a PC as soon as the configuration is complete. See the ProLink II manual for details.

D.4 Connecting from a PC to a Model 2200S transmitter

The Model 2200S transmitter supports only HART/Bell 202 connections. You can connect to the HART clips on the transmitter's user interface or to a HART multidrop network.

To make a HART/Bell 202 connection using ProLink II:

1. Attach the HART signal converter to the serial or USB port of your PC.
2. To connect to a HART multidrop network, connect the HART signal converter leads to any point on the network (see Figure D-1). The HART/Bell 202 connection is polarity-insensitive.

   To connect to the HART clips:

   a. Remove the transmitter housing cover (see Section C.3).

   b. Connect the HART signal converter leads to the HART clips on the face of the transmitter (see Figure D-2). The HART/Bell 202 connection is polarity-insensitive. You can connect either lead to either clip.

Note: The HART clips on the face of the transmitter are connected to the transmitter's mA/HART terminals. You may connect directly to the mA/HART terminals (terminals 1 and 2) if you have removed the user interface module.

Figure D-1 HART/Bell 202 connections to network

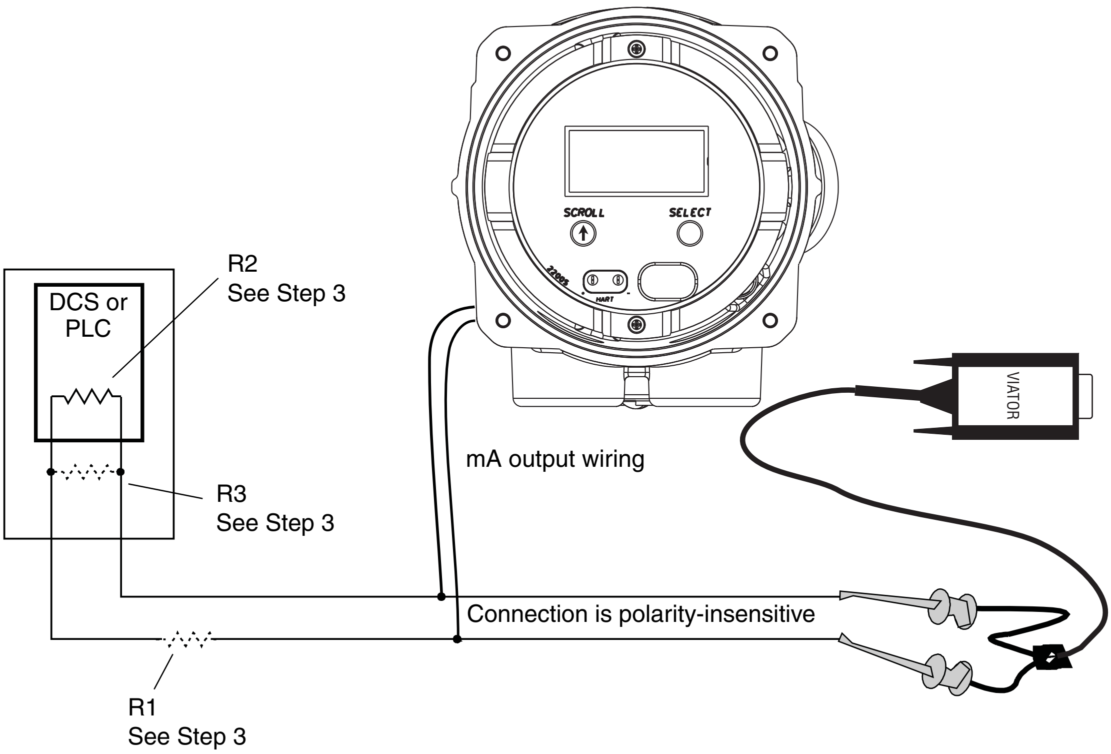
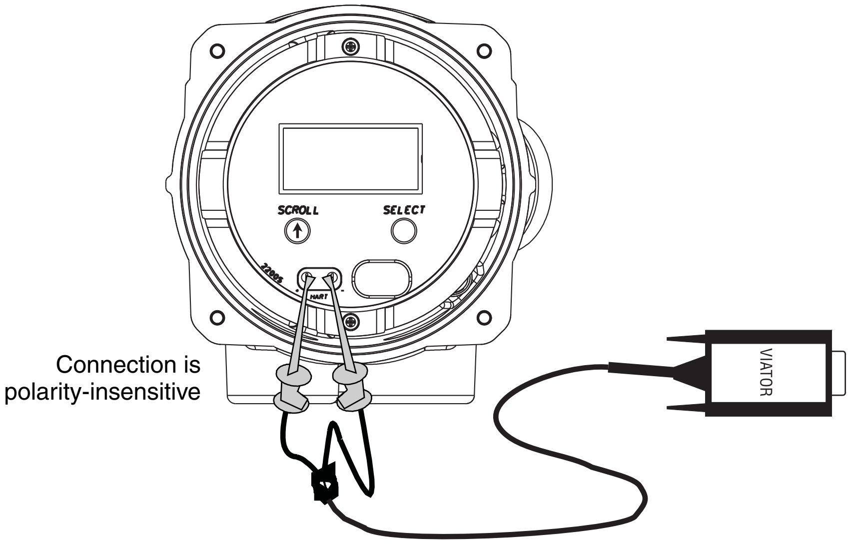


Figure D-2 **HART/Bell 202 connections to HART clips**



Note: Additional resistance may be required. See Step 3.

3. Add resistance as required. The HART signal converter must be connected across a resistance of 250–600 Ω. To meet the resistance requirements, you may use any combination of resistors R1, R2, and R3 (see Figure D-1).
4. Start ProLink II. In the Connection menu, click **Connect to Device**.
5. In the screen that appears:
   a. Set **Protocol** to **HART Bell 202**. **Baud rate**, **Stop bits**, and **Parity** are automatically set to the values required by HART protocol.
   b. If you are using a USB signal converter, enable **Converter Toggles RTS**.
   c. Set the **Address** or **Tag** value to the HART address or software tag configured for the transmitter. The default HART address is 0. See Section 3.3 for information on the HART address and software tag.
   d. Set the **Serial Port** value to the PC COM port assigned to this connection.
   e. Set **Master** as appropriate:
      - If another host such as a DCS is on the network, set **Master** to **Secondary**.
      - If no other host is on the network, set **Master** to **Primary**.

Note: The 375 Field Communicator is not a host.

Note: The ProLink II HART master implementation does not perform bus arbitration. If another device is on the HART bus, ProLink II will not connect to the transmitter.

Note: ProLink II will not connect to the transmitter if burst mode is enabled on the transmitter. For information about burst mode, see Section 6.3.4.

6. Click **Connect**. The software will attempt to make the connection.

7. If an error message appears:
   a. You may be using incorrect connection parameters.
      - Ensure you are using the correct COM port.
      - If you are unsure of the transmitter's address, use the **Poll** button in the **Connect** window to return a list of all devices on the network.
   b. Check all the wiring between the PC and the transmitter.
   c. Increase or decrease resistance.

Note: For more troubleshooting information, see Section 10.14.3.

D.5 ProLink II language

ProLink II can be configured for the following languages:

- English
- French
- Spanish
- German

Note: Other languages may be available, depending on the version of ProLink II.

To configure the ProLink II language, use the Tools menu. See Figure 2-2.

In this manual, English is used as the ProLink II language.

Appendix E
Using the 375 Field Communicator

E.1 Overview

The 375 Field Communicator is a handheld configuration and management tool for HART-compatible devices, including Micro Motion transmitters. It provides complete access to transmitter functions and data.

This appendix provides basic information for connecting the 375 Field Communicator to your transmitter. The following topics and procedures are discussed:

- Communicator device description – see Section E.2
- Connecting to a transmitter – see Section E.3
- Conventions used in this manual – see Section E.4
- Safety messages and notes – see Section E.5

The instructions in this manual assume that users are already familiar with the Communicator and can perform the following tasks:

- Turn on the Communicator
- Navigate the Communicator menus
- Establish communication with HART-compatible devices
- Transmit and receive configuration information between the Communicator and HART-compatible devices
- Use the alpha keys to type information

If you are unable to perform the tasks listed above, consult the Communicator manual before attempting to use the software. The documentation is available on the Micro Motion web site (www.micromotion.com).

E.2 Communicator device description

The **2200S Analog** device description must be installed on the Communicator.

To view the device descriptions that are installed on your Communicator:

1. At the HART application menu, select **Utility**.
2. Select **Available Device Descriptions**.
3. Select **Micro Motion**.

If you do not see the required device description, download the latest device description file from the Micro Motion web site, and upgrade your Communicator.

E.3 Connecting to a transmitter

You can connect the Communicator to the transmitter's HART clips or to a point on a HART network.

Note: The HART clips on the face of the transmitter are connected to the transmitter's mA/HART terminals. You may connect directly to the mA/HART terminals if you have removed the user interface module.

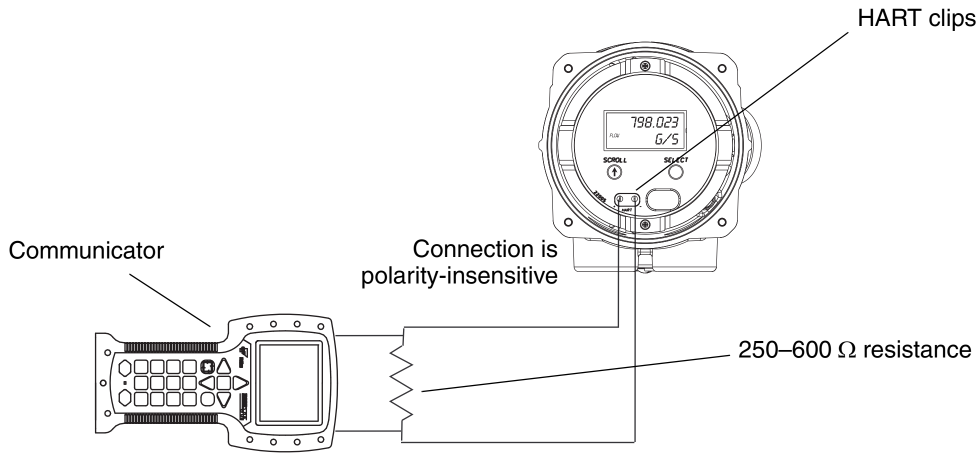
Note: If you are using the mA/HART terminals to report a process variable and also for HART communications, see the transmitter installation manual for wiring diagrams.

E.3.1 Connecting to HART clips

To connect the Communicator to the transmitter's HART clips:

1. Remove the user interface cover (see Section C.3).
2. Connect the Communicator leads to the HART clips on the face of the transmitter. The connection is polarity-insensitive. See Figure E-1.
3. The Communicator must be connected across a resistance of 250–600 Ω. Add resistance to the connection. See Figure E-1.

Figure E-1 Connecting to HART clips

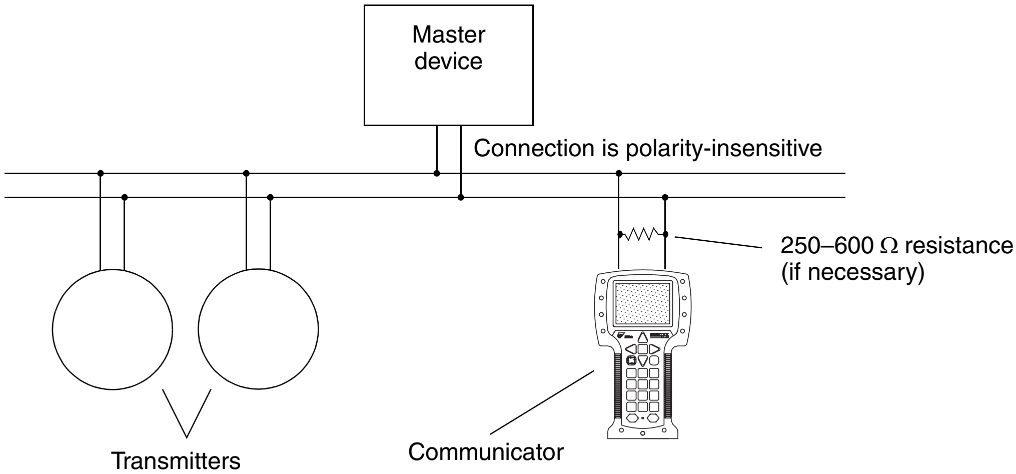


E.3.2 Connecting to a multidrop network

The Communicator can be connected to any point in a multidrop network. The connection is polarity-insensitive. See Figure E-2.

The Communicator must be connected across a resistance of 250–600 Ω. Add resistance to the connection if necessary.

Figure E-2 Connecting to a multidrop network



E.4 Using the Communicator with the Model 2200S

All Communicator procedures assume that you are starting at the on-line menu. “Online” appears on the top line of the Communicator main menu when the Communicator is at the on-line menu.

Menu flowcharts for using the Communicator with the Model 2200S transmitter are provided in Figures 2-5 through 2-9.

E.5 Communicator safety messages and notes

Users are responsible for responding to safety messages (e.g., warnings) and notes that appear on the Communicator. Safety messages and notes that appear on the Communicator are not discussed in this manual.

Index

D

For the latest Micro Motion product specifications, view the PRODUCTS section of our web site at www.micromotion.com

Micro Motion Inc. USA
Worldwide Headquarters
7070 Winchester Circle
Boulder, Colorado 80301
T +1 303-527-5200
+1 800-522-6277
F +1 303-530-8459

Micro Motion Europe
Emerson Process Management
Neonstraat 1
6718 WX Ede
The Netherlands
T +31 (0) 318 495 555
F +31 (0) 318 495 556

Micro Motion United Kingdom
Emerson Process Management Limited
Horsfield Way
Bredbury Industrial Estate
Stockport SK6 2SU U.K.
T +44 0870 240 1978
F +44 0800 966 181

Micro Motion Asia
Emerson Process Management
1 Pandan Crescent
Singapore 128461
Republic of Singapore
T +65 6777-8211
F +65 6770-8003

Micro Motion Japan
Emerson Process Management
1-2-5, Higashi Shinagawa
Shinagawa-ku
Tokyo 140-0002 Japan
T +81 3 5769-6803
F +81 3 5769-6844

Micro Motion®

recycled paper

EMERSON™
Process Management