Configuration and Use Manual
P/N 20001715, Rev. B
September 2006

Micro Motion®
Series 1000 and
Series 2000 Transmitters

Configuration and Use Manual

- Model 1500 with analog outputs
- Model 1700 with analog outputs
- Model 1700 with intrinsically safe outputs
- Model 2500 with configurable input/outputs
- Model 2700 with analog outputs
- Model 2700 with intrinsically safe outputs
- Model 2700 with configurable input/outputs

Micro Motion®

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Process Management

Contents

Chapter 1
Before You Begin

1.1 Overview

This chapter provides an orientation to the use of this manual, and includes a pre-configuration worksheet. This manual describes the procedures required to start, configure, use, maintain, and troubleshoot the following Series 1000 and Series 2000 transmitters:

- Model 1500 with analog outputs option board
- Model 1700 with analog outputs option board
- Model 1700 with intrinsically safe outputs option board
- Model 2500 with configurable input/outputs option board
- Model 2700 with analog outputs option board
- Model 2700 with intrinsically safe outputs option board
- Model 2700 with configurable input/outputs option board

If you do not know what transmitter you have, see Section 1.3 for instructions on identifying the transmitter type from the model number on the transmitter's tag.

Note: Information on configuration and use of Model 2700 transmitters with FOUNDATION fieldbus™, Model 2700 transmitters with Profibus-PA, and Model 1500 transmitters with the Filling and Dosing application is provided in separate manuals. See the manual for your transmitter.

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 Determining your transmitter type and version

To configure, use, and troubleshoot the transmitter, you must know your transmitter type, installation type, outputs option board, and several different types of version information. This section provides instructions for this information. Record this information in the pre-configuration worksheet in Section 1.7.

1.3.1 Transmitter type, installation type, and outputs option board

To determine your transmitter type, installation type, and outputs option board:

1. Obtain the transmitter's model number, which is provided on a tag attached to the side of the transmitter.
   - Model 1500 transmitters have a model number of the form **1500xxxxxxxxxx**.
   - Model 2500 transmitters have a model number of the form **2500xxxxxxxxxx**.
   - Model 1700 transmitters have a model number of the form **1700xxxxxxxxxx**.
   - Model 2700 transmitters have a model number of the form **2700xxxxxxxxxx**.
2. The fifth character in the model number (**xxxxXxxxxxxxxx**) represents the installation type that was ordered:
   - **R** = remote (4-wire remote installation)
   - **I** = integral (transmitter mounted on sensor)
   - **C** = transmitter/core processor assembly (9-wire remote installation)
   - **B** = remote core processor with remote transmitter
   - **D** = DIN rail (for Model 1500 or 2500 transmitters in 4-wire remote installations)

Note: For more information on installation type, see Appendix B.

3. The eighth character in the model number (**xxxxxxxXxxxxxx**) represents the outputs option board:
   - **A** = transmitter with analog outputs option board (one mA, one frequency, one RS-485)
   - **B** = transmitter with configurable input/outputs option board, default output configuration (two mA, one frequency)
   - **C** = transmitter with configurable input/outputs option board, customized output configuration
   - **D** = transmitter with intrinsically safe outputs option board

Note: The remaining characters in the model number describe options that do not affect transmitter configuration or use.

The following examples illustrate use of the model number to determine transmitter type, installation type, and output board type:

- **1700RxxAxxxxxx** = Model 1700 remote transmitter with analog outputs option board
- **2700CxxDxxxxxx** = Model 2700 transmitter/core processor assembly with intrinsically safe outputs option board

1.3.2 Version

Different configuration options are available with different versions of the components. Table 1-1 lists the version information that you may need and describes how to obtain the information.

Table 1-1 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
Core processor software	Not available	Review/Device info> Hardware rev	OFF-LINE MAINT>VER
ProLink II	Help>About ProLink II	Not applicable	Not applicable
Communicator device description	Not applicable	See Section 4.2.2	Not applicable

1.4 Flowmeter documentation

Table 1-2 lists documentation sources for additional information.

Table 1-2 Flowmeter documentation resources

Topic	Document
Installing the sensor	Sensor installation manual
Installing a Model 1500/2500 transmitter	*Transmitter Installation: Model 1500 and 2500 Transmitters*
Installing a Model 1700/2700 transmitter	*Transmitter Installation: Model 1700 and 2700 Transmitters*

1.5 Using this manual

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

This manual describes features and procedures that apply to most or all of the Series 1000 and 2000 transmitters. To help you identify the topics that apply to your transmitter, a list of transmitters is supplied with topic headings (see the example to the left of this paragraph). If no list is supplied with the topic heading, the topic is applicable to all transmitters.

1.5.1 Component versions

In general, this manual documents transmitters with transmitter software rev5.0, connected to either a standard core processor (v2.5) or an enhanced core processor (v3.21). Earlier versions of transmitter and core processor software are similar but not identical. Significant differences between versions are noted in the manual; however, not all differences are noted.

1.5.2 Terminology

Table 1-3 lists definitions for the terms and codes that are used in this manual.

Table 1-3 Terms and codes used in this manual

Term	Definition
Series 1000	Refers to the following transmitters: • Model 1500 • Model 1700
Series 2000	Refers to the following transmitters: • Model 2500 • Model 2700
Model 1500	Refers to the following transmitter: • Model 1500 with the analog outputs option board
Model 1700	Refers to the following transmitters: • Model 1700 with the analog outputs option board • Model 1700 with the intrinsically safe outputs option board
Model 2500	Refers to the following transmitter: • Model 2500 with the configurable input/outputs option board
Model 2700	Refers to the following transmitters: • Model 2700 with the analog outputs option board • Model 2700 with the intrinsically safe outputs option board • Model 2700 with the configurable input/outputs option board
AN	Analog outputs option board. Available with the following transmitters: • Model 1500 with the analog outputs option board • Model 1700 with the analog outputs option board • Model 2700 with the analog outputs option board
IS	Intrinsically safe outputs option board. Available with the following transmitters: • Model 1700 with the intrinsically safe outputs option board • Model 2700 with the intrinsically safe outputs option board
CIO	Configurable input/outputs option board. Available with the following transmitters: • Model 2500 with the configurable input/outputs option board • Model 2700 with the configurable input/outputs option board

1.5.3 Communication tools

Most of the procedures described in this manual require the use of a communication tool. Table 1-4 lists the transmitters discussed in this manual, and the communication tools that can be used with them.

Table 1-4 Transmitters and communication tools

Transmitter	Transmitter display(1)	ProLink II software	Communicator
Model 1500		✓(2)	✓(3)
Model 1700 with analog outputs option board	✓	✓	✓
Model 1700 with intrinsically safe outputs option board	✓	✓	✓
Model 2500 with configurable input/outputs option board		✓	✓(4)
Model 2700 with analog outputs option board	✓	✓	✓
Model 2700 with intrinsically safe outputs option board	✓	✓	✓
Model 2700 with configurable input/outputs option board	✓	✓	✓

(1) Model 1700 and 2700 transmitters may be ordered with or without a display.
(2) Requires ProLink II v2.1 or later.
(3) Requires 375 Field Communicator.
(4) Partial support available with 275 HART Communicator; requires 375 Field Communicator for full support.

In this manual:

- Basic information on using the display is provided in Chapter 2.
- Basic information on ProLink II and connecting ProLink II to your transmitter is provided in Chapter 3. For more information, refer to the ProLink II manual, available on the Micro Motion web site (www.micromotion.com).
- Basic information on the 275 HART Communicator, the 375 Field Communicator, and connecting the Communicator to your transmitter is provided in Chapter 4. For more information, refer to the HART Communicator or 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. Use of AMS is not discussed in this manual; however, the user interface that AMS provides is similar to the ProLink II user interface.

1.6 Planning the configuration

The pre-configuration worksheet in Section 1.7 provides a place to record information about your flowmeter (transmitter and sensor) and your application. This information will affect your configuration options as you work through this manual. Fill out the pre-configuration worksheet and refer to it during configuration. You may need to consult with transmitter installation or application process personnel to obtain the required information.

If you are configuring multiple transmitters, make copies of this worksheet and fill one out for each individual transmitter.

1.7 Pre-configuration worksheet

Note: Not all options are available for all transmitters.

Item		Configuration data	
Sensor type		☐ T-Series ☐ Other	
Transmitter model number		____________________	
Transmitter model		☐ 1500 ☐ 1700 ☐ 2500 ☐ 2700	
Installation type		☐ Integral ☐ 4-wire remote ☐ 9-wire remote ☐ Remote core processor with remote transmitter	
Outputs option board		☐ Analog (AN) ☐ Intrinsically safe (IS) ☐ Configurable input/outputs (CIO)	
Transmitter software version		____________________	
Core processor software version		____________________	
Outputs	Terminals 1 & 2 **or** Terminals 21 & 22 **or** Channel A	☐ Milliamp (no options) ☐ Used for HART/Bell202 digital communications	
	Terminals 3 & 4 **or** Terminals 23 & 24 **or** Channel B	☐ Milliamp ☐ Frequency ☐ Discrete output	☐ Internal power ☐ External power
	Terminals 5 & 6 **or** Terminals 31 & 32 **or** Channel C	☐ Milliamp ☐ Frequency ☐ RS-485 ☐ Discrete output ☐ Discrete input	☐ Internal power ☐ External power
Process variable or assignment	Terminals 1 & 2 **or** Terminals 21 & 22 **or** Channel A	____________________	
	Terminals 3 & 4 **or** Terminals 23 & 24 **or** Channel B	____________________	
	Terminals 5 & 6 **or** Terminals 31 & 32 **or** Channel C	____________________	
Measurement units	Mass flow	____________________	
	Volume flow	____________________	
	Density	____________________	
	Pressure	____________________	
	Temperature	____________________	

Item	Configuration data
Installed applications and options	☐ Petroleum measurement (API) ☐ Enhanced density ☐ Custody transfer ☐ Meter verification
ProLink II version	______________________________________
Communicator device description version	______________________________________

1.8 Micro Motion customer service

For customer service, phone the support center nearest you:

- In the U.S.A., phone **800-522-MASS** (1-800-522-6277) (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) 318 495 670 (The Netherlands)

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

Chapter 2
Using the Transmitter Display

2.1 Overview

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The transmitter display provides basic configuration and management functionality. This chapter describes the user interface of the transmitter display. The following topics are discussed:

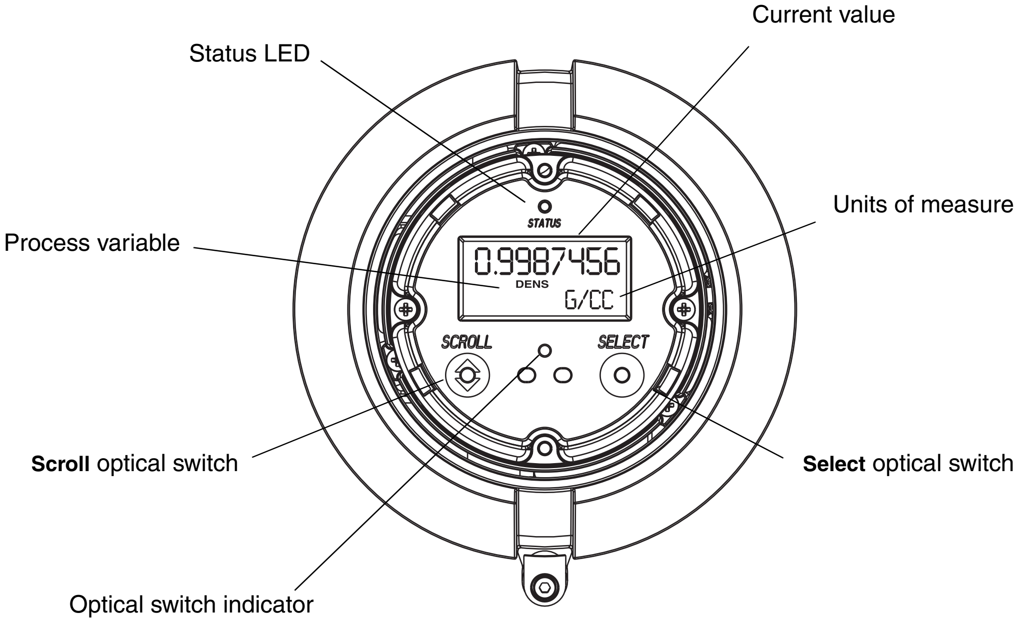
- Display components (see Section 2.2)
- Using the **Scroll** and **Select** optical switches (see Section 2.3)
- Using the display (see Section 2.4)

Note that the Model 1500 and 2500 transmitters do not have displays, and the Model 1700 and 2700 transmitters can be ordered with or without displays. Not all configuration and use functions are available through the display. If you need the added functionality, or if your transmitter does not have a display, you must use either ProLink II or a Communicator.

2.2 Components

Figure 2-1 illustrates the display components.

Figure 2-1 Display components



2.3 Using the optical switches

The **Scroll** and **Select** optical switches are used to navigate the transmitter display. To activate an optical switch, touch the glass in front of the optical switch or move your finger over the optical switch close to the glass. The optical switch indicator will be solid red when a single switch is activated, and will flash red when both switches are activated simultaneously.

> **⚠ WARNING**
>
> **Removing the display cover in an explosive atmosphere can cause an explosion.**
>
> When using the optical switches, do not remove the display cover. To activate an optical switch, touch the glass of the display cover or move your finger over the switch close to the glass.

2.4 Using the display

The display can be used to view process variable data or to access the transmitter menus for configuration or maintenance.

2.4.1 Display language

The display can be configured for the following languages:

- English
- French
- Spanish
- German

Due to software and hardware restrictions, some English words and terms may appear in the non-English display menus. For a list of the codes and abbreviations used on the display, see Appendix H.

For information on configuring the display language, see Section 8.14.2.

In this manual, English is used as the display language.

2.4.2 Viewing process variables

In ordinary use, the **Process variable** line on the display shows the configured display variables, and the **Units of measure** line shows the measurement unit for that process variable.

- See Section 8.15.1 for information on configuring the display variables.
- See Appendix H for information on the codes and abbreviations used on the display (e.g., **SrC**).

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 display is showing a mass inventory value, the **Units of measure** line alternates between the measurement unit (**G**) and the name of the inventory (**MASSI**).

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. At any time, you can interrupt the automatic scrolling (e.g., to control the display manually) by activating either optical switch. The display reverts to auto scrolling after 30 seconds of inactivity.
- Whether Auto Scroll is enabled or not, the operator can manually scroll through the configured display variables by activating **Scroll**.

For more information on using the display to view process variables or manage totalizers and inventories, see Chapter 7.

2.4.3 Display menus

To enter the display menus, activate **Scroll** and **Select** simultaneously. The optical switch indicator will flash. Hold **Scroll** and **Select** until the words **SEE ALARM** or **OFF-LINE MAINT** appear.

To move through a list of options, activate **Scroll**.

To select from a list, scroll to the desired option, then activate **Select**.

To exit a display menu without making any changes:

- Use the **EXIT** option if available.
- If the **EXIT** option is not available, activate **Scroll** and **Select** simultaneously, and hold until the screen returns to the previous display.

2.4.4 Display password

A password can be used to control access to either the off-line maintenance menu, the alarm menu, or both. The same code is used for both:

- If both passwords are enabled, the user must enter the password to access the top-level off-line menu. The user can then access either the alarm menu or the off-line maintenance menu without re-entering the password.
- If only one password is enabled, the user can access the top-level off-line menu, but will be prompted for the password when he or she attempts to access the alarm menu or the off-line maintenance menu (depending on which password is enabled). The user can access the other menu without a password.
- If neither password is enabled, the user can access all parts of the off-line menu without a password.

For information about enabling and setting the display password, see Section 8.14.

Note: If the petroleum measurement application is installed on your transmitter, the display password is always required to start, stop, or reset a totalizer, even if neither password is enabled. If the petroleum measurement application is not installed, the display password is never required for these functions, even if one of the passwords is enabled.

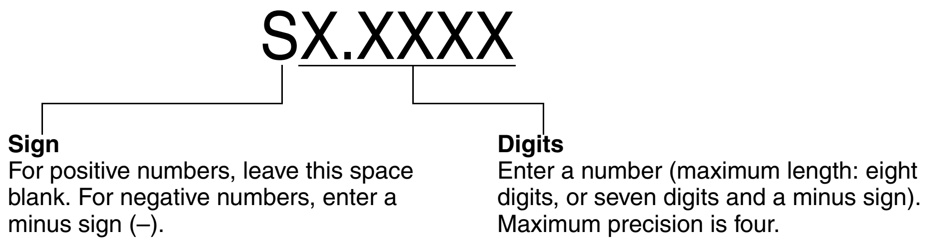
If a password is required, the word **CODE?** appears at the top of the password screen. Enter the digits of the password one at a time by using **Scroll** to choose a number and **Select** to move to the next digit.

If you encounter the display password screen but do not know the password, wait 30 seconds without activating any of the display optical switches. The password screen will timeout automatically and you will be returned to the previous screen.

2.4.5 Entering floating-point values with the display

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 2-2) and the active digit is flashing.

Figure 2-2 **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 a minus sign (–) for a negative value or a blank space 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.

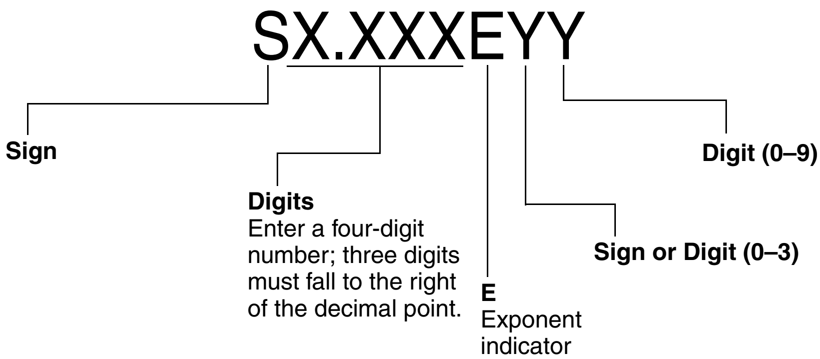
To change from decimal to exponential notation (see Figure 2-3):

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**.

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

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

Figure 2-3 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.

Chapter 3
Connecting with ProLink II or Pocket ProLink Software

3.1 Overview

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

ProLink II is a Windows-based configuration and management tool for Micro Motion transmitters. It provides complete access to transmitter functions and data. Pocket ProLink is a version of ProLink II that runs on a Pocket PC.

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

- Requirements (see Section 3.2)
- Configuration upload/download (see Section 3.3)
- Connecting to a Model 1700 or 2700 transmitter (see Section 3.4)
- Connecting to a Model 1500 or 2500 transmitter (see Section 3.5)

The instructions in this manual assume that users are already familiar with ProLink II or Pocket ProLink software. For more information on using ProLink II, see the ProLink II manual. For more information on using Pocket ProLink, see the Pocket ProLink manual. Instructions in this manual will refer only to ProLink II.

3.2 Requirements

To use ProLink II with a Series 1000 or 2000 transmitter, the following are required:

- ProLink II v2.0 or later for most basic functions
- ProLink II v2.5 or later for access to many advanced functions, such as meter verification
- Signal converter(s), to convert the PC port's signal to the signal used by the transmitter
  - For RS-485 connections, an RS-485 to RS-232 signal converter. The Black Box® Async IC521A-F RS-232 to RS-485 converter is recommended. For computers without serial ports, the Black Box IC138A USB to RS-232 converter can be used in conjunction with the IC521A-F. Both converters are available from Micro Motion.
  - For Bell 202 connections, a HART interface. The MACTek® Viator® RS232 HART Interface (for serial port) or USB HART Interface Model 010031 (for USB) are recommended. Both converters are available from Micro Motion.
- 25-pin to 9-pin adapter (if required by your PC)

Note: If you are using the enhanced core processor and you connect directly to the core processor's RS-485 terminals (see Figure B-4 or Figure B-14) instead of to the transmitter, ProLink II v2.4 or later is required. This connection type is sometimes used for troubleshooting.

3.3 ProLink II 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.

To access the configuration upload/download function:

1. Connect ProLink II to your transmitter as described in this chapter.
2. Open the **File** menu.
   - To save a configuration file to a PC, use the **Load from Xmtr to File** option.
   - To restore or load a configuration file to a transmitter, use the **Send to Xmtr from File** option.

3.4 Connecting from a PC to a Model 1700 or Model 2700 transmitter

Depending on your transmitter, there are several options for connecting ProLink II to your transmitter. See Table 3-1.

Notes: Service port connections use standard settings, do not require transmitter configuration, and are always available. Therefore, they are easy and convenient. However, service port connections require opening the power supply compartment. Accordingly, service port connections should be used only for temporary connections, and may require extra safety precautions.

Due to the design of HART protocol, connections made using HART protocol are slower than connections that use Modbus protocol. If you use HART protocol, you cannot open more than one ProLink II window at a time.

Table 3-1 Connection options for Model 1700 or Model 2700 transmitters

			Transmitter		
Connection	**Physical layer**	**Protocol**	**1700/2700 AN**	**1700/2700 IS**	**2700 CIO**
Service port (see Section 3.4.1)	RS-485	Modbus	✓	✓	✓
RS-485 terminals or RS-485 network (see Section 3.4.2)	RS-485	Modbus	✓		
	RS-485	HART	✓		
Primary mA terminals or HART network (see Section 3.4.3)	Bell 202	HART	✓	✓	✓

3.4.1 Connecting to the service port

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

To connect to the service port, which is located in the non-intrinsically safe power supply compartment (see Figure 3-1):

1. Attach the signal converter to the serial or USB port of your PC, using a 25-pin to 9-pin adapter if required.
2. Open the cover to the wiring compartment.

⚠ WARNING

Opening the wiring compartment in a hazardous area can cause an explosion.

Because the wiring compartment must be open to make this connection, the service port should be used only for temporary connections, for example, for configuration or troubleshooting purposes.

When the transmitter is in an explosive atmosphere, use a different method to connect to your transmitter.

3. Open the power supply compartment.

⚠ WARNING

Opening the power supply compartment in explosive atmospheres while the power is on can cause an explosion.

Before using the service port to communicate with the transmitter in a hazardous area, make sure the atmosphere is free from explosive gases.

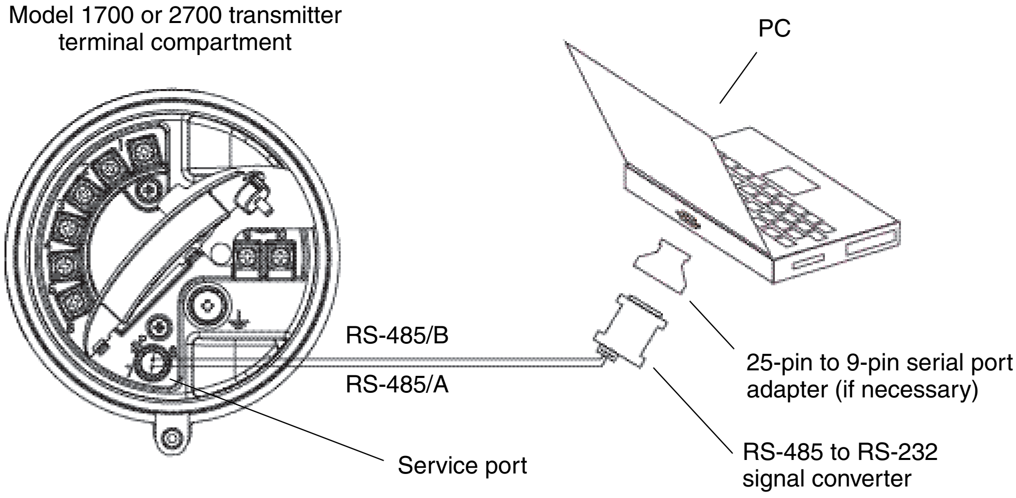
⚠ WARNING

Opening the power supply compartment can expose the operator to electric shock.

To avoid the risk of electric shock, do not touch the power supply wires or terminals while using the service port.

4. Connect the signal converter leads to the service port terminals. See Figure 3-1.

Figure 3-1 Service port connections to Model 1700 or 2700



5. Start ProLink II. Choose **Connection > Connect to Device**. In the screen that appears, specify:
   - **Protocol**: Service Port
   - **COM Port**: as appropriate for your PC

   All other parameters are set to service port required values and cannot be changed.
6. Click **Connect**.
7. If an error message appears:
   a. Swap the leads between the two service port terminals and try again.
   b. Ensure that you are using the correct COM port.
   c. Check all the wiring between the PC and the transmitter.

3.4.2 Connecting to the RS-485 terminals or an RS-485 network

- Model 1700 AN
- Model 2700 AN

To connect a PC to the RS-485 terminals or an RS-485 network:

1. Attach the signal converter to the serial or USB port of your PC, using a 25-pin to 9-pin adapter if required.
2. To connect to the RS-485 terminals, open the cover to the wiring compartment and connect the signal converter leads to the transmitter terminals labeled **5** and **6**, or to the output wires from these terminals. See Figure 3-2.
3. To connect to an RS-485 network, connect the signal converter leads to any point in the network. See Figure 3-3.
4. For long-distance communication, or if noise from an external source interferes with the signal, install 120 Ω, 1/2 watt resistors in parallel with the output at both ends of the communication segment.

Figure 3-2 **RS-485 terminal connections to Model 1700 or 2700 AN**

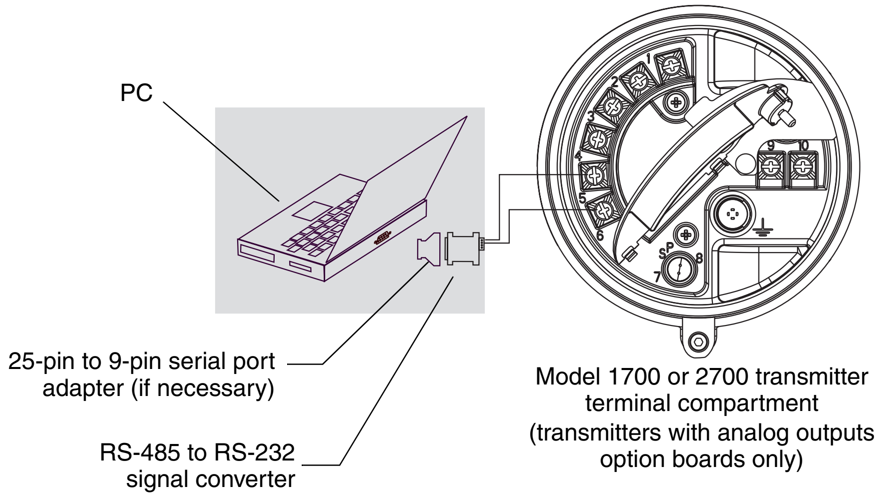
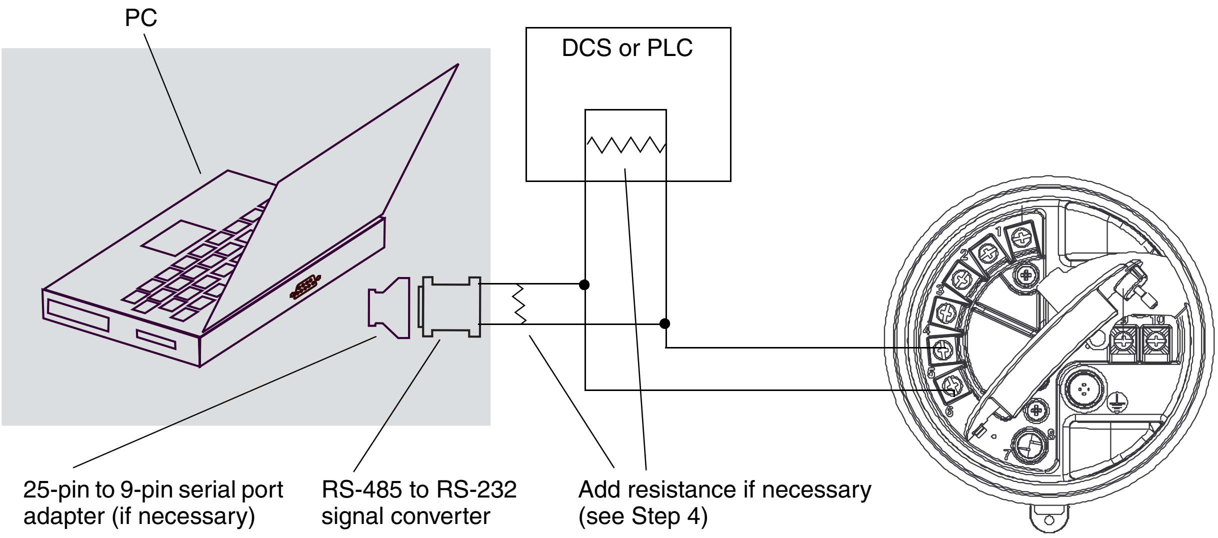


Figure 3-3 **RS-485 network connections to Model 1700 or 2700 AN**



5. Start ProLink II. Choose **Connection > Connect to Device**.
6. Set **Protocol**, **Baud Rate**, **Stop Bits**, and **Parity** to the RS-485 values configured in the transmitter. See Section 8.16.

Note: If you do not know the transmitter's RS-485 configuration, you can connect through the service port, which always uses default settings, or you can use the Communicator or the display to view or change the transmitter's RS-485 configuration. Default RS-485 communication parameters are listed in Table 8-13.

7. Set the **Address/Tag** value to the Modbus or HART polling address configured for the transmitter. The default Modbus address is 1; the default HART polling address is 0. See Section 8.16.
8. Set the **COM Port** value to the PC COM port assigned to this connection.
9. Click **Connect**.

10. If an error message appears:
    a. Swap the leads and try again.
    b. You may be using incorrect connection parameters.
       - Ensure you are using the correct COM port.
       - Connect using the service port and check the RS-485 configuration. If required, change the configuration or change your RS-485 connection parameters to match the existing configuration.
       - 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.
       - Check all the wiring between the PC and the network. You may need to add resistance. See Figure 3-3.

3.4.3 Connecting to the primary mA output terminals or to a HART multidrop network

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

⚠ CAUTION

Connecting a HART device to the transmitter's primary mA output terminals could cause transmitter output error.

If the primary mA output is being used for flow control, connecting a HART device to the output loop could cause the transmitter's 4–20 mA output to change, which would affect flow control devices.

Set control devices for manual operation before connecting a HART device to the transmitter's primary mA output loop.

To connect a PC to the primary mA output terminals or to a HART multidrop network:

1. If you are connecting to an AN or CIO transmitter, see Figure 3-4. If you are connecting to an IS transmitter, see Figure 3-5.
2. Attach the HART interface to the serial or USB port of your PC.
3. To connect to the primary mA output terminals, open the cover to the intrinsically safe wiring compartment and connect the HART interface leads to the terminals labeled **1** and **2**, or to the output wires from these terminals.
4. To connect to a HART multidrop network, connect the HART interface leads to any point on the network.

Figure 3-4 HART/Bell 202 connections to Model 1700/2700 AN or Model 2700 CIO

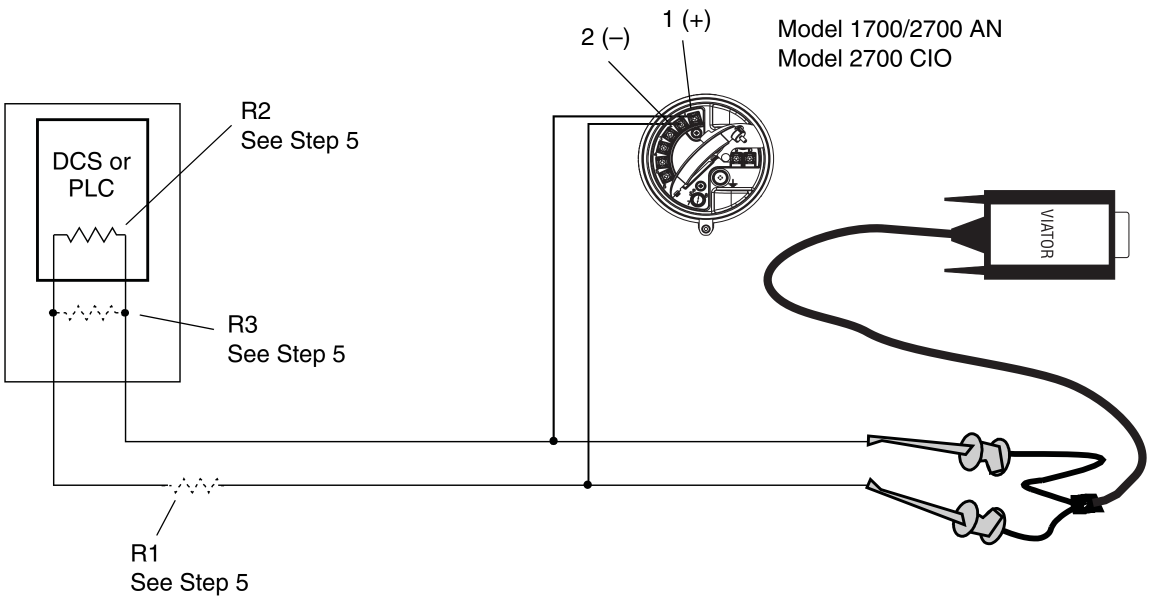
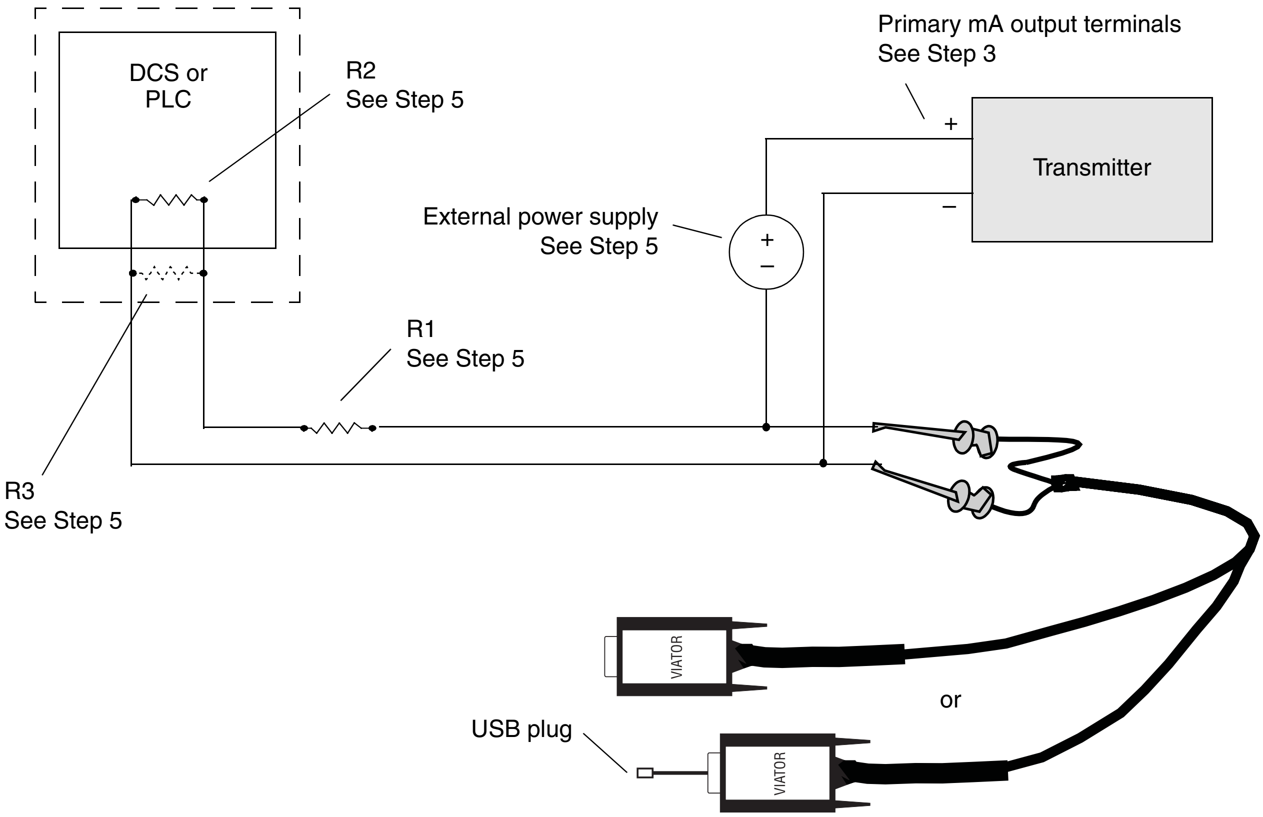
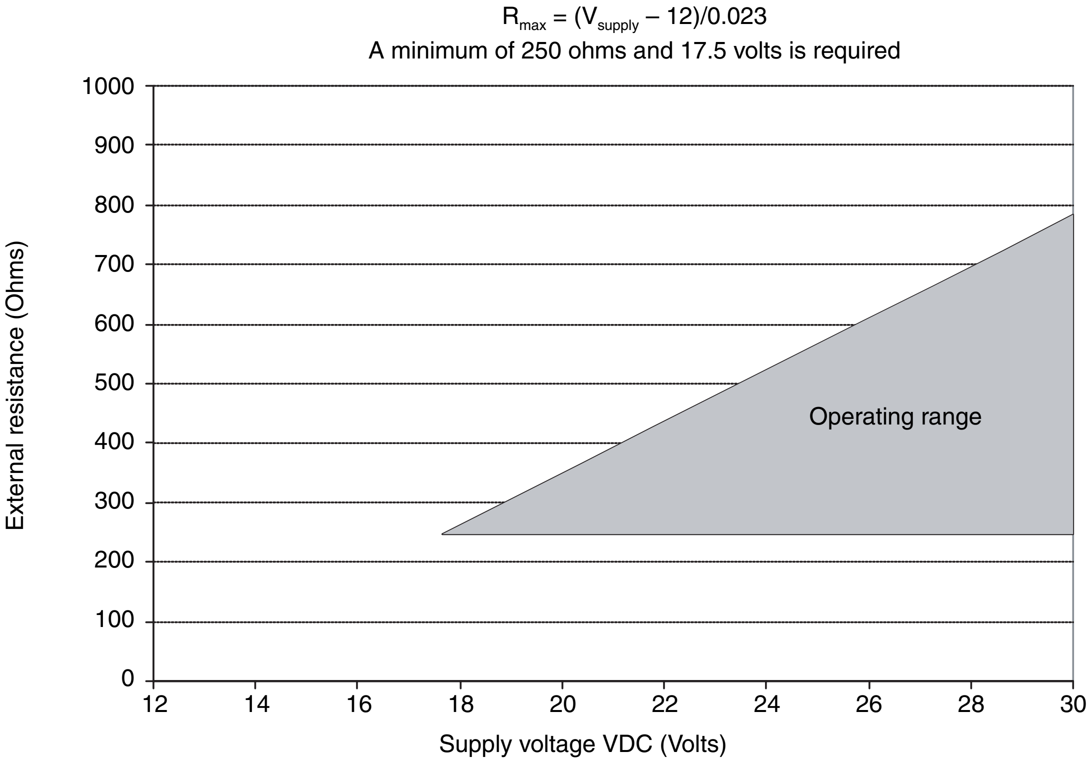


Figure 3-5 HART/Bell 202 connections to Model 1700/2700 IS



5. Add resistance as required. The Viator HART interface must be connected across a resistance of 250–600 Ω. In addition, if you are using an IS transmitter, the primary mA output requires an external power supply with a minimum of 250 Ω and 17.5 volts (see Figure 3-6). To meet the resistance requirements, you may use any combination of resistors R1, R2, and R3 (see Figure 3-4 or 3-5).

Figure 3-6 Model 1700/2700 IS: Resistance and voltage requirements for HART/Bell 202 connections



6. Start ProLink II. Choose **Connection > Connect to Device**.
7. Set **Protocol** to HART Bell 202. **Baud rate**, **Stop bits**, and **Parity** are automatically set to the values required by HART protocol.
8. Set the **Address/Tag** value to the HART polling address configured for the transmitter. The default HART polling address is 0. See Section 8.16 for information on the HART polling address.
9. Set the **COM Port** value to th e PC COM port assigned to this connection.
10. 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 275 HART Communicator or 375 Field Communicator is not a host.

11. Click **Connect**.

12. 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.

3.5 Connecting from a PC to a Model 1500 or Model 2500 transmitter

- Model 1500 AN
- Model 2500 CIO

ProLink II software can communicate with a Model 1500 or Model 2500 transmitter using:

- Modbus/RS-485 protocol (see Section 3.5.1)
    - Configurable connection
    - SP (service port) standard connection
- A HART/Bell 202 connection (see Section 3.5.2)

Note: Service port connections use standard settings and do not require transmitter configuration. Therefore, they are easy and convenient. However, service port connections can be established only during a 10-second interval after power-up. See Step 5 in the following section.

Note: Due to the design of HART protocol, connections made using HART protocol are slower than connections that use Modbus protocol. If you use HART protocol, you cannot open more than one ProLink II window at a time.

3.5.1 Connecting to the RS-485 terminals or an RS-485 network

To connect a PC to the RS-485 terminals or an RS-485 network:

1. Attach the signal converter to the serial or USB port of your PC, using a 25-pin to 9-pin adapter if required.
2. To connect to the RS-485 terminals, connect the signal converter leads to terminals 33 and 34. See Figure 3-7.
3. To connect to an RS-485 network, connect the signal converter leads to any point in the network. See Figure 3-8.
4. For long-distance communication, or if noise from an external source interferes with the signal, install 120 ohm, 1/2 watt resistors in parallel with the output at both ends of the communication segment.

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Figure 3-7 **RS-485 terminal connections to Model 1500 or 2500**

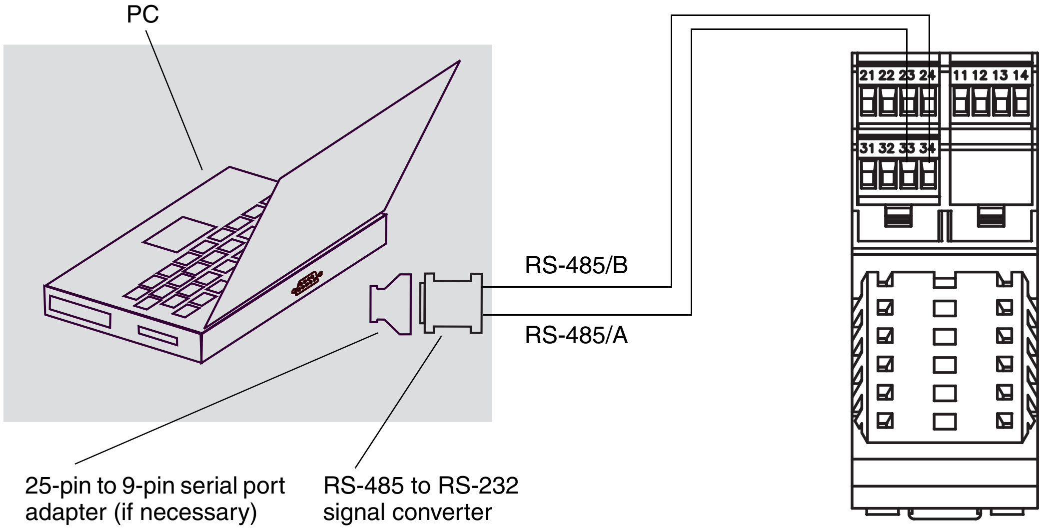
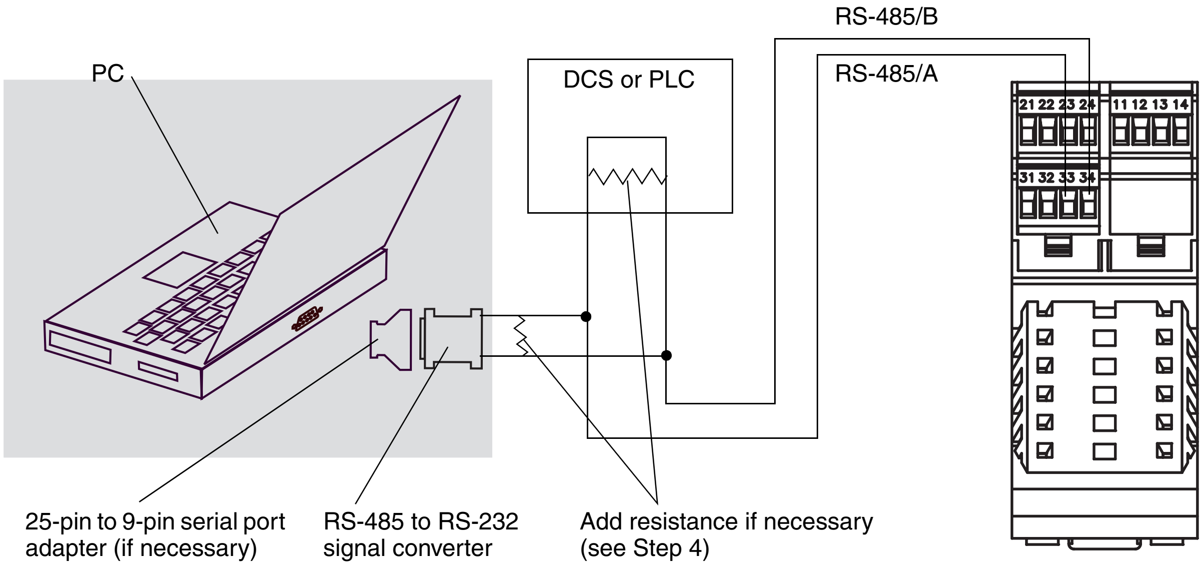


Figure 3-8 **RS-485 network connections to Model 1500 or 2500**



5. Start ProLink II. Choose **Connection > Connect to Device**. In the screen that appears, specify connection parameters appropriate to your connection type:
   - *Service port mode* – Immediately after the transmitter is powered up, terminals 33 and 34 are available in service port mode for 10 seconds. To connect during this period, set **Protocol** to Service Port, and set **COM port** to the appropriate value for your PC. **Baud rate**, **Stop bits**, and **Parity** are set to standard values and cannot be changed (see Table 3-2). If a connection is made during this period, the port will remain in service port mode until power is cycled.
   - *RS-485 mode* – If no connection is made during the 10-second period, the terminals are automatically reset to the configured RS-485 communication parameters. To connect, set the connection parameters to the values configured in your transmitter (see Table 3-2).

Table 3-2 Modbus connection parameters for ProLink II

	Connection type	
Connection parameter	**Configurable (RS-485 mode)**	**SP standard (service port mode)**
Protocol	As configured in transmitter (default = Modbus RTU)	Modbus RTU(1)
Baud rate	As configured in transmitter (default = 9600)	38,400(1)
Stop bits	As configured in transmitter (default = 1)	1(1)
Parity	As configured in transmitter (default = odd)	none(1)
Address/Tag	Configured Modbus address (default = 1)	111(1)
COM port	COM port assigned to PC serial port	COM port assigned to PC serial port

(1) Required value; cannot be changed by user.

6. Click **Connect**.
7. If an error message appears:
   a. Swap the leads between the two terminals and try again.
   b. Ensure you are using the correct COM port.
   c. If you are in RS-485 mode, you may be using incorrect connection parameters.
      - Connect using the service port and check the RS-485 configuration. If required, change the configuration or change your RS-485 connection parameters to match the existing configuration.
      - 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.
      - Check all the wiring between the PC and the transmitter.

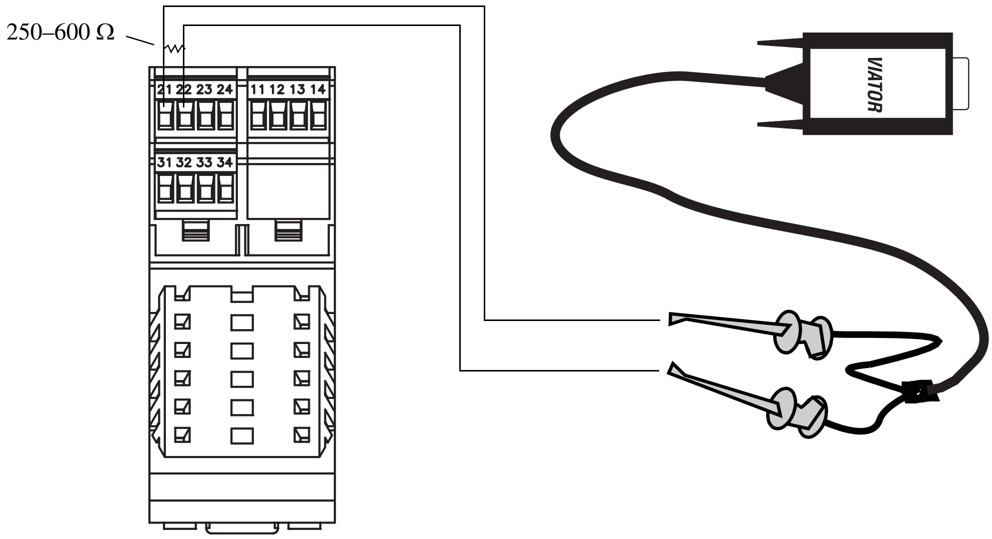
3.5.2 HART/Bell 202 connections

> **⚠ CAUTION**
>
> **Connecting a HART device to the transmitter's primary mA output terminals could cause transmitter output error.**
>
> If the primary mA output is being used for flow control, connecting a HART device to the output loop could cause the transmitter's 4–20 mA output to change, which would affect flow control devices.
>
> Set control devices for manual operation before connecting a HART device to the transmitter's primary mA output loop.

Follow the instructions below to make the connection.

1. Connect the HART interface to your PC's serial or USB port. Then connect the leads of the HART interface to terminals 21 and 22 on the transmitter (see Figure 3-9).

Figure 3-9 HART/Bell 202 connections to Model 1500 or 2500



2. Add 250–600 Ω resistance to the connection, as required.
3. Start ProLink II. Choose **Connection > Connect to Device**.
4. In the screen that appears, set **Protocol** to HART Bell 202. **Baud rate**, **Stop bits**, and **Parity** are automatically set to the values required by HART protocol. Specify the remaining connection parameters as shown in Table 3-3.

Table 3-3 HART connection parameters for ProLink II

Connection parameter	HART setting
Address/Tag	Configured HART polling address (default = 0)
COM port	COM port assigned to PC serial port

5. Click **Connect**.
6. If an error message appears:
   a. Ensure that you are using the correct COM port.
   b. Check all the wiring between the PC and the transmitter.
   c. Increase or decrease the resistance.

3.6 ProLink II language

ProLink II can be configured for the following languages:

- English
- French
- German

To configure the ProLink II language, choose **Tools > Options**.

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

Chapter 4
Connecting with the 275 HART Communicator or 375 Field Communicator

4.1 Overview

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The 275 HART Communicator and the 375 Field Communicator are handheld configuration and management tools for HART-compatible devices, including Micro Motion transmitters.

This chapter provides basic information for connecting the 275 HART Communicator or 375 Field Communicator to your transmitter. The following topics and procedures are discussed:

- Communicator models (see Section 4.2)
- Connecting to a transmitter (see Section 4.3)
- Conventions used in this manual (see Section 4.4)

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 Communicator. The documentation is available on the Micro Motion web site (www.micromotion.com).

4.2 Communicator models

Two models of the Communicator – the 275 HART Communicator and the 375 Field Communicator – can be used with Series 1000 and Series 2000 transmitters. However, the 275 HART Communicator does not have device descriptions for all models. In some cases, you can communicate with a transmitter using a device description that provides partial support for the new transmitter's features.

Some features of the Series 1000 and 2000 transmitters, e.g., gas standard volume flow, are not supported by the device descriptions for either the 275 or 375 Communicator.

Table 4-1 lists the Communicator device descriptions that are available for Series 1000 and 2000 transmitters, and the type of support they provide.

Table 4-1 Communicator models, device descriptions, and transmitter support

	275 HART Communicator		375 Field Communicator	
Transmitter	**Device description**	**Support(1)**	**Device description**	**Support(1)**
Model 1500 AN	Not available	None	1500 Mass Flow	Full
Model 1700 AN	1000 Mass Flow	Full	1000 Mass Flow	Full
Model 1700 IS	1000I Mass Flow	Full	1000I Mass Flow	Full
Model 2500 CIO	2000C Mass Flow(2)	Partial	2000C Mass Flow	Full
Model 2700 AN	2000 Mass Flow	Full	2000 Mass Flow	Full
Model 2700 IS	2000I Mass Flow	Full	2000I Mass Flow	Full
Model 2700 CIO	2000C Mass Flow	Full	2000C Mass Flow	Full

(1) "Full" support does not include all functionality (e.g., gas standard volume flow).
(2) See Section 4.2.2 for information on using the 275 HART Communicator with this transmitter.

4.2.1 Viewing the device descriptions

HART Communicator 275

To view the device descriptions that are installed on your 275 HART Communicator:

1. Turn on the HART 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**.

375 Field Communicator

To view the device descriptions that are installed on your 375 Field Communicator:

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

4.2.2 Using the 275 HART Communicator with the Model 2500

• Model 2500 CIO

To use the 275 HART Communicator with the Model 2500 transmitter:

1. Turn on the HART Communicator and connect it to the transmitter. The following warning message is displayed:

```
HART Communicator
Notice: Upgrade 275
Software to access
new Xmtr functions.
Continue with old
description?
```

2. Press **Yes** to continue using the 275 HART Communicator. Do not upgrade the 275 HART Communicator.

Note: This procedure allows you to use the device description for the Model 2700 transmitter with the configurable input/outputs option board. You will not be able to configure the RS-485 parameters using this device description. To configure the RS-485 parameters, use the 375 Field Communicator or ProLink II.

4.3 Connecting to a transmitter

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

You can connect the Communicator directly to the transmitter's mA/HART terminals or to a point on a HART network.

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

4.3.1 Connecting to communication terminals

To connect the Communicator directly to the transmitter's mA/HART terminals:

⚠ CAUTION

Connecting a HART device to the transmitter's primary mA output terminals could cause transmitter output error.

If the primary mA output is being used for flow control, connecting a HART device to the output loop could cause the transmitter's 4–20 mA output to change, which would affect flow control devices.

Set control devices for manual operation before connecting a HART device to the transmitter's primary mA output loop.

1. If you are connecting to a Model 1700/2700 transmitter, open the cover to the wiring compartment.

⚠ WARNING

Opening the wiring compartment in a hazardous area can cause an explosion.

Because the wiring compartment must be open to make this connection, connections to the mA terminals should be used only for temporary connections, for example, for configuration or troubleshooting purposes.

When the transmitter is in an explosive atmosphere, use a different method to connect to your transmitter.

2. Connect the Communicator leads to the transmitter's primary mA output terminals:
   - Model 1700/2700 transmitters: terminals 1 and 2 (see Figure 4-1)
   - Model 1500/2500 transmitters: terminals 21 and 22 (see Figure 4-2)

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3. The Communicator must be connected across a resistance of 250–600 Ω. Add resistance to the connection. See Figure 4-1.

Figure 4-1 Connecting to communication terminals – Model 1700/2700 transmitters

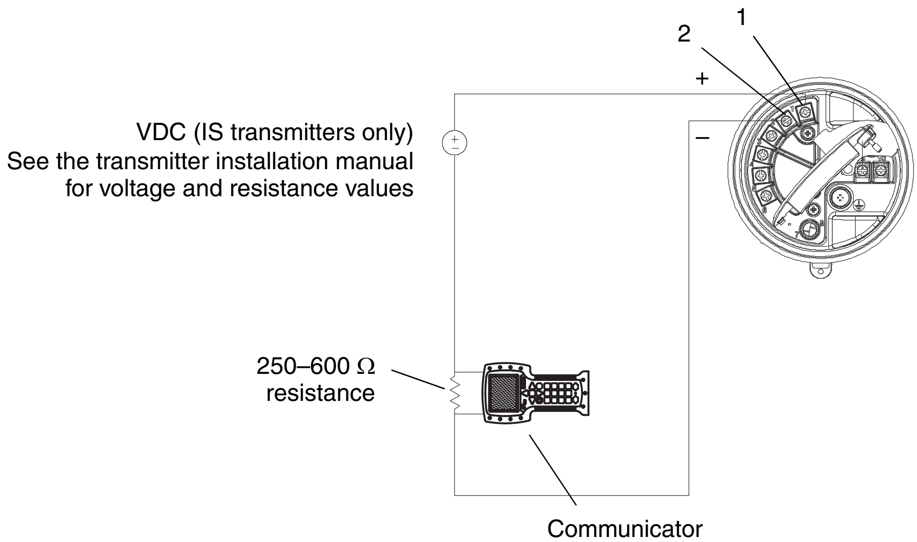
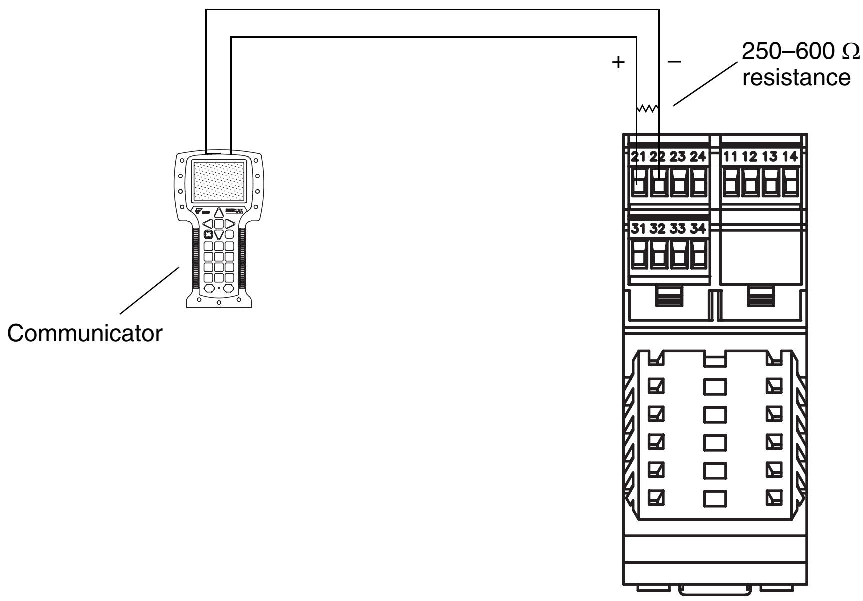


Figure 4-2 Connecting to communication terminals – Model 1500/2500 transmitters

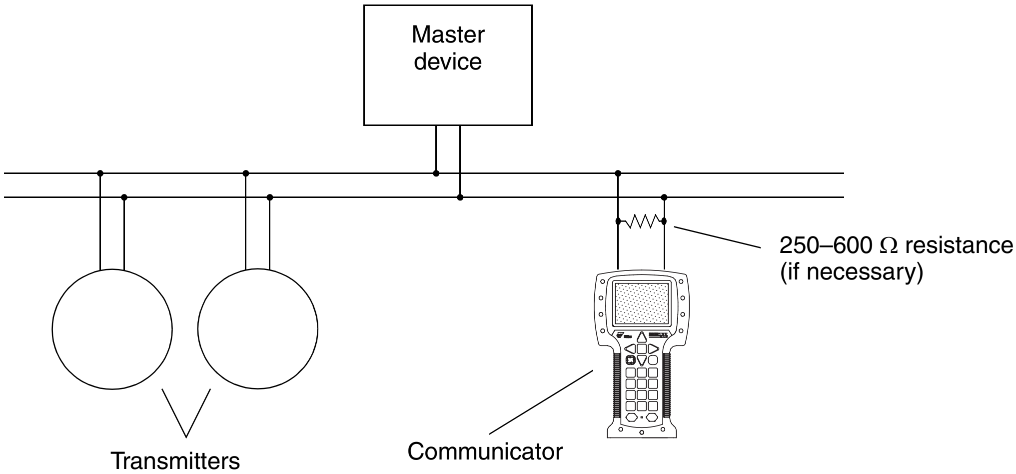


4.3.2 Connecting to a multidrop network

The Communicator can be connected to any point in a multidrop network. See Figure 4-3.

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

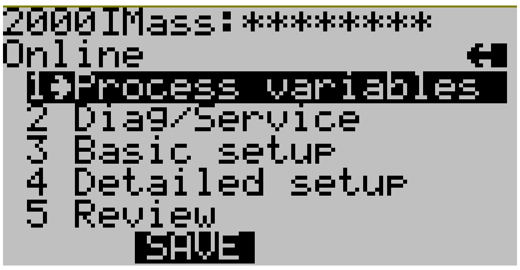
Figure 4-3 Connecting to a multidrop network



4.4 Conventions used in this manual

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. Figure 4-4 shows the 275 HART Communicator on-line menu for the Model 2700 transmitter with the intrinsically safe outputs option board.

Figure 4-4 275 HART Communicator on-line menu



4.5 HART 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.

Chapter 5
Flowmeter Startup

5.1 Overview

This chapter describes the procedures you should perform the first time you install the flowmeter. Performing these steps will help verify that all the flowmeter components are installed and wired correctly. It is usually necessary to perform some additional first-time configuration of the transmitter, which is described in Chapter 6.

The following procedures are discussed:

- Applying power to the flowmeter (see Section 5.2) – This step is required.
- Performing a loop test on the transmitter outputs (see Section 5.3) – Although this is not a requirement, performing a loop test is strongly recommended as a way to verify that the flowmeter is properly installed and wired.
- Trimming the mA outputs (see Section 5.4) – This step may be necessary depending on the results of a loop test.
- Zeroing the flowmeter (see Section 5.5) – Zeroing is not generally necessary, but you may need to zero to meet local requirements or if you are instructed to do so by Micro Motion Customer Service.

This chapter provides only basic information for each procedure. For more details about how to perform each procedure, see the flowcharts for your transmitter and communication tool, provided in the appendices to this manual.

Notes: All ProLink II procedures provided in this chapter 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 Chapter 3 for more information.

If you are using AMS, the AMS interface will be similar to the ProLink II interface described in this chapter.

All Communicator procedures provided in this chapter assume that you are starting from the "Online" menu. See Chapter 4 for more information.

5.2 Applying power

Before you apply power to the flowmeter, close and tighten all housing covers.

⚠ WARNING

Operating the flowmeter without covers in place creates electrical hazards that can cause death, injury, or property damage.

Make sure safety barrier partition and covers for the field-wiring, circuit board compartments, electronics module, and housing are all in place before applying power to the transmitter.

⚠ WARNING

Using the service port to communicate with a Model 1700/2700 transmitter in a hazardous area can cause an explosion.

Before using the service port to communicate with the transmitter in a hazardous area, make sure the atmosphere is free from explosive gases.

Turn on the electrical power at the power supply. The flowmeter will automatically perform diagnostic routines. When the flowmeter has completed its power-up sequence:

- For Model 1700/2700 transmitters under normal conditions, the status LED on the display will turn green and begin to flash.
- For Model 1500/2500 transmitters under normal conditions, the status LED will turn green.
- If the status LED exhibits different behavior, an alarm condition is present or transmitter zero is in progress. See Section 7.5.

Note: The flowmeter is ready to receive process fluid approximately one minute after power-up (time varies with models). However, approximately ten minutes are required for the electronics to warm up to equilibrium. During this ten-minute period, the transmitter may exhibit minor instability or inaccuracy.

5.2.1 Communication methods after power-up

For Model 1700/2700 transmitters, all communication methods supported by the transmitter are available immediately after power-up.

For Model 1500/2500 transmitters:

- If you are using the Communicator, or ProLink II with HART/Bell 202, you can establish communication with the transmitter immediately after power-up, using terminals 21 and 22. See Chapter 3 for more information on using ProLink II and Chapter 4 for more information on using the Communicator.
- If you are using ProLink II via the RS-485 physical layer, terminals 33 and 34 are available to establish a connection in service port mode for 10 seconds immediately after power-up. If no service port connection is made during this period, the terminals are automatically reset to the configured Modbus communication parameters. Be sure to set the ProLink II connection parameters appropriately. See Chapter 3.

5.3 Performing a loop test

A *loop test* is a means to:

- Verify that analog outputs (mA and frequency) are being sent by the transmitter and received accurately by the receiving devices
- Determine whether or not you need to trim the mA outputs
- Select and verify the discrete output voltage
- Read the discrete input

Perform a loop test on all inputs and outputs available on your transmitter. Before performing the loop tests, ensure that your transmitter's channels are configured for the input/outputs that will be used in your application (see Section 6.3).

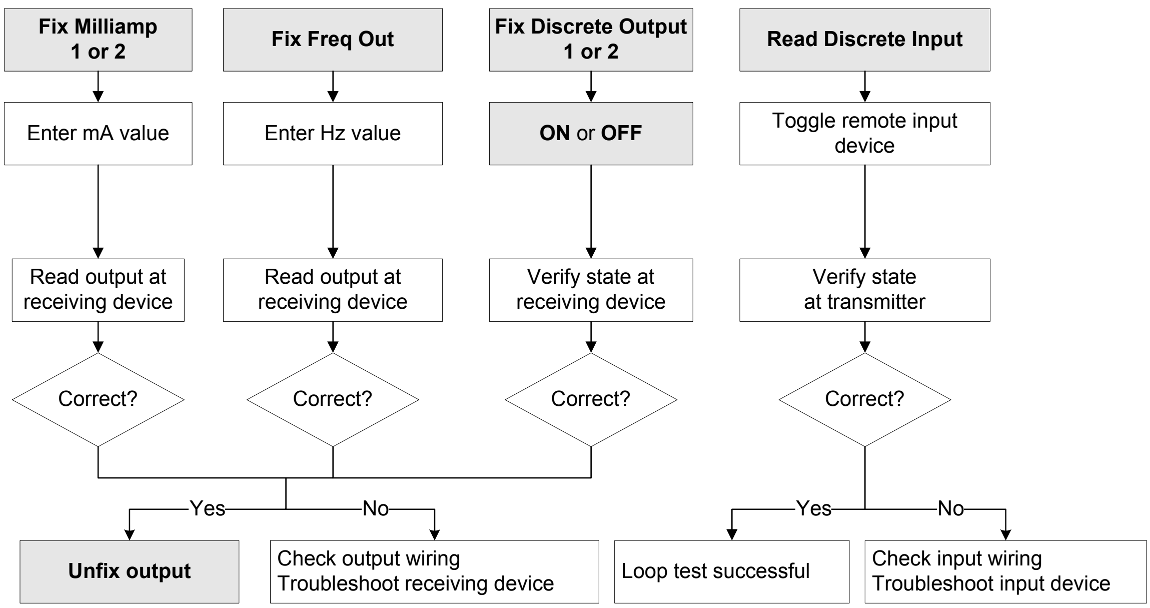
You can perform a loop test with the display, with ProLink II, or the Communicator. The general procedure for performing a loop test is shown in Figure 5-1.

Notes: If you are using the display, dots will traverse the top line of the display when an output is fixed, and the status LED will blink yellow.

If you are using either a Communicator or ProLink II via HART/Bell 202, the HART signal will affect the primary mA reading. While testing the primary mA output, disconnect the Communicator or ProLink II before reading the output, then reconnect the Communicator or ProLink II and resume the loop test after taking the reading.

Milliamp readings do not need to be exact. You will correct differences when you trim the mA output(s).

Figure 5-1 Loop test procedure



Note: Not all inputs and outputs shown here will be available on every device.

5.4 Trimming the milliamp outputs

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 4 mA signal that the receiving device reports incorrectly as 3.8 mA. If the transmitter output is trimmed correctly, it will send a signal appropriately compensated to ensure that the receiving device actually indicates a 4 mA signal.

You must trim the mA output at both the 4 mA and 20 mA points to ensure appropriate compensation across the entire output range.

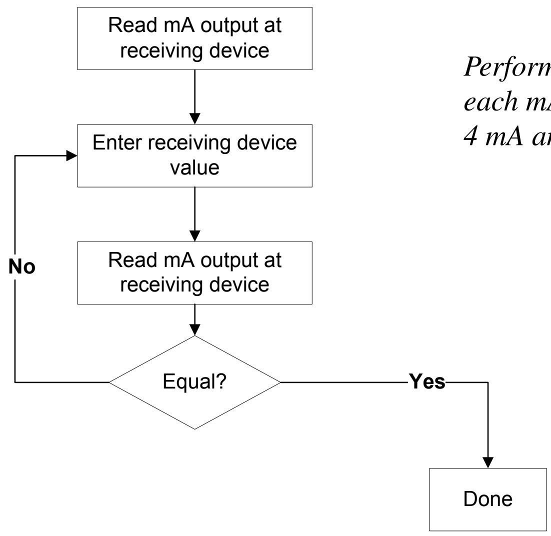
Perform a milliamp trim on all mA outputs available on your transmitter. Before performing the trim, ensure that your transmitter's channels are configured for the input/outputs that will be used in your application (see Section 6.3).

You can trim the outputs with ProLink II or a Communicator. The general procedure for performing a milliamp trim is shown in Figure 5-2.

Notes: If you are using either a Communicator or ProLink II via HART/Bell 202, the HART signal will affect the primary mA reading. While trimming the primary mA output, disconnect the Communicator or ProLink II before reading the output, then reconnect the Communicator or ProLink II and resume the trim procedure after taking the reading.

Any trimming performed on the output should not exceed ±200 microamps. If more trimming is required, contact Micro Motion customer support.

Figure 5-2 Trimming the milliamp output



Perform the procedure for each mA output at both 4 mA and 20 mA.

5.5 Zeroing the flowmeter

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: In some menus, a convergence limit parameter is displayed. Micro Motion recommends that you use the default value for convergence limit.

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 7.5 for information on viewing transmitter status and alarms.

If the zero procedure fails, see Section 12.6 for troubleshooting information. Additionally, if you have the enhanced core processor:

- You can restore the factory zero. This procedure returns the zero value to the value obtained at the factory. The factory zero can be restored with ProLink II or the display (if the transmitter has a display).
- If you are using ProLink II to zero the flowmeter, you can also restore the prior zero immediately after zeroing (e.g., an "undo" function), as long as you have not disconnected from the transmitter. Once you have disconnected from the transmitter, you can no longer restore the prior zero.

5.5.1 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

If fluid is flowing through the sensor, the sensor zero calibration may be inaccurate, resulting in inaccurate process measurement.

To improve the sensor zero calibration and measurement accuracy, ensure that process flow through the sensor has completely stopped.

5.5.2 Zero procedure

To zero the flowmeter, refer to the procedures shown in Figures 5-3 through 5-6. Note the following:

- The zero button is available only on Model 1500 or Model 2500 transmitters. It is located on the front panel of the transmitter. To press the zero button, use a fine-pointed object that will fit into the opening (0.14 in [3.5 mm]). Hold the button down until the status LED begins to flash yellow.
- If the off-line menu has been disabled, you will not be able to zero the transmitter with the display.
- You cannot change the zero time with the zero button or the display. If you need to change the zero time, you must use the Communicator or ProLink II.

Figure 5-3 Zero button – Flowmeter zero procedure

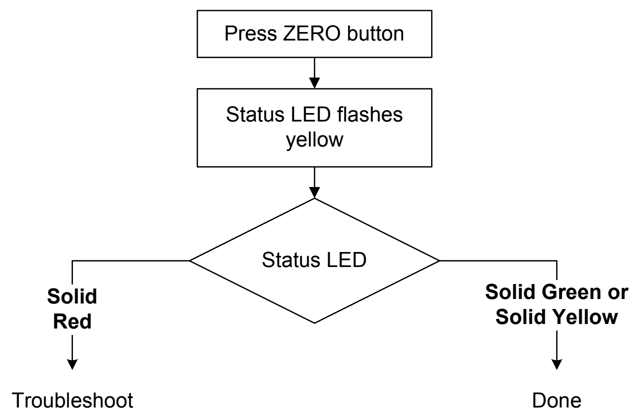


Figure 5-4 ProLink II – Flowmeter zero procedure

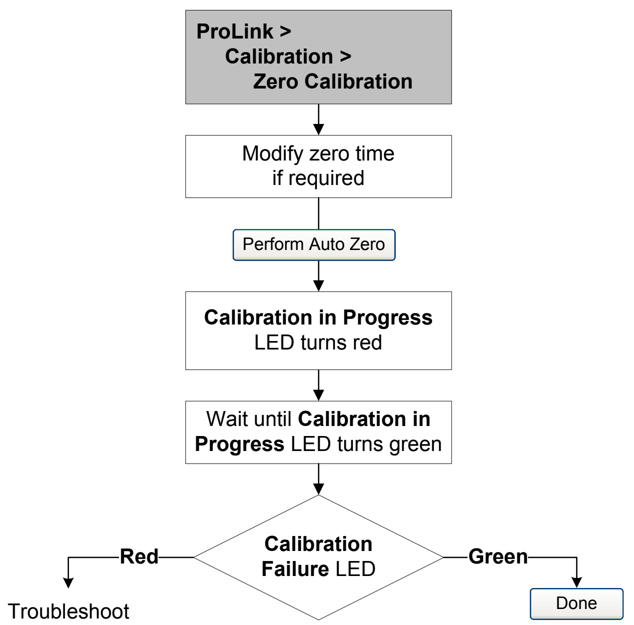
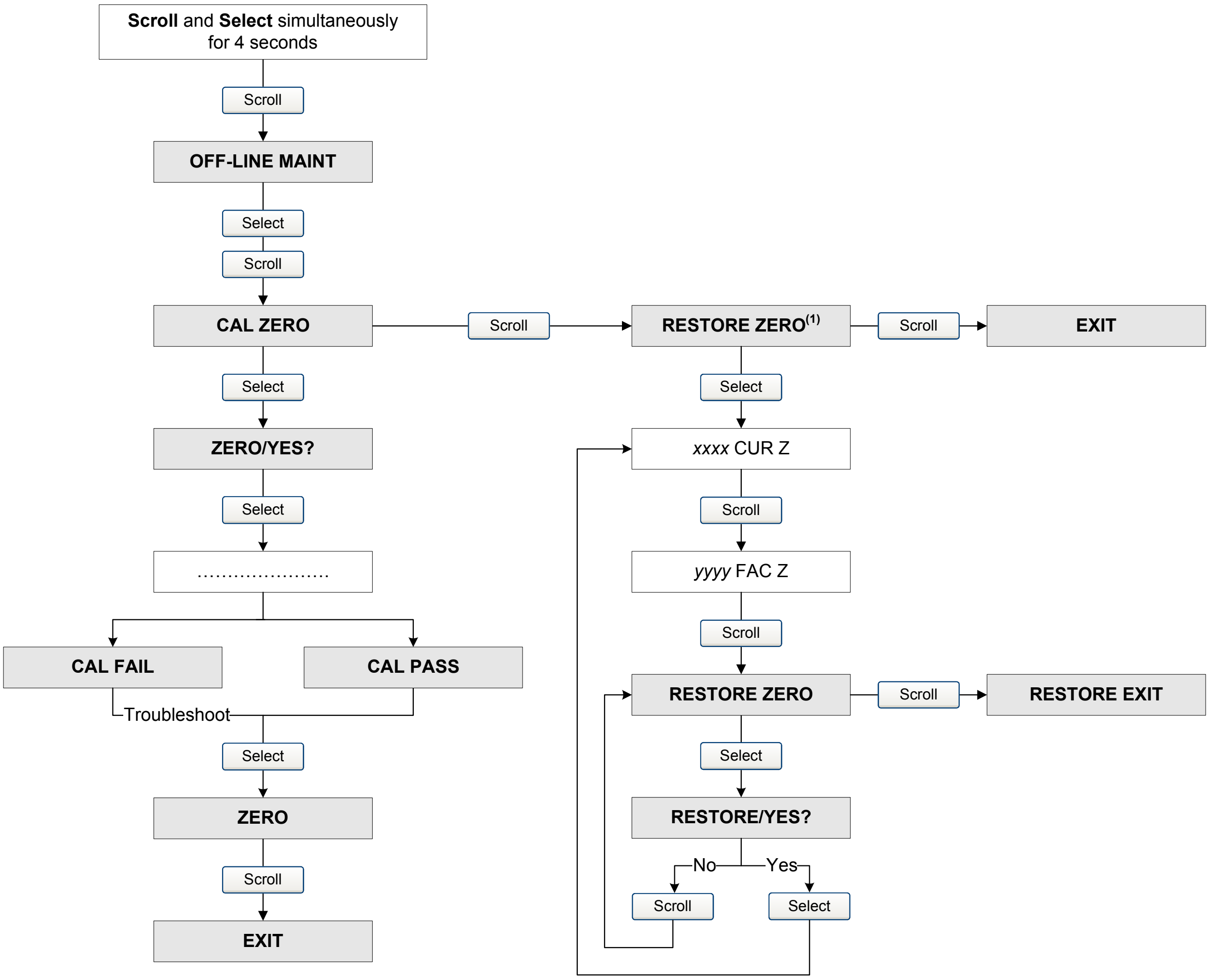
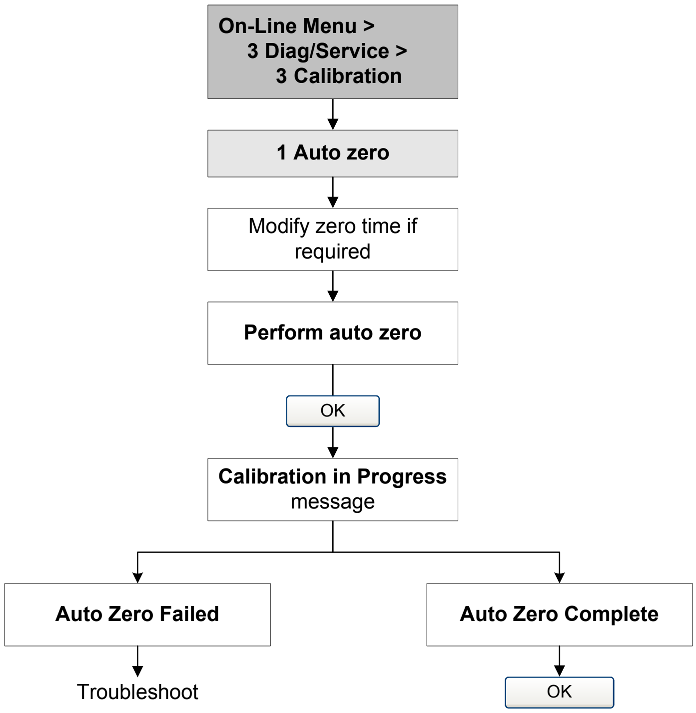


Figure 5-5 Display menu – Flowmeter zero procedure



(1) Available only on systems with the enhanced core processor.

Figure 5-6 Communicator – Flowmeter zero procedure

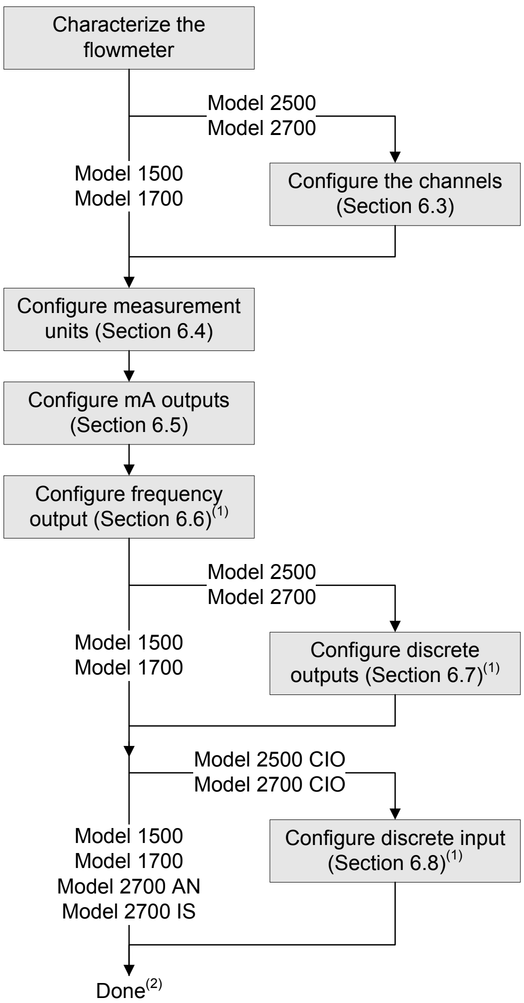


Chapter 6
Required Transmitter Configuration

6.1 Overview

This chapter describes the configuration procedures that are usually required when a transmitter is installed for the first time. The procedures in this chapter should be performed in the order shown in Figure 6-1.

Figure 6-1 Required configuration procedures in order



(1) Only the input or outputs that have been assigned to a channel need to be configured.
(2) If the meter verification option has been purchased, the final configuration step should be to establish a meter verification baseline (Section 6.9).

This chapter provides basic information and procedural flowcharts for each configuration step. For more details about how to perform each procedure, see the flowcharts for your transmitter and communication tool, provided in the appendices to this manual.

Default values and ranges for the parameters described in this chapter are provided in Appendix A. Optional configuration procedures are described in Chapter 8.

Notes: All ProLink II procedures provided in this chapter 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 Chapter 3 for more information.

If you are using AMS, the AMS interface will be similar to the ProLink II interface described in this chapter.

All Communicator procedures provided in this chapter assume that you are starting from the "Online" menu. See Chapter 4 for more information.

6.2 Characterizing the flowmeter

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

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.

6.2.1 When to characterize

If the transmitter, core processor, and sensor were ordered together, then the flowmeter has already been characterized. You need to characterize the flowmeter only if the core processor and sensor are being paired together for the first time.

6.2.2 Characterization parameters

The characterization parameters that must be configured depend on your flowmeter's sensor type: "T-Series" or "Other" (also referred to as "Straight Tube" and "Curved Tube," respectively), as listed in Table 6-1. The "Other" category includes all Micro Motion sensors except T-Series.

The characterization parameters are provided on the sensor tag. The format of the sensor tag varies depending on your sensor's date of purchase. See Figures 6-2 and 6-3 for illustrations of newer and older sensor tags.

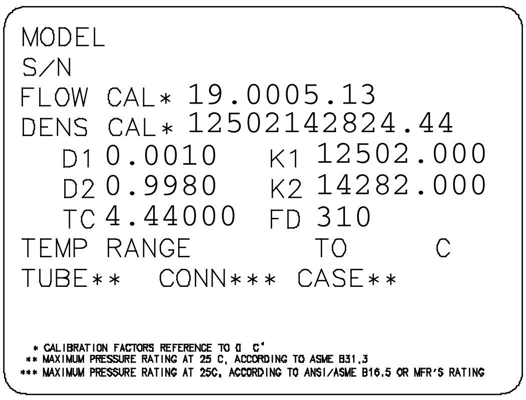
Table 6-1 Sensor calibration parameters

	Sensor type	
Parameter	**T-Series**	**Other**
K1	✓	✓[(1)]
K2	✓	✓[(1)]
FD	✓	✓[(1)]
D1	✓	✓[(1)]
D2	✓	✓[(1)]
Temp coeff (DT)[(2)]	✓	✓[(1)]
Flowcal		✓[(3)]
FCF and FT	✓[(4)]	
FCF	✓[(5)]	
FTG	✓	
FFQ	✓	
DTG	✓	
DFQ1	✓	
DFQ2	✓	

(1) See the section entitled "Density calibration factors."
(2) On some sensor tags, shown as TC.
(3) See the section entitled "Flow calibration values."
(4) Older T-Series sensors. See the section entitled "Flow calibration values."
(5) Newer T-Series sensors. See the section entitled "Flow calibration values."

Figure 6-2 Sample calibration tags – All sensors except T-Series

Newer tag



Older tag

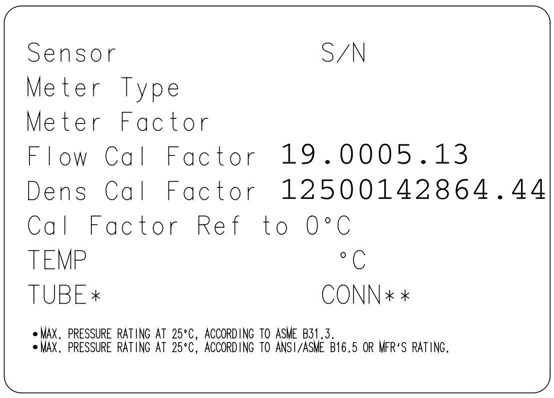


Figure 6-3 **Sample calibration tags – T-Series sensors**

Newer tag

```
MODEL T100T628SCAZEZZZZ  S/N 1234567890
FLOW FCF XXXX.XX.XX
     FTG X.XX    FFQ    X.XX
DENS D1  X.XXXXX K1     XXXXX.XXX
     D2  X.XXXXX K2     XXXXX.XXX
     DT  X.XX    FD     XX.XX
     DTG X.XX    DFQ1   XX.XX DFQ2 X.XX
TEMP RANGE -XXX TO XXX C
TUBE*  CONN**  CASE*
XXXX   XXXXX   XXXX XXXXXX

 * MAXIMUM PRESSURE RATING AT 25°C, ACCORDING TO ASME B31.3
** MAXIMUM PRESSURE RATING AT 25°C, ACCORDING TO ANSI/ASME B16.5, OR MFR'S RATING
```

Older tag

```
MODEL T100T628SCAZEZZZZ   S/N 1234567890
FLOW FCF X.XXXX  FT     X.XX
     FTG X.XX    FFQ    X.XX
DENS D1  X.XXXXX K1     XXXXX.XXX
     D2  X.XXXXX K2     XXXXX.XXX
     DT  X.XX    FD     XX.XX
     DTG X.XX    DFQ1   XX.XX DFQ2 X.XX
TEMP RANGE -XXX TO XXX C
TUBE*  CONN**  CASE*
XXXX   XXXXX   XXXX XXXXXX

 * MAXIMUM PRESSURE RATING AT 25°C, ACCORDING TO ASME B31.3
** MAXIMUM PRESSURE RATING AT 25°C, ACCORDING TO ANSI/ASME B16.5, OR MFR'S RATING
```

Density calibration factors

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

- For D1, enter the Dens A or D1 value from the calibration certificate. This value is the line-condition density of the low-density calibration fluid. Micro Motion uses air.
- For D2, enter the Dens B or D2 value from the calibration certificate. This value is the line-condition density of the high-density calibration fluid. Micro Motion uses water.

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

- For K1, enter the first 5 digits of the density calibration factor. In the sample tag in Figure 6-2, this value is shown as **12500**.
- For K2, enter the second 5 digits of the density calibration factor. In the sample tag in Figure 6-2, this value is shown as **14286**.

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

If your sensor tag does not show a DT or TC value, enter the last 3 digits of the density calibration factor. In the sample tag in Figure 6-2, this value is shown as **4.44**.

Flow calibration values

Two separate values are used to describe flow calibration: a 6-character FCF value and a 4-character FT value. Both values contain decimal points. During characterization, these are entered as a single 10-character string that includes two decimal points. In ProLink II, this value is called the Flowcal parameter; in the Communicator, it is called the FCF for T-Series sensors, and Flowcal for other sensors.

To obtain the required value:

- For older T-Series sensors, concatenate the FCF value and the FT value from the sensor tag, as shown below.

  Flow FCF X.XXXX   FT X.XX

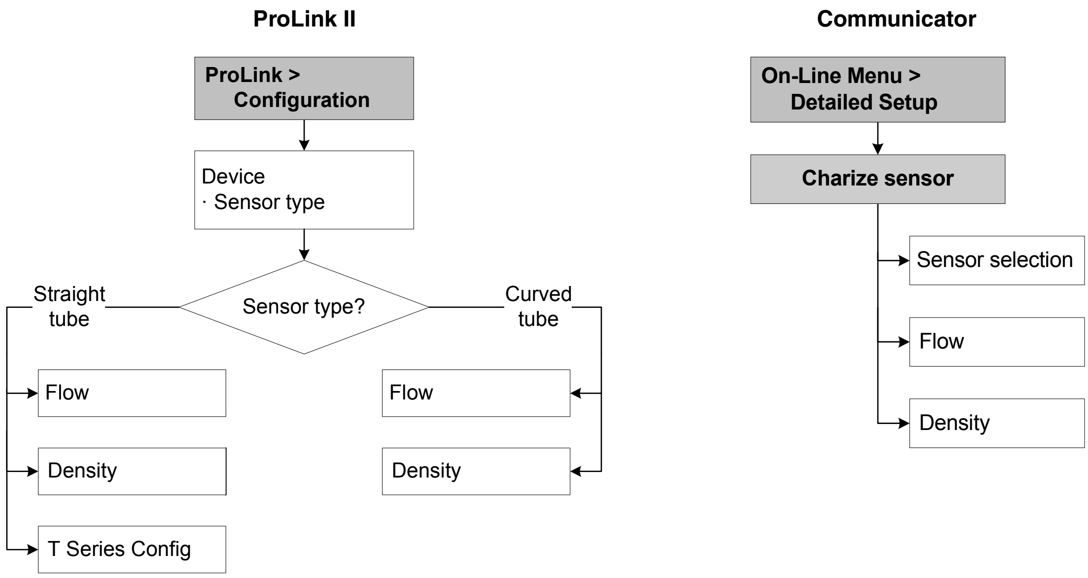
- For newer T-Series sensors, the 10-character string is represented on the sensor tag as the FCF value. The value should be entered exactly as shown, including the decimal points. No concatenation is required.
- For all other sensors, the 10-character string is represented on the sensor tag as the Flow Cal value. The value should be entered exactly as shown, including the decimal points. No concatenation is required.

6.2.3 How to characterize

To characterize the flowmeter:

- Refer to Figure 6-4.
- Ensure that the correct sensor type is configured.
- Set required parameters, as listed in Table 6-1.

Figure 6-4 Characterizing the flowmeter



6.3 Configuring the channels

The input/output terminal pairs on Series 1000/2000 transmitters are called channels, and are identified as Channel A, Channel B, and Channel C. On some transmitters, the channels can be configured for different I/O functions. The channels should be configured before doing any other I/O configuration.

⚠ CAUTION

Changing the channel configuration without verifying I/O configuration can produce process error.

When the configuration of a channel is changed, the channel's behavior will be controlled by the I/O configuration that is stored for the new channel type, which may or may not be appropriate for the process. To avoid causing process error:

- Configure the channels before configuring the I/O.
- When changing channel configuration, be sure that all control loops affected by this channel are under manual control.
- Before returning the loop to automatic control, ensure that the channel's I/O is correctly configured for your process. See Sections 6.5, 6.6, 6.7, and 6.8.

To configure the channels:

- On a Model 2700 CIO or Model 2500 CIO transmitter, see Section 6.3.1.
- On a Model 2700 AN or Model 2700 IS transmitter, see Section 6.3.2.

6.3.1 Channels B and C on Model 2700 CIO or Model 2500 CIO

- Model 2500 CIO
- Model 2700 CIO

For these transmitters, input/output and power options for each channel are shown in Table 6-2. Configure both options for all channels before doing any other I/O configuration.

Note the following constraints:

- Channel A is always an mA output.
- If you require both a frequency output and a discrete output, you must configure Channel B as the frequency output and Channel C as the discrete output.

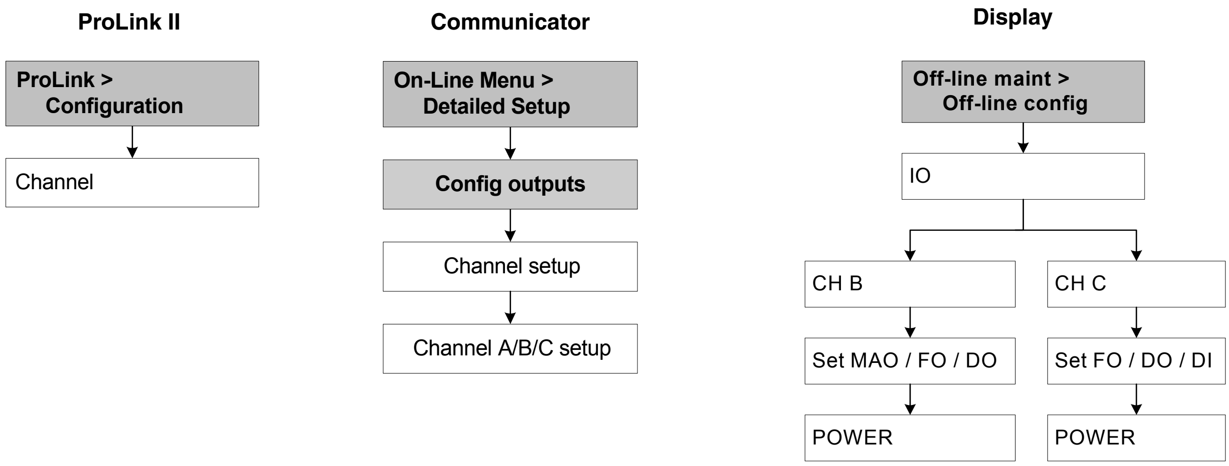
Table 6-2 Channel configuration options

	Terminals			
Channel	2500	2700	Configuration option	Power
A	21 & 22	1 & 2	mA output 1 (with HART/Bell 202)	Internal
B	23 & 24	3 & 4	mA output 2 (default)(1)	Internal or external(2)
			Frequency output (FO)	
			Discrete output 1 (DO1)(3)	
C	31 & 32	5 & 6	FO (default)(3)(4)	Internal or external(2)
			Discrete output 2 (DO2)	
			Discrete input (DI)	

(1) If set to MAO2, internal power is required.
(2) If set to external power, you must provide power to the outputs.
(3) Because DO1 uses the same circuitry as the frequency output, it is not possible to configure both FO and DO1. If both a frequency output and a discrete output are required, configure Channel B as the FO and Channel C as DO2.
(4) When configured for two FOs (dual pulse), FO2 is generated from the same FO signal sent to the first FO. FO2 is electrically isolated but not independent.

To configure Channel B or C, refer to the flowcharts in Figure 6-5.

Figure 6-5 Configuring the channels on Model 2700 CIO or Model 2500 CIO



6.3.2 Channel B on Model 2700 AN or Model 2700 IS

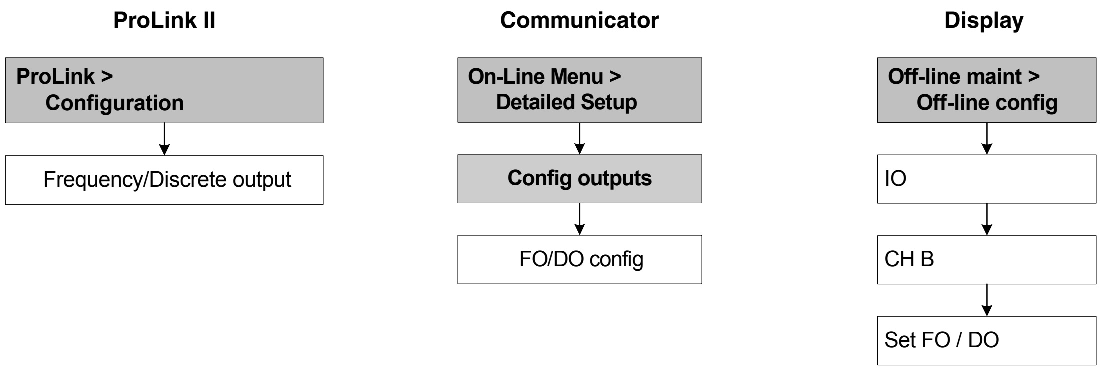
- Model 2700 AN
- Model 2700 IS

On these transmitters, Channel A is always an mA output. Channel B can operate as a frequency output (FO) or a discrete output (DO). The default is FO. Power is not configurable:

- On the Model 2700 AN transmitter, power to both channels is always internal.
- On the Model 2700 IS transmitter, power to both channels is always external.

To configure Channel B, refer to the flowcharts in Figure 6-6.

Figure 6-6 Configuring Channel B on Model 2700 AN or Model 2700 IS



6.4 Configuring the measurement units

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

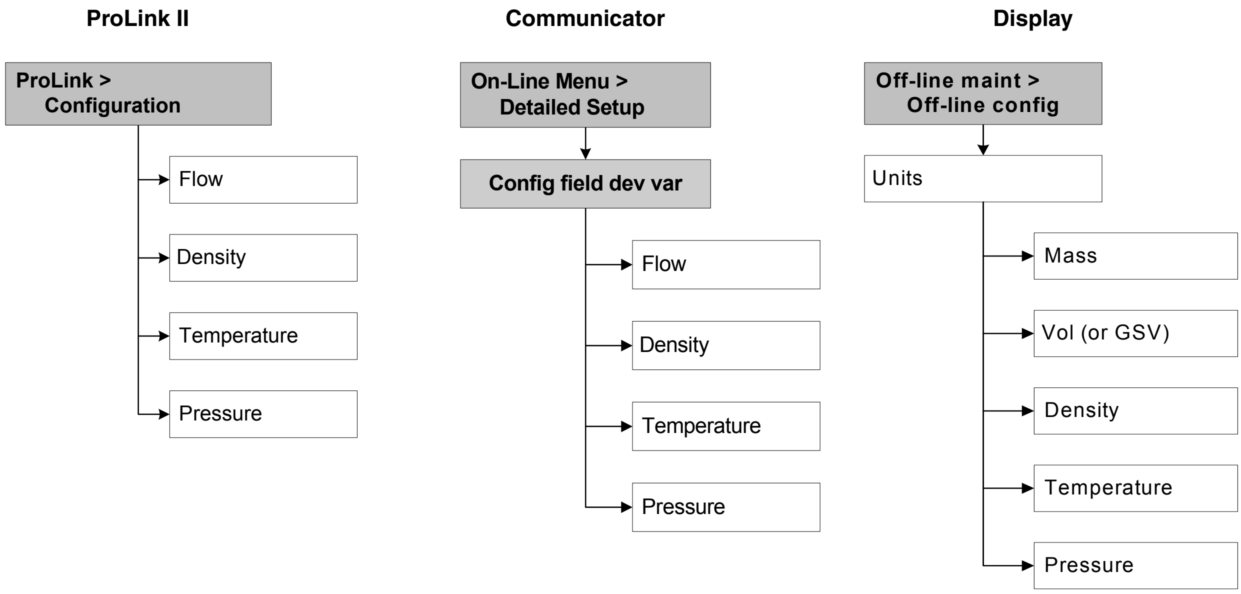
For the following process variables, the transmitter must be configured to use the measurement unit appropriate to your application:

- Mass flow
- Volume flow
- Density
- Pressure (optional)

The measurement units used for totalizers and inventories are assigned automatically, based on the measurement unit configured for the corresponding process variable. For example, if **kg/hr** (kilograms per hour) is configured for mass flow, the unit used for the mass flow totalizer and mass flow inventory is **kg** (kilograms).

To configure measurement units, refer to the flowcharts in Figure 6-7.

Figure 6-7 Configuring measurement units



6.4.1 Mass flow units

The default mass flow measurement unit is **g/s**. See Table 6-3 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 8.5).

Table 6-3 Mass flow measurement units

Mass flow unit			
Display	**ProLink II**	**Communicator**	**Unit description**
G/S	g/s	g/s	Grams per second
G/MIN	g/min	g/min	Grams per minute
G/H	g/hr	g/h	Grams per hour
KG/S	kg/s	kg/s	Kilograms per second
KG/MIN	kg/min	kg/min	Kilograms per minute
KG/H	kg/hr	kg/h	Kilograms per hour
KG/D	kg/day	kg/d	Kilograms per day
T/MIN	mTon/min	MetTon/min	Metric tons per minute
T/H	mTon/hr	MetTon/h	Metric tons per hour
T/D	mTon/day	MetTon/d	Metric tons per day
LB/S	lbs/s	lb/s	Pounds per second

Table 6-3 **Mass flow measurement units** *continued*

Mass flow unit			
Display	**ProLink II**	**Communicator**	**Unit description**
LB/MIN	lbs/min	lb/min	Pounds per minute
LB/H	lbs/hr	lb/h	Pounds per hour
LB/D	lbs/day	lb/d	Pounds per day
ST/MIN	sTon/min	STon/min	Short tons (2000 pounds) per minute
ST/H	sTon/hr	STon/h	Short tons (2000 pounds) per hour
ST/D	sTon/day	STon/d	Short tons (2000 pounds) per day
LT/H	lTon/hr	LTon/h	Long tons (2240 pounds) per hour
LT/D	lTon/day	LTon/d	Long tons (2240 pounds) per day
SPECL	special	Spcl	Special unit (see Section 8.5)

6.4.2 Volume flow units

Two different sets of volume flow measurement units are provided:

- Units typically used for liquid volume – see Table 6-4
- Units typically used for gas volume – see Table 6-5

The default liquid volume flow measurement unit is **L/s**. The default gas standard volume flow measurement unit is **SCFM**.

By default, only liquid volume flow units are listed. To access the gas volume flow units, you must first use ProLink II to configure Vol Flow Type. See Section 8.4.

Note: The Communicator cannot be used to configure gas volume flow units. If a volume flow unit for gas is configured, the Communicator will display "Unknown Enumerator" for the units label.

If the volume flow unit you want to use is not listed, you can define a special measurement unit for volume flow (see Section 8.5).

Table 6-4 **Volume flow measurement units – Liquids**

Volume flow unit			
Display	**ProLink II**	**Communicator**	**Unit description**
CUFT/S	ft3/sec	Cuft/s	Cubic feet per second
CUF/MN	ft3/min	Cuft/min	Cubic feet per minute
CUFT/H	ft3/hr	Cuft/h	Cubic feet per hour
CUFT/D	ft3/day	Cuft/d	Cubic feet per day
M3/S	m3/sec	Cum/s	Cubic meters per second
M3/MIN	m3/min	Cum/min	Cubic meters per minute
M3/H	m3/hr	Cum/h	Cubic meters per hour
M3/D	m3/day	Cum/d	Cubic meters per day
USGPS	US gal/sec	gal/s	U.S. gallons per second
USGPM	US gal/min	gal/min	U.S. gallons per minute
USGPH	US gal/hr	gal/h	U.S. gallons per hour
USGPD	US gal/d	gal/d	U.S. gallons per day

Table 6-4 Volume flow measurement units – Liquids *continued*

Volume flow unit			
Display	**ProLink II**	**Communicator**	**Unit description**
MILG/D	mil US gal/day	MMgal/d	Million U.S. gallons per day
L/S	l/sec	L/s	Liters per second
L/MIN	l/min	L/min	Liters per minute
L/H	l/hr	L/h	Liters per hour
MILL/D	mil l/day	ML/d	Million liters per day
UKGPS	Imp gal/sec	Impgal/s	Imperial gallons per second
UKGPM	Imp gal/min	Impgal/min	Imperial gallons per minute
UKGPH	Imp gal/hr	Impgal/h	Imperial gallons per hour
UKGPD	Imp gal/day	Impgal/d	Imperial gallons per day
BBL/S	barrels/sec	bbl/s	Barrels per second(1)
BBL/MN	barrels/min	bbl/min	Barrels per minute(1)
BBL/H	barrels/hr	bbl/h	Barrels per hour(1)
BBL/D	barrels/day	bbl/d	Barrels per day(1)
BBBL/S	Beer barrels/sec	bbbl/s	Beer barrels per second(2)
BBBL/MN	Beer barrels/min	bbbl/min	Beer barrels per minute(2)
BBBL/H	Beer barrels/hr	bbbl/h	Beer barrels per hour(2)
BBBL/D	Beer barrels/day	bbbl/d	Beer barrels per day(2)
SPECL	special	Spcl	Special unit (see Section 8.5)

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

Table 6-5 Volume flow measurement units – Gas

Volume flow unit			
Display	**ProLink II**	**Communicator**	**Unit description**
NM3/S	Nm3/sec	Not available	Normal cubic meters per second
NM3/MN	Nm3/min	Not available	Normal cubic meters per minute
NM3/H	Nm3/hr	Not available	Normal cubic meters per hour
NM3/D	Nm3/day	Not available	Normal cubic meters per day
NLPS	NLPS	Not available	Normal liter per second
NLPM	NLPM	Not available	Normal liter per minute
NLPH	NLPH	Not available	Normal liter per hour
NLPD	NLPD	Not available	Normal liter per day
SCFS	SCFS	Not available	Standard cubic feet per second
SCFM	SCFM	Not available	Standard cubic feet per minute
SCFH	SCFH	Not available	Standard cubic feet per hour
SCFD	SCFD	Not available	Standard cubic feet per day
SM3/S	Sm3/S	Not available	Standard cubic meters per second
SM3/MN	Sm3/min	Not available	Standard cubic meters per minute

Table 6-5 **Volume flow measurement units – Gas** *continued*

Volume flow unit			
Display	**ProLink II**	**Communicator**	**Unit description**
SM3/H	Sm3/hr	Not available	Standard cubic meters per hour
SM3/D	Sm3/day	Not available	Standard cubic meters per day
SLPS	SLPS	Not available	Standard liter per second
SLPM	SLPM	Not available	Standard liter per minute
SLPH	SLPH	Not available	Standard liter per hour
SLPD	SLPD	Not available	Standard liter per day
SPECL	special	Spcl	Special unit (see Section 8.5)

6.4.3 Density units

The default density measurement unit is **g/cm3**. See Table 6-3 for a complete list of density measurement units.

Table 6-6 **Density measurement units**

Density unit			
Display	**ProLink II**	**Communicator**	**Unit description**
SGU	SGU	SGU	Specific gravity unit (not temperature corrected)
G/CM3	g/cm3	g/Cucm	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/m3	kg/Cum	Kilograms per cubic meter
LB/GAL	lbs/Usgal	lb/gal	Pounds per U.S. gallon
LB/CUF	lbs/ft3	lb/Cuft	Pounds per cubic foot
LB/CUI	lbs/in3	lb/CuIn	Pounds per cubic inch
D API	degAPI	degAPI	API gravity
ST/CUY	sT/yd3	STon/Cuyd	Short ton per cubic yard

6.4.4 Temperature units

The default temperature measurement unit is **degC**. See Table 6-7 for a complete list of temperature measurement units.

Table 6-7 **Temperature measurement units**

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

6.4.5 Pressure units

The flowmeter does not measure pressure, but the transmitter can poll an external pressure measurement device. The default pressure measurement unit is **PSI**. See Table 6-8 for a complete list of pressure measurement units. It is not necessary to match units between the transmitter and the external pressure device – the transmitter will convert units for you.

Table 6-8 Pressure measurement units

Pressure unit			
Display	**ProLink II**	**Communicator**	**Unit description**
FTH2O	Ft Water @ 68°F	ftH2O	Feet water @ 68 °F
INW4C	In Water @ 4°C	inH2O @4DegC	Inches water @ 4 °C
INW60	In Water @ 60°F	inH2O @60DegF	Inches water @ 60 °F
INH2O	In Water @ 68°F	inH2O	Inches water @ 68 °F
mmW4C	mm Water @ 4°C	mmH2O @4DegC	Millimeters water @ 4 °C
mmH2O	mm Water @ 68°F	mmH2O	Millimeters water @ 68 °F
mmHG	mm Mercury @ 0°C	mmHg	Millimeters mercury @ 0 °C
INHG	In Mercury @ 0°C	inHg	Inches mercury @ 0 °C
PSI	PSI	psi	Pounds per square inch
BAR	bar	bar	Bar
mBAR	millibar	mbar	Millibar
G/SCM	g/cm2	g/Sqcm	Grams per square centimeter
KG/SCM	kg/cm2	kg/Sqcm	Kilograms per square centimeter
PA	pascals	Pa	Pascals
KPA	Kilopascals	kPa	Kilopascals
MPA	megapascals	MPa	Megapascals
TORR	Torr @ 0 °C	torr	Torr @ 0 °C
ATM	atms	atms	Atmospheres

6.5 Configuring the mA output(s)

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

All transmitters have one mA output, called the primary mA output. Some transmitters always have a secondary mA output, and some transmitters can be configured for a secondary mA output (see Section 6.3).

⚠ CAUTION

Changing the channel configuration without verifying I/O configuration can produce process error.

When the configuration of a channel is changed, the channel's behavior will be controlled by the configuration that is stored for the new channel type, which may or may not be appropriate for the process. To avoid causing process error:

- Configure the channels before configuring the mA output (see Section 6.3).
- When changing the mA output configuration, be sure that all control loops affected by this output are under manual control.
- Before returning the loop to automatic control, ensure that the mA output is correctly configured for your process.

If Channel B can be configured as an mA output, the transmitter always stores a configuration for the secondary mA output, independent of Channel B's current configuration. This may be the factory configuration or a previous site configuration. If you reconfigure Channel B as an mA output, the stored secondary mA output configuration will be loaded and used. Be sure to check the mA output configuration before returning the transmitter to service.

If Channel B can be configured as an mA output, but is configured for another I/O type:

- The output current and percent of range values will be reported as 0 via digital communications.
- Any alarms related to the secondary mA output will be cleared.

The parameters listed below may be set for the primary mA output, and for the secondary mA output if it will be used:

- Process variable
- Upper range value (URV) and lower range value (LRV)
- AO (analog output) cutoff (required only if the process variable is a flow variable)
- Fault indicator and fault value

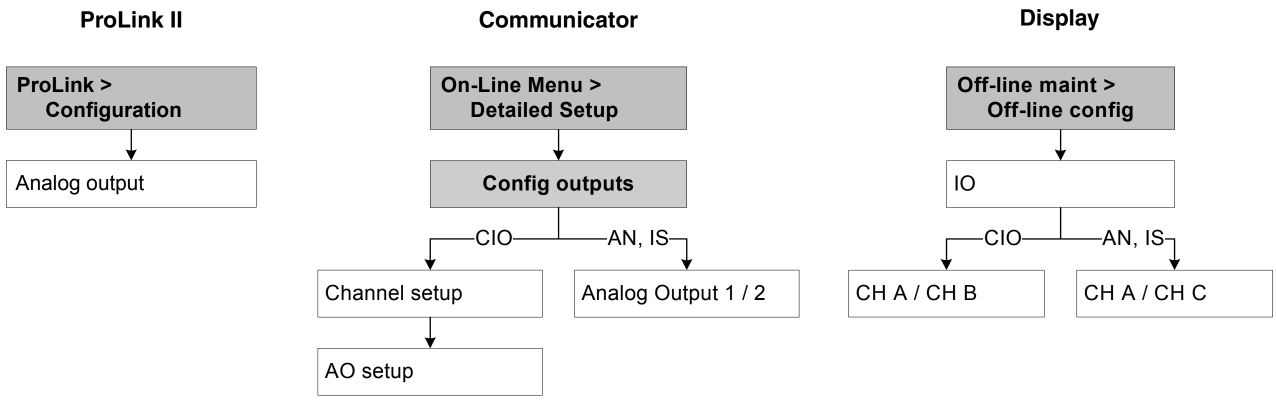
Always configure the process variable first, and if the process variable is changed, check the URV and LRV to ensure that they are correct for the new configuration.

An additional parameter – added damping – can be configured if required. For details on mA output parameters, see Sections 6.5.1 through 6.5.5.

To configure mA outputs, follow the flowcharts in Figure 6-8.

Note: If you use the display to configure the mA output, you can configure only the process variable and the range. To configure other mA output parameters, use ProLink II or the Communicator.

Figure 6-8 Configuring the mA output



6.5.1 Configuring the process variable

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

You can configure the process variables to be reported through the mA outputs. Table 6-9 lists the process variables that can be assigned to the primary and secondary mA outputs.

Note: Series 1000 transmitters can measure only mass flow and volume flow.

⚠ CAUTION

Changing the process variable assignment without verifying the mA output range can produce process error.

When the process variable assignment is changed, the mA output range will be changed automatically. The new output range may or may not be appropriate for the process. To avoid causing process error, always verifiy the mA output range after changing the process variable assignment. See Section 6.5.2

Table 6-9 mA output process variable assignments

Process variable	ProLink II code	Communicator code	Display code
Mass flow	Mass Flow	Mass flo	MFLOW
Volume flow	Vol Flow	Vol flo	VFLOW
Gas standard volume flow rate(1)	Gas Std Vol Flow Rate	Gas vol flo	GSV F
Temperature	Temp	Temp	TEMP
Density	Density	Dens	DENS
External pressure(1)	External Pressure	External pres	EXT P
External temperature(1)	External Temperature	External temp	EXT T
Temperature-corrected density(2)	Dens at Ref	TC Dens	TCDEN
Temperature-corrected (standard) volume flow(2)	Std Vol Flow	TC Vol	TCVOL
Drive gain	Drive Gain	Driv signl	DGAIN
Average corrected density(2) (3)	Avg Density	N/A	AVE D
Average temperature(2) (3)	Avg Temp	N/A	AVE T

Table 6-9 **mA output process variable assignments** *continued*

Process variable	ProLink II code	Communicator code	Display code
ED density at reference(4)	ED: Density @ Reference	N/A	RDENS
ED specific gravity(4)	ED: Density (Fixed SG units)	N/A	SGU
ED standard volume flow(4)	ED: Std Vol Flow Rate	N/A	STD V
ED net mass flow(4)	ED: Net Mass Flow Rate	N/A	NET M
ED net volume flow(4)	ED: Net Vol Flow Rate	N/A	NET V
ED concentration(4)	ED: Concentration	N/A	CONC
ED Baume(4)	ED: Density (Fixed Baume Units)	N/A	BAUME

(1) Requires rev5.0 or later of the transmitter software.
(2) Available only if the petroleum measurement application is enabled on your transmitter.
(3) Requires rev3.3 or later of the transmitter software. Can be configured only with the display or with v1.2 or later of ProLink II software.
(4) Available only if the enhanced density application is enabled on your transmitter.

Notes: The process variable assigned to the primary mA output is always the PV (primary variable) defined for HART communications. You can specify this process variable either by configuring the primary mA output or by configuring the PV (see Section 8.16.9). If you change the process variable assigned to the mA output, the PV assignment is changed automatically, and vice versa.

If your transmitter has a secondary mA output, the process variable assigned to it is always the SV (secondary variable) defined for HART communications. You can specify this process variable either by configuring the secondary mA output or by configuring the SV (see Section 8.16.9). If you change the process variable assigned to the mA output, the SV assignment is changed automatically, and vice versa.

If your transmitter does not have a secondary mA output, the SV assignment must be configured directly (see Section 8.16.9), and the value of the SV must be queried through an RS-485 connection, read through the Communicator, or reported through burst mode.

6.5.2 Configuring the mA output range (LRV and URV)

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The mA outputs use a range of 4 to 20 mA to represent the assigned process variable. You must specify:

- The lower range value (LRV) – the value of the process variable that will be indicated when the mA output produces 4 mA
- The upper range value (URV) – the value of the process variable that will be indicated when the mA output produces 20 mA

Enter values in the measurement units that are configured for the assigned process variable (see Section 6.4).

Note: 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 that can be assigned to an mA output has its own LRV and URV. If you assign a different process variable to an mA output, the corresponding LRV and URV are loaded and used. Default LRV and URV settings are listed in Table 6-10.

Table 6-10 Default LRV and URV

Process variable	LRV	URV
All mass flow variables	–200.000 g/s	200.000 g/s
All liquid volume flow variables	–0.200 l/s	0.200 l/s
All density variables	0.000 g/cm^3	10.000 g/cm^3
All temperature variables	–240.000 °C	450.000 °C
Drive gain	0.000%	100.000%
Gas standard volume flow	–423.78 SCFM	423.78 SCFM
External temperature	–240.000 °C	450.000 °C
External pressure	0.000 bar	100.000 bar
Enhanced density concentration	0%	100%
Enhanced density Baume	0	10
Enhanced density specific gravity	0	10

Note: Beginning with rev5.0 of the transmitter software, if the LRV and URV are changed from the defaults, and the mA output source is later changed, the LRV and URV will not be reset to their default values. For example, if mass flow is assigned to the mA output, and the LRV and URV for mass flow are changed, then density is assigned to the mA output, and finally mass flow is reassigned to the mA output, the LRV and URV for mass flow are reset to the configured values. In earlier versions of the transmitter software, the LRV and URV were reset to factory default values.

6.5.3 Configuring the AO cutoff(s)

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

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 or volume flow. If an mA output has been configured for a process variable other than mass flow or volume flow, the AO cutoff menu option is not displayed for that output.

Note: For most applications, the default AO cutoff should be 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 Section 8.7). If mass flow or volume flow has been assigned to an 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: • Primary mA output: Mass flow • Frequency output: Mass flow • AO cutoff for primary mA output: 10 g/sec • Mass flow cutoff: 15 g/sec As a result, if the mass flow rate drops below 15 g/sec, all outputs representing mass flow will report zero flow.

Example	Configuration:
	• Primary mA output: Mass flow
	• Frequency output: Mass flow
	• AO cutoff for primary mA output: 15 g/sec
	• Mass flow cutoff: 10 g/sec
	
	As a result:
	• If the mass flow rate drops below 15 g/sec but not below 10 g/sec:
	  • The primary mA output will report zero flow.
	  • The frequency output will report nonzero flow.
	• If the mass flow rate drops below 10 g/sec, both outputs will report zero flow.

6.5.4 Configuring the fault indicator and fault value

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

If the transmitter encounters an internal fault condition, it can indicate the fault over the mA output by sending a preprogrammed output level to the receiving device. You can specify the output level by configuring the fault indicator. Options are shown in Table 6-11.

By default, the transmitter immediately reports a fault when a fault is encountered. You can delay reporting certain faults by changing the fault timeout. See Section 8.13.2.

Note: The fault indicator for the mA output is independent of all other fault indicators except the digital communication fault indicator. If the mA fault indicator is set to None, the digital communication fault indicator should also be set to None.

Table 6-11 mA output fault indicators and values

Fault indicator	Fault output value
Upscale	21–24 mA (default: 22 mA)
Downscale	IS transmitters: 3.2–3.6 mA (default: 3.2 mA) All other transmitters: 1.0–3.6 mA (default: 2.0 mA)
Internal zero	The value associated with 0 (zero) flow, as determined by URV and LRV values
None	Tracks data for the assigned process variable; no fault action

⚠ CAUTION

Setting the fault indicator to NONE may result in process error due to undetected fault conditions.

To avoid undetected fault conditions when the fault indicator is set to NONE, use some other mechanism such as digital communication to monitor device status.

6.5.5 Configuring added damping

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

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, but does not affect the frequency or digital outputs.

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

When you specify a new added damping value, it is automatically rounded down to the nearest valid value. Valid added damping values are listed in Table 6-12. Note that added damping values are affected by the Update Rate parameter (see Section 8.9).

Table 6-12 Valid added damping values

Update rate parameter	100 Hz variable	Process variable update rate	Valid added damping values
Normal	N/A	20 Hz	0.0, 0.1, 0.3, 0.75, 1.6, 3.3, 6.5, 13.5, 27.5, 55.0, 110, 220, 440
Special	100 Hz variable assigned to the mA output	100 Hz	0.0, 0.04, 0.12, 0.30, 0.64, 1.32, 2.6, 5.4, 11.0, 22.0, 44, 88, 176, 350
	100 Hz variable not assigned to the mA output	6.25 Hz	0.0, 0.32, 0.96, 2.40, 5.12, 10.56, 20.8, 43.2, 88.0, 176.0, 352

Note: Added damping is not applied if the mA output is fixed (i.e., during loop testing) or is reporting a fault. Added damping is applied while simulation mode is active.

Multiple damping parameters

Damping can also be configured for the flow (mass and volume), density, and temperature process variables (see Section 8.8). If one of these process variables has been assigned to an mA output, a non-zero value is configured for its damping, and added damping is also configured for the mA output, 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 • Primary mA output: Mass flow • Frequency output: Mass flow • Primary mA output added damping: 2 As a result: • A change in mass flow will be reflected in the primary 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. • The frequency output level changes over a 1–second time period (the mass flow damping value). It is not affected by the added damping value.

6.6 Configuring the frequency output(s)

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Different transmitters have different frequency output options. See Section 6.3 for information on assigning a channel as a frequency output.

⚠ CAUTION

Changing the channel configuration without verifying I/O configuration can produce process error.

When the configuration of a channel is changed, the channel's behavior will be controlled by the configuration that is stored for the new channel type, which may or may not be appropriate for the process. To avoid causing process error:

- Configure the channels before configuring the frequency output (see Section 6.3).
- When changing the frequency output configuration, be sure that all control loops affected by this output are under manual control.
- Before returning the loop to automatic control, ensure that the frequency output is correctly configured for your process.

The frequency output generates two voltage levels:

- 0 V
- A site-specific voltage, determined by the power supply, pull-up resistor, and load (see the installation manual for your transmitter)

If your transmitter is configured for two frequency outputs (Model 2500 CIO and Model 2700 CIO transmitters only), the Channel C signal is generated from the Channel B signal, with a user-specified phase shift. The signals are electrically isolated but not independent. You cannot configure Channel B and Channel C independently.

Note: Configuring both Channel B and Channel C as frequency outputs is used to enable dual pulse or quadrature mode (see Section 6.6.5).

The transmitter always stores a configuration for the frequency output, independent of current channel configuration. This may be the factory configuration or a previous site configuration. If you reconfigure Channel B or Channel C as a frequency output, the stored configuration will be loaded and used. Be sure to check the frequency output configuration before returning the transmitter to service.

If neither Channel B nor Channel C is configured as a frequency output:

- The frequency value reported via digital communications will go to 0.0 Hz.
- Any alarms related to the frequency output will be cleared.

If a frequency output is present on your transmitter, the following parameters may be set:

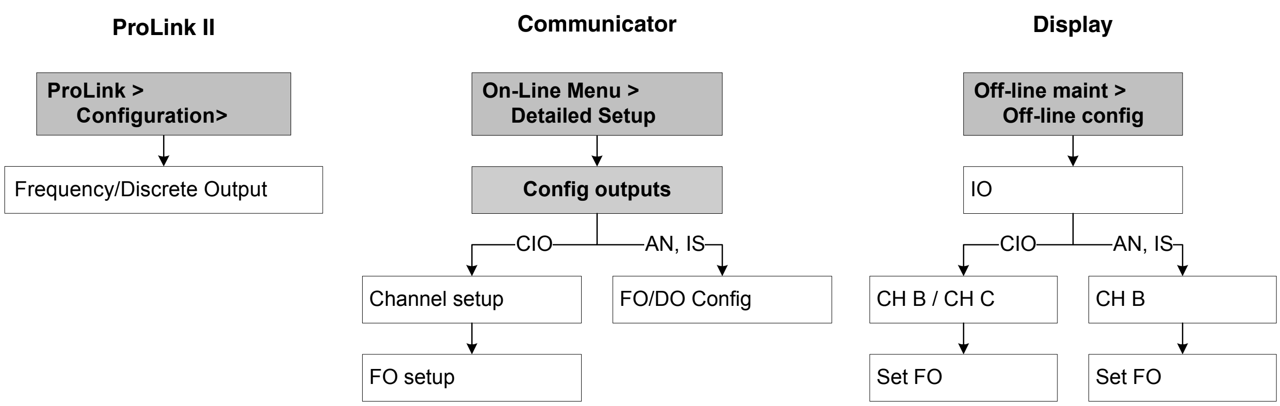
- Process variable
- Output scale
- Pulse width
- Polarity
- Mode (Model 2500 and Model 2700 only, if two frequency outputs have been configured)
- Fault indicator

For details on frequency output parameters, see Sections 6.6.1 through 6.6.6.

Notes: If you use the display to configure the frequency output, you can configure only the process variable and the Frequency=Flow output scale. To configure other frequency output parameters, use ProLink II or the Communicator.

To configure the frequency output, refer to the flowcharts in Figure 6-9.

Figure 6-9 Configuring the frequency output



6.6.1 Configuring the process variable

- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

With a Series 1000 transmitter, the process variable assigned to the primary mA output is automatically assigned to the frequency output.

With a Series 2000 transmitter, the frequency output is independent of the primary mA output. Table 6-13 lists the process variables that can be assigned to the frequency output.

Table 6-13 **Frequency output process variable assignments for Series 2000 transmitters**

Process variable	ProLink II code	Communicator code	Display code
Mass flow	Mass Flow	Mass flo	MFLOW
Volume flow	Vol Flow	Vol flo	VFLOW
Gas standard volume flow	Gas Std Vol Flow Rate	Gas vol flo	GSV F
Temperature-corrected (standard) volume flow(1)	Std Vol Flow	TC Vol	TCVOL
ED standard volume flow(2)	ED: Std Vol Flow Rate	N/A	STD V
ED net mass flow(2)	ED: Net Mass Flow Rate	N/A	NET M
ED net volume flow(2)	ED: Net Vol Flow Rate	N/A	NET V

(1) Available only if the petroleum measurement application is enabled on your transmitter.
(2) Available only if the enhanced density application is enabled on your transmitter.

Notes: The process variable assigned to the frequency output is always the TV (tertiary variable) defined for HART communications. You can specify this process variable either by configuring the frequency output or by configuring the TV (see Section 8.16.9). If you change the process variable assigned to the mA output, the TV assignment is changed automatically, and vice versa.

If your transmitter does not have a frequency output, the TV assignment must be configured directly (see Section 8.16.9), and the value of the TV must be queried through an RS-485 connection, read through the Communicator, or reported through burst mode.

6.6.2 Configuring the output scale

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The frequency *output scale* defines the relationship between output pulse and flow units. You can select one of three output scale methods, as listed in Table 6-14.

Table 6-14 **Frequency output scale methods and required parameters**

Method	Description	Required parameters
Frequency = flow	• Frequency calculated from flow rate as described below	• *TV frequency factor* • *TV rate factor*
Pulses per unit	• A user-specified number of pulses represents one flow unit	• *TV pulses/unit*
Units per pulse	• A pulse represents a user-specified number of flow units	• *TV units/pulse*

Frequency=Flow

If you specify **Frequency=Flow**, you must also specify **TV frequency factor** and **TV rate factor**. **TV rate factor** is defined as the maximum flow rate appropriate to your application. **TV frequency factor** can then be calculated using the following formula:

$$\text{FrequencyFactor} = \frac{\text{Rate}}{\text{T}} \times \text{N}$$

where:

- *Rate* = maximum appropriate flow rate (**TV rate factor** in configuration)
- *T* = factor to convert selected flow time base to seconds
- *N* = number of pulses per flow unit, as configured in the receiving device

The resulting **TV frequency factor** value must be within the range of the frequency output (0 to 10,000 Hz).

- If the **TV frequency factor** value is less than 1 Hz, reconfigure the receiving device for a higher pulses/unit setting.
- If the **TV frequency factor** value is greater than 10,000 Hz, reconfigure the receiving device for a lower pulses/unit setting.

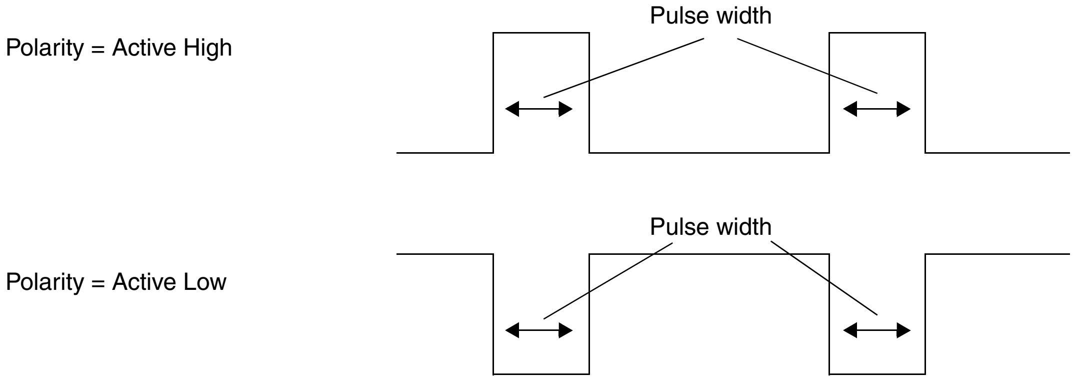
Example	Maximum appropriate flow rate (**TV rate factor**) is 2000 lbs/min. Receiving device is configured for 10 pulses/pound. Solution: $\text{FrequencyFactor} = \frac{\text{Rate}}{\text{T}} \times \text{N}$ $\text{FrequencyFactor} = \frac{2000}{60} \times 10$ $\text{FrequencyFactor} = 333.33$ Configuration: • TV frequency factor = 333.33 • TV rate factor = 2000

6.6.3 Configuring the maximum pulse width

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

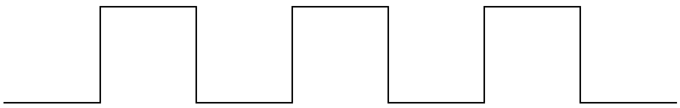
The frequency output *maximum pulse width* defines the maximum duration of the “active” portion of the wave that the transmitter sends to the frequency receiving device. The active portion may be the high voltage or 0.0 V, depending on the polarity setting (see Figure 6-10 and Section 6.6.4).

Figure 6-10 Pulse width



Maximum Pulse Width can be set to 0, or to values between 0.5 and 277.5 milliseconds. The user-entered value is adjusted automatically to the nearest valid value. If Maximum Pulse Width is set to 0 (the default), the output will have a 50% duty cycle, independent of the output frequency. A 50% duty cycle is illustrated in Figure 6-11.

Figure 6-11 50% duty cycle



Note: If the transmitter is configured for two frequency outputs, Maximum Pulse Width is ignored. The outputs always use a 50% duty cycle.

If Maximum Pulse Width is set to a non-zero value, the duty cycle is controlled by the *crossover frequency*. The crossover frequency is calculated as follows:

$$\text{Crossover frequency} = \frac{1}{2 \times \text{max pulse width}}$$

- At frequencies below the crossover frequency, the duty cycle is determined by the pulse width and the frequency.
- At frequencies above the crossover frequency, the output changes to a 50% duty cycle.

You can change the setting for Maximum Pulse Width so that the transmitter will output a pulse width appropriate to your receiving device:

- High-frequency counters such as frequency-to-voltage converters, frequency-to-current converters, and Micro Motion peripherals usually require approximately a 50% duty cycle.
- Electromechanical counters and PLCs that have low-scan cycle rates generally use an input with a fixed non-zero state duration and a varying zero state duration. Most low-frequency counters have a specified requirement for Maximum Pulse Width.

Note: For typical applications, the default pulse width is used.

Example	The frequency output is wired to a PLC with a specified pulse width requirement of 50 ms. The crossover frequency is 10 Hz. Solution: • Set Max Pulse Width to 50 ms. • For frequencies less than 10 Hz, the frequency output will have a 50 msec ON state, and the OFF state will be adjusted as required. For frequencies higher than 10 Hz, the frequency output will be a square wave with a 50% duty cycle.

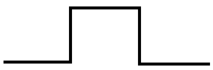
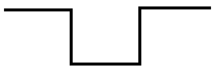
Note: If you are using the Frequency=Flow output scale method, and you set maximum pulse width to a non-zero value, Micro Motion recommends setting the frequency factor to a value below 200 Hz. See Section 6.6.2.

6.6.4 Configuring the frequency output polarity

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The frequency output *polarity* controls how the output indicates the active (ON) state. See Table 6-15. The default value, Active High, is appropriate for most applications. Active Low may be required by applications that use low-frequency signals.

Table 6-15 Polarity settings and frequency output levels

Polarity		Reference voltage (OFF)	Pulse voltage (ON)
Active high		0	As determined by power supply, pull-up resistor, and load (see the installation manual for your transmitter)
Active low		As determined by power supply, pull-up resistor, and load (see the installation manual for your transmitter)	0

6.6.5 Configuring mode

- Model 2500 CIO
- Model 2700 CIO

If both Channel B and Channel C are configured as frequency outputs, they function as a dual-pulse output. In dual-pulse mode, the second frequency output can be phase-shifted either 0°, 180°, +90°, or –90°, or set to quadrature (the default). See Figure 6-12.

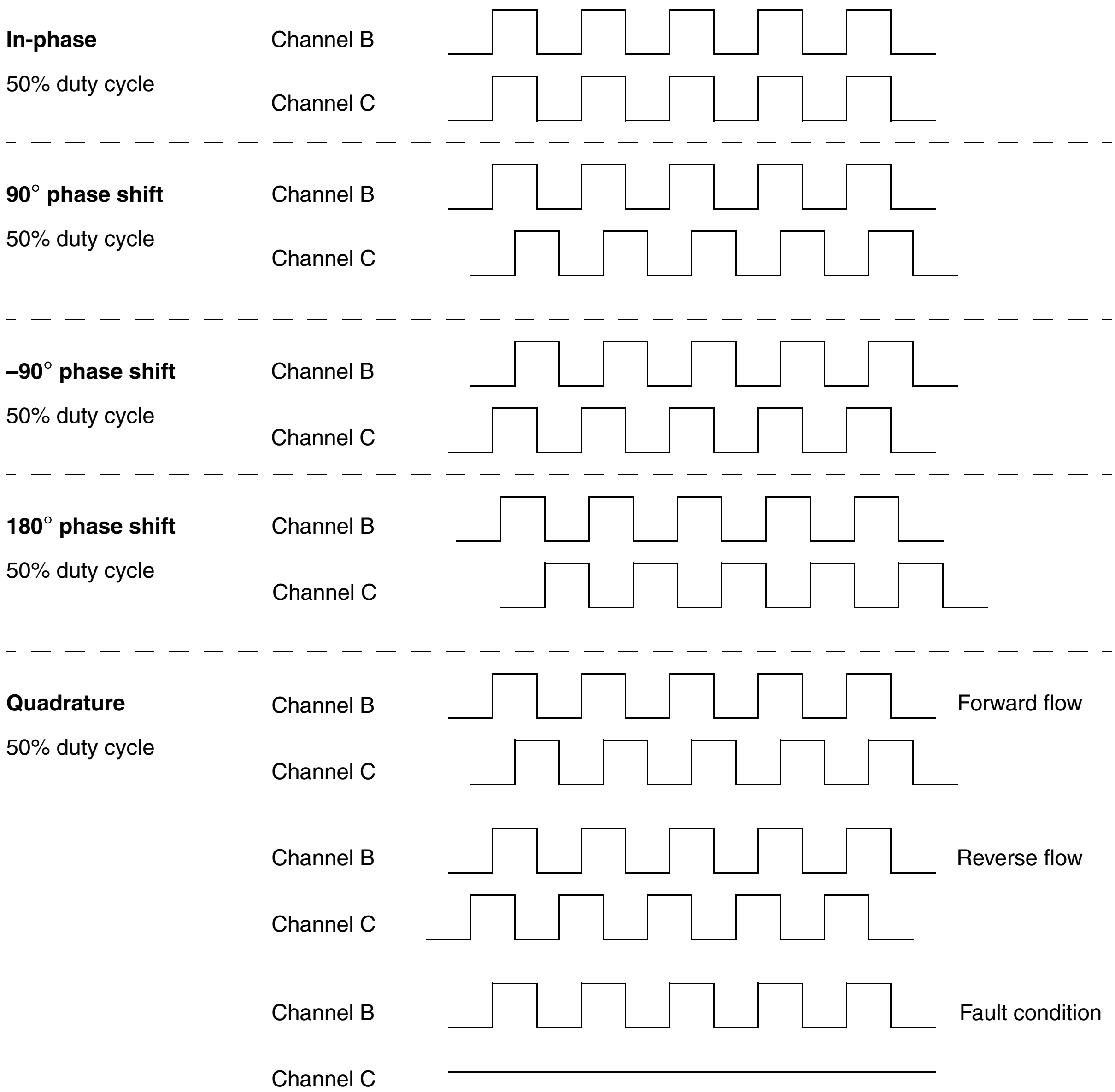
In Quadrature mode, Channel C:

- Lags Channel B by 90° during forward flow
- Leads Channel B by 90° during reverse flow
- Is driven to 0 during a fault condition

Quadrature mode is used only for specific weights & measures applications where required by law.

Note: If only one channel is configured as a frequency output, **Frequency Output Mode** *is set to* **Single** *and cannot be changed.*

Figure 6-12 **Dual-pulse output options**



6.6.6 Configuring the fault indicator

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

If the transmitter encounters an internal fault condition, it can indicate the fault over the frequency output by sending a preprogrammed output level to the receiving device. You can specify the output level by configuring the fault indicator. See Table 6-16.

Note: By default, the transmitter immediately reports a fault when a fault is encountered. You can delay reporting certain faults by changing the fault timeout. See Section 8.13.2.

Table 6-16 Frequency output fault indicators and values

Fault indicator	Fault output value
Upscale	The user-specified upscale value between 10 Hz and 15,000 Hz (15,000 Hz default)
Downscale	0 Hz
Internal zero	0 Hz
None	Tracks the data for the assigned process variable; no fault action

⚠ CAUTION

Setting the fault indicator to NONE may result in process error due to undetected fault conditions.

To avoid undetected fault conditions when the fault indicator is set to NONE, use some other mechanism such as digital communication to monitor device status.

If both Channel B and Channel C are configured as frequency outputs (dual-pulse mode), performance during fault conditions depends on the configured fault indicator and the configured phase shift, as described in Table 6-17.

Table 6-17 Dual-phase fault indication

Configured fault indicator	All phase shifts except quadrature	Quadrature	
	Channels B and C	Channel B	Channel C
Upscale	Upscale value	Upscale value	0 Hz
Downscale	0 Hz	Upscale value	0 Hz
Internal zero	0 Hz	Upscale value	0 Hz
None	Tracks data for the assigned process variable	Tracks data for the assigned process variable	Tracks data for the assigned process variable

Note: The fault indicator for the frequency output is independent of all other fault indicators except the digital communication fault indicator. If the frequency output fault indicator is set to None, the digital communication fault indicator should also be set to None.

6.7 Configuring the discrete output(s)

- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Different transmitters have different discrete output options. See Section 6.3 for information on assigning a channel as a discrete output.

CAUTION

Changing the channel configuration without verifying I/O configuration can produce process error.

When the configuration of a channel is changed, the channel's behavior will be controlled by the configuration that is stored for the new channel type, which may or may not be appropriate for the process. To avoid causing process error:

- Configure the channels before configuring the discrete output (see Section 6.3).
- When changing the discrete output configuration, be sure that all control loops affected by this output are under manual control.
- Before returning the loop to automatic control, ensure that the discrete output is correctly configured for your process.

The transmitter always stores a configuration for the discrete output(s), independent of current channel configuration. This may be the factory configuration or a previous site configuration. If you reconfigure Channel B or Channel C as a discrete output, the stored configuration will be loaded and used. Be sure to check the discrete output configuration before returning the transmitter to service.

If neither Channel B nor Channel C is configured as a discrete output:

- The discrete output states are reported as inactive via digital communications.
- If the Discrete Output Fixed alarm was active, it will be cleared.

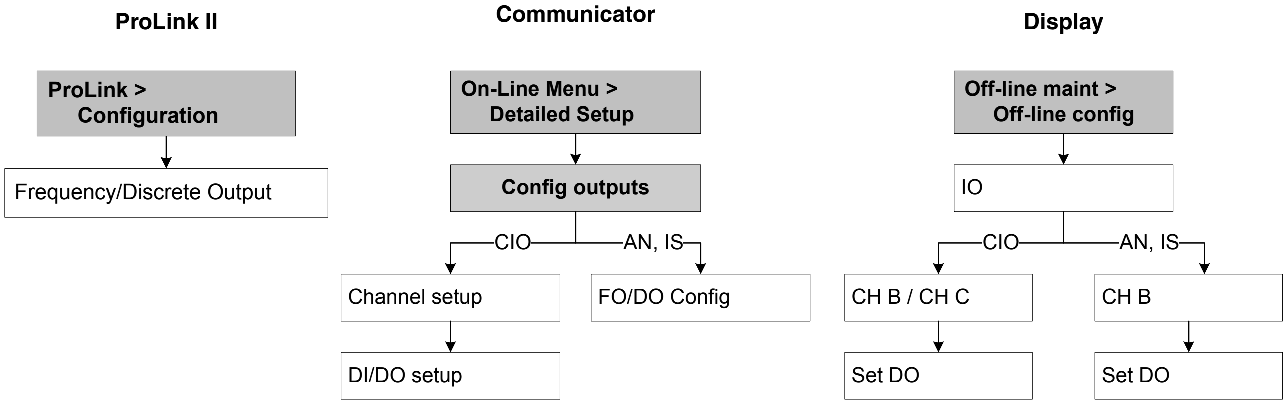
If a discrete output is present on your transmitter, the following parameters may be set:

- Polarity
- Assignment
- Fault indicator

For details on discrete output parameters, see Sections 6.7.1 through 6.7.4.

To configure the discrete output, follow the flowcharts in Figure 6-13.

Figure 6-13 **Configuring the discrete output**



6.7.1 Configuring the discrete output polarity

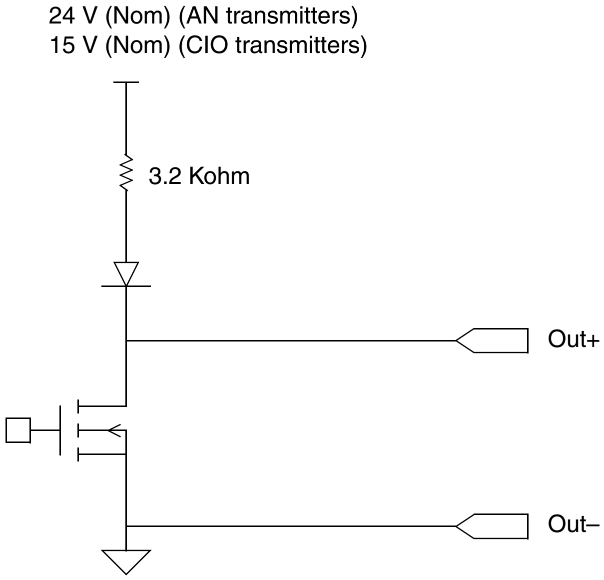
The discrete outputs generate two voltage levels to represent ON or OFF states. The voltage levels depend on the output's polarity, as shown in Table 6-18. Figure 6-14 shows a diagram of a typical discrete output circuit.

Table 6-18 **Discrete output polarity**

Polarity	Output power supply[1]	Description
Active high	Internal	• When asserted (condition tied to DO is true), the circuit provides a pull-up to 24 V (AN transmitters) or 15 V (CIO transmitters). • When not asserted (condition tied to DO is false), the circuit provides 0 V.
	External	• When asserted (condition tied to DO is true), the circuit provides a pull-up to a site-specific voltage, maximum 30 V. • When not asserted (condition tied to DO is false), the circuit provides 0 V.
Active low	Internal	• When asserted (condition tied to DO is true), the circuit provides 0 V. • When not asserted (condition tied to DO is false), the circuit provides a pull-up to 24 V (AN transmitters) or 15 V (CIO transmitters).
	External	• When asserted (condition tied to DO is true), the circuit provides 0 V. • When not asserted (condition tied to DO is false), the circuit provides a pull-up to a site-specific voltage, to a maximum of 30 V.

(1) On AN transmitters, all outputs are internally powered. On IS transmitters, all outputs are externally powered. On CIO transmitters, the two channels which can be configured as discrete outputs (Channels B and C) can be configured for either internal or external power (see Section 6.3).

Figure 6-14 **Discrete output circuit**



6.7.2 Assignment

The discrete output can be used to indicate the conditions described in Table 6-19. If you have two discrete outputs, you can configure them independently; for example, you can assign one to flow switch and the other to fault.

Table 6-19 **Discrete output assignments and output levels**

Assignment	ProLink II code	Communicator code	Display code	Condition	Discrete output level(1)
Discrete event 1–5(2)	Discrete Event *x*	Discrete Event *x*	D EV*x*	ON	Site-specific
				OFF	0 V
Event 1–2(3)	Event 1, Event 2, Event 1 or Event 2	Event 1, Event 2, Event1 or Event2	EVNT1, EVNT2, E1OR2	ON	Site-specific
				OFF	0 V
Flow switch(4)	Flow Switch Indication	Flow switch	FL SW	ON	Site-specific
				OFF	0 V
Flow direction	Forward/Reverse Indication	Forward/Reverse	FLDIR	Forward	0 V
				Reverse	Site-specific
Calibration in progress	Calibration in Progress	Calibration in progr	ZERO	ON	Site-specific
				OFF	0 V
Fault	Fault Condition Indication	Fault	FAULT	ON	Site-specific
				OFF	0 V

(1) Voltage descriptions in this column assume that Polarity is set to Active High. If Polarity is set to Active Low, the voltages are reversed.
(2) Events configured using the dual-setpoint event model. See Section 8.11.
(3) Events configured using the single-setpoint event model. See Section 8.11.
(4) See Section 6.7.3.

6.7.3 Flow switch

The flow switch is used to indicate that the flow rate (e.g., mass flow, liquid volume flow) has dropped below a user-configured setpoint. The flow switch has a 5% hysteresis, which means that no change occurs when the flow rate is within ±5% of the setpoint. At startup, the flow switch is OFF.

For example, if the setpoint is 100 lb/min and the first reading is below 95 lb/min, the flow switch turns ON and will stay ON until the flow rate rises above 105 lb/min. At this point it turns OFF, and will stay off until the flow rate drops below 95 lb/min.

If a discrete output is assigned to flow switch, the flow switch variable and flow switch setpoint must be configured. Any flow variable, including gas standard volume flow and petroleum measurement or enhanced density flow variables, can be assigned as the flow switch variable.

Note: If your transmitter is configured with two discrete outputs, it is possible to configure both DO1 and DO2 for flow switch, but both discrete outputs will use the same setpoint.

6.7.4 Safe state

The Fault Action (or Fault Indication) parameter is used to specify the state to which the discrete output will be forced if the transmitter encounters an internal fault condition. This allows you to define a discrete output "safe" state. See Table 6-20.

Notes: Because the safe state of the discrete output is either ON or OFF, you may not be able to distinguish the safe state from the normal state. Therefore, it may not be appropriate to use the Safe State parameter as a fault indicator. If you want to use the discrete output to indicate faults, assign Fault to the discrete output as described in Section 6.7.2, and set Safe State to None.

If Fault is assigned to the discrete output (see Section 6.7.2), the Safe State setting is not applicable. The discrete output will be ON whenever a fault condition is active.

By default, the transmitter immediately applies the Safe State setting when a fault is encountered. You can delay reporting faults by changing the fault timeout. See Section 8.13.2.

Table 6-20 Discrete output safe state and values

	Discrete output state	
Safe state	**Polarity = Active High**	**Polarity = Active Low**
Upscale	• Fault: DO is ON (site-specific voltage) • No fault: DO is controlled by its assignment	• Fault: DO is OFF (0 V) • No fault: DO is controlled by its assignment
Downscale	• Fault: DO is OFF (0 V) • No fault: DO is controlled by its assignment	• Fault: DO is ON (site-specific voltage) • No fault: DO is controlled by its assignment
None	DO is controlled by its assignment	

6.8 Configuring the discrete input

- Model 2500 CIO
- Model 2700 CIO

The discrete input is used to initiate a transmitter action from a remote input device.

Note: Discrete events (dual-setpoint event model) may also be used to initiate these transmitter actions.

> **⚠ CAUTION**
>
> **Changing the channel configuration without verifying I/O configuration can produce process error.**
>
> When the configuration of a channel is changed, the channel's behavior will be controlled by the configuration that is stored for the new channel type, which may or may not be appropriate for the process. To avoid causing process error:
>
> - Configure the channels before configuring the discrete input (see Section 6.3).
> - When changing channel configuration, be sure that all control loops affected by the discrete input are under manual control.
> - Before returning the loop to automatic control, ensure that the discrete input is correctly configured for your process.

The action is triggered when the discrete input or discrete event changes state from inactive to active. No action is triggered:

- When the discrete input or discrete event remains active or inactive.
- When the discrete input or discrete event changes state from active to inactive, with one exception: if the discrete input or discrete event is assigned to start/stop totalizers, the totalizers will be started when the discrete input or discrete event is active, and stopped with the discrete input or discrete event is inactive.

The transmitter always stores a configuration for the discrete input, independent of current channel configuration. This may be the factory configuration or a previous site configuration. If you reconfigure Channel C as a discrete input, the stored configuration will be loaded and used. Be sure to check the discrete input configuration before returning the transmitter to service.

If Channel C is not configured as a discrete input, the input state is reported as inactive via digital communications.

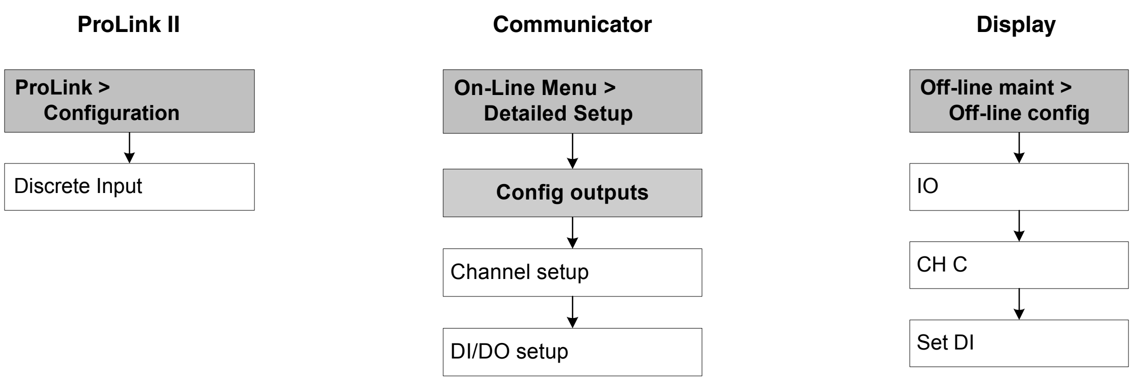
If a discrete input is present on your transmitter, the following parameters may be set:

- Assignment
- Polarity

For details on discrete input parameters, see Sections 6.8.1 through 6.8.2.

To configure the discrete input, follow the flowcharts in Figure 6-15.

Figure 6-15 Configuring the discrete input



6.8.1 Configuring discrete input or discrete event assignments

Table 6-21 lists the actions that can be assigned to the discrete input or to discrete events. You can assign more than one action to the same discrete input or discrete event.

Note: See Section 8.11 for information on discrete events.

Table 6-21 Discrete input and discrete event assignments

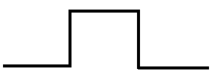
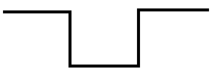
Assignment	ProLink II code	Communicator code	Display code
None (default)	None	None	NONE
Start sensor zero	Start Sensor Zero	Perform auto zero	START ZERO
Start/stop all totalizers	Start/Stop All Totalization	Start/stop totals	START STOP
Reset mass total	Reset Mass Total	Reset mass total	RESET MASS
Reset volume total	Reset Volume Total	Reset volume total	RESET VOL
Reset gas standard volume total	Reset Gas Std Volume Total	Reset gas standard volume total	RESET GSVT
Reset all totals	Reset Totals	Reset totals	RESET ALL
Reset temperature-corrected volume total(1)	Reset Corrected Volume Total	Reset corrected volume total	TCVOL
Reset ED reference volume total(2)	Reset ED Ref Vol Total	N/A	RESET STD V
Reset ED net mass total(2)	Reset ED Net Mass Total	N/A	RESET NET M
Reset ED net volume total(2)	Reset ED Net Vol Total	N/A	RESET NET V
Increment ED curve(2)	Increment Current ED Curve	N/A	INCr CURVE

(1) Available only if the petroleum measurement application is enabled on your transmitter.
(2) Available only if the enhanced density application is enabled on your transmitter.

6.8.2 Configuring the discrete input polarity

The state of the discrete input depends on the input voltage and the configured polarity, as shown in Table 6-22.

Table 6-22 Discrete input polarity

Polarity	Input power supply	DI Status	Description
Active high 	Internal	ON	Voltage across terminals is high
		OFF	Voltage across terminals is zero
	External	ON	Voltage applied across terminals is 3–30 VDC
		OFF	Voltage applied across terminals is <0.8 VDC
Active low 	Internal	ON	Voltage across terminals is zero
		OFF	Voltage across terminals is high
	External	ON	Voltage applied across terminals is <0.8 VDC
		OFF	Voltage applied across terminals is 3–30 VDC

6.9 Establishing a meter verification baseline

Note: This procedure applies only if your transmitter is connected to an enhanced core processor and you have ordered the meter verification option. In addition, ProLink II v2.5 or later is required.

Meter verification is a method of establishing that the flowmeter is performing within factory specifications. See Chapter 10 for more information about meter verification.

Micro Motion recommends performing meter verification several times over a range of process conditions after the transmitter's required configuration procedures have been completed. This will establish a baseline for how widely the verification measurement varies under normal circumstances. The range of process conditions should include expected temperature, pressure, density, and flow rate variations.

View the trend chart for these initial tests. By default, the specification uncertainty limit is set at ±4.0%, which will avoid false Fail/Caution results over the entire range of specified process conditions. If you observe a structural integrity variation greater than 4% due to normal process conditions, you may adjust the specification uncertainty limit to match your process variation. To avoid false Fail/Caution results, it is advisable to set the specification uncertainty limit to approximately twice the variation due to the effect of normal process conditions.

In order to perform this baseline analysis, you will need the enhanced meter verification capabilities of ProLink II v2.5 or later. Refer to the manual entitled *ProLink® II Software for Micro Motion® Transmitters: Installation and Use*.

Chapter 7
Using the Transmitter

7.1 Overview

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

- Special applications on your transmitter (see Section 7.2)
- Viewing process variables (see Sections 7.4)
- Viewing transmitter status and alarms (see Section 7.5)
- Acknowledging alarms (see Section 7.6)
- Viewing and using the totalizers and inventories (see Section 7.7)

Notes: 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 Chapter 3 for more information.

If you are using AMS, the AMS interface will be similar to the ProLink II interface described in this chapter.

All Communicator key sequences in this section assume that you are starting from the "Online" menu. See Chapter 4 for more information.

7.2 Special applications

Your transmitter may support one of the following special applications:

- Petroleum measurement (API feature)
- Enhanced density
- Meter verification
- Custody transfer

The special application must be enabled at the factory or by a Micro Motion field service engineer.

Configuration of the petroleum measurement application is discussed in Section 8.6. For information on configuring and using the enhanced density application, see the manual entitled *Micro Motion Enhanced Density Application: Theory, Configuration, and Use*. Meter verification is discussed in Chapter 10. For information on configuring the custody transfer application, see Chapter 11.

7.3 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 12.13.

7.4 Viewing process variables

Process variables include measurements such as mass flow rate, volume flow rate, mass total, volume total, temperature, and density.

You can view process variables with the display (Model 1700 and 2700 transmitters only), ProLink II, or the Communicator.

7.4.1 With the display

The display reports the abbreviated name of the process variable (e.g., **DENS** for density), the current value of that process variable, and the associated unit of measure (e.g., **G/CM3**). See Appendix H for information on the codes and abbreviations used for display variables.

The display can be configured. For instructions on how to configure the display, see Section 8.14.3.

To view a process variable with the display:

- If Auto Scroll is not enabled, activate the **Scroll** optical switch until the name of the desired process variable either:
  - Appears on the process variable line, or
  - Begins to alternate with the units of measure

  See Figure 2-1.
- If Auto Scroll is enabled, wait until the desired process variable appears on the display.

The display precision can be configured separately for each process variable (see Section 8.15.1). This affects only the value shown on the display, and does not affect the actual value as reported by the transmitter over outputs or digital communications.

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

- Values < 100,000,000 are displayed in decimal notation (e.g., 123456.78).
- Values ≥ 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.

7.4.2 With ProLink II

The Process Variables window opens automatically when you first connect to the transmitter. This window displays current values for the standard process variables (mass, volume, density, temperature, external pressure, and external temperature).

To view the standard process variables with ProLink II, if you have closed the Process Variables window, click **ProLink > Process Variables**.

To view API process variables (if the petroleum measurement application is enabled), click **ProLink > API Process Variables**.

To view enhanced density process variables (if the enhanced density application is enabled), click **ProLink > ED Process Variables**. Different enhanced density process variables are displayed, depending on the configuration of the enhanced density application.

7.4.3 With a Communicator

To view process variables with a Communicator:

1. Press **1**, **1**.
2. Scroll through the list of process variables by pressing **Down Arrow**.
3. Press the number corresponding to the process variable you wish to view, or highlight the process variable in the list and press **Right Arrow**.

7.5 Viewing transmitter status and alarms

You can view transmitter status using the status LED or display, ProLink II, or the Communicator.

The transmitter broadcasts alarms whenever a process variable exceeds its defined limits or the transmitter detects a fault condition. You can view alarms with the display, ProLink II, or the Communicator. For information regarding all the possible alarms, see Table 12-5.

You can use the display or ProLink II to acknowledge alarms.

7.5.1 Using the status LED

- Model 1500 AN
- Model 2500 CIO

For these transmitters, the status LED is located on the front panel. This LED shows transmitter status as described in Table 7-1.

Table 7-1 Transmitter status reported by the Model 1500/2500 status LED

Status LED state	Alarm priority	Definition
Green	No alarm	Normal operating mode
Flashing yellow	No alarm	Zero in progress
Yellow	Low severity alarm	• Alarm condition: will not cause measurement error • Outputs continue to report process data
Red	High severity (critical fault) alarm	• Alarm condition: will cause measurement error • Outputs go to configured fault indicators

7.5.2 Using the display

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The display reports alarms in two ways:

- With the status LED, which reports only that one or more alarms has occurred
- Through the alarm list, which reports each specific alarm

Note: If access to the alarm menu from the display has been disabled (see Section 8.14.3), then the display will not list active alarms.

For these transmitters, the status LED is located at the top of the display (see Figure 7-1). It can be in one of six possible states, as listed in Table 7-1.

Figure 7-1 Display status LED

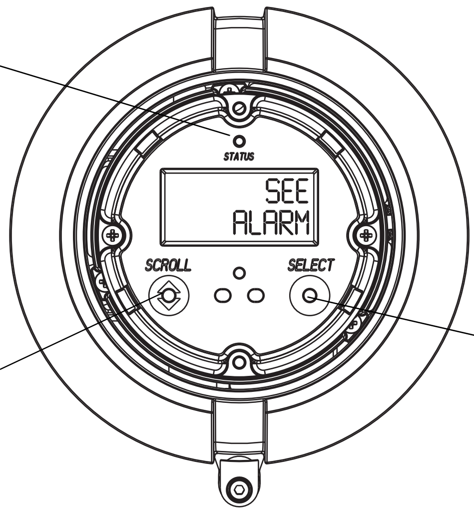


Table 7-2 Priorities reported by the Model 1700/2700 status LED

Status LED state	Alarm priority
Green	No alarm – normal operating mode
Flashing green(1)	Unacknowledged corrected condition
Yellow	Acknowledged low severity alarm
Flashing yellow(1)	Unacknowledged low severity alarm
Red	Acknowledged high severity alarm
Flashing red(1)	Unacknowledged high severity alarm

(1) If the LED blinking option is turned off (see Section 8.14), the status LED will flash only during calibration. It will not flash to indicate an unacknowledged alarm..

Alarms in the alarm list are listed by number. To view specific alarms in the list:

1. Activate and hold **Scroll** and **Select** simultaneously until the words **SEE ALARM** appear on the screen. See Figure 7-1.
2. **Select**.
3. If the alternating words **ACK ALL** appear, **Scroll**.
4. If the words **NO ALARM** appear, go to Step 6.

5. **Scroll** to view each alarm in the list. See Section 12.12 for an explanation of the alarm codes reported by the display. The status LED changes color to reflect the severity of the current alarm, as described in Table 7-2.
6. **Scroll** until the word **EXIT** appears.
7. **Select**.

7.5.3 Using ProLink II

ProLink II provides two ways to view alarm information:

- Choose **ProLink > Status**. This window shows the current status of all possible alarms, independent of configured alarm severity. The alarms are divided into three categories: Critical, Informational, and Operational. To view the indicators in a category, click on the associated tab. A tab is red if one or more status indicators in that category is active. On each tab, currently active alarms are shown by red indicators.
- Choose **ProLink > Alarm Log**. This window lists all active alarms, and all inactive but unacknowledged Fault and Informational alarms. (The transmitter automatically filters out Ignore alarms.) A green indicator means "inactive but unacknowledged" and a red indicator means "active." Alarms are organized into two categories: High Priority and Low Priority.

Notes: The location of alarms in the Status window is not affected by the configured alarm severity (see Section 8.13.1). Alarms in the Status window are predefined as Critical, Informational, or Operational.

The alarm log in ProLink II is similar to but not the same as the alarm log in the Communicator.

7.5.4 Using the Communicator

To view status and alarms with a Communicator:

1. Press **2, 1, 1**.
2. Press **OK** to scroll through the list of current alarms.

This view will show all Fault and Informational alarms. (The transmitter automatically filters out Ignore alarms.)

7.6 Acknowledging alarms

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

You can acknowledge alarms using ProLink II or the display.

For transmitters with a display, access to the alarm menu can be enabled or disabled, and a password may or may not be required. If access to the alarm menu is enabled, the operator may or may not be allowed to acknowledge all alarms simultaneously (the **Ack All?** function). See Section 8.14.3 for information on controlling these functions.

If the LED blinking option has been turned off, the status LED will not flash to indicate unacknowledged alarms. Alarms can still be acknowledged.

To acknowledge alarms using the display:

1. Activate and hold **Scroll** and **Select** simultaneously until the words **SEE ALARM** appear on the screen. See Figure 7-1.
2. **Select**.
3. If the words **NO ALARM** appear, go to Step 8.

4. If you want to acknowledge all alarms:
   a. **Scroll** until the word **ACK** appears by itself. The word **ACK** begins to alternate with the word **ALL?**.
   b. **Select**.

Note: If the "acknowledge all alarms" feature has been disabled (see Section 8.14.1, then you must acknowledge each alarm individually. See Step 5.

5. If you want to acknowledge a single alarm:
   a. **Scroll** until the alarm you want to acknowledge appears.
   b. **Select**. The word **ALARM** begins to alternate with the word **ACK**.
   c. **Select** to acknowledge the alarm.
6. If you want to acknowledge another alarm, go to Step 3.
7. If you do NOT want to acknowledge any more alarms, go to Step 8.
8. **Scroll** until the word **EXIT** appears.
9. **Select**.

To acknowledge alarms using ProLink II:

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.

7.7 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 viewed, started, stopped, and reset.

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

7.7.1 Viewing the totalizers and inventories

You can view the current value of the totalizers and inventories with the display (if the transmitter is equipped with a display), ProLink II, or the Communicator.

With the display

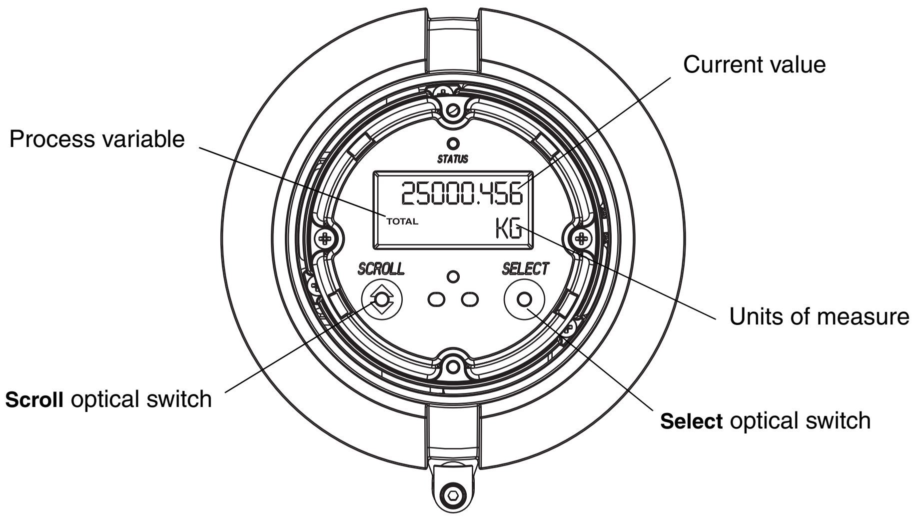
You cannot view totalizers or inventories with the display unless the display has been configured to show them. See Section 8.15.1.

1. To view totalizer values, **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)
   - For petroleum measurement or enhanced density totalizers, the mass or volume unit alternating with the process variable (e.g., **TCORR** or **NET M**) (see Table H-1).

   See Figure 7-2. Read the current value from the top line of the display.
2. To view inventory values, **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 petroleum measurement or enhanced density inventories, the mass or volume unit alternating with the process variable (e.g., **TCORI** or **NET VI**) (see Appendix H).

   See Figure 7-2. Read the current value from the top line of the display.

Figure 7-2 Display totalizer



With ProLink II software

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

1. Click **ProLink**.
2. Select **Process Variables**, **API Process Variables,** or **ED Process Variables.**

With a Communicator

To view the current value of the totalizers and inventories with a Communicator:

1. Press **1**, **1**.
2. Select **Mass totl**, **Mass inventory**, **Vol totl**, or **Vol inventory**.

7.8 Controlling totalizers and inventories

Table 7-3 shows all of the totalizer and inventory functions and which configuration tools you can use to control them.

Table 7-3 Totalizer and inventory control methods

Function name	Communicator	ProLink II	Display(1)
Stop all totalizers and inventories (mass, volume, ED, and API)	Yes	Yes	Yes
Start all totalizers and inventories (mass, volume, ED, and API)	Yes	Yes	Yes
Reset mass totalizer only	Yes	Yes	Yes(2)
Reset volume totalizer only	Yes	Yes	Yes(2)
Reset API totalizer only	Yes	No	Yes(2)
Reset ED totalizer only	Yes	Yes	Yes(2)
Simultaneously reset all totalizers (mass, volume, and API)	Yes	Yes	No
Simultaneously reset all inventories (mass, volume, and API)	No	Yes(3)	No
Individually reset inventories	No	Yes(3)	No

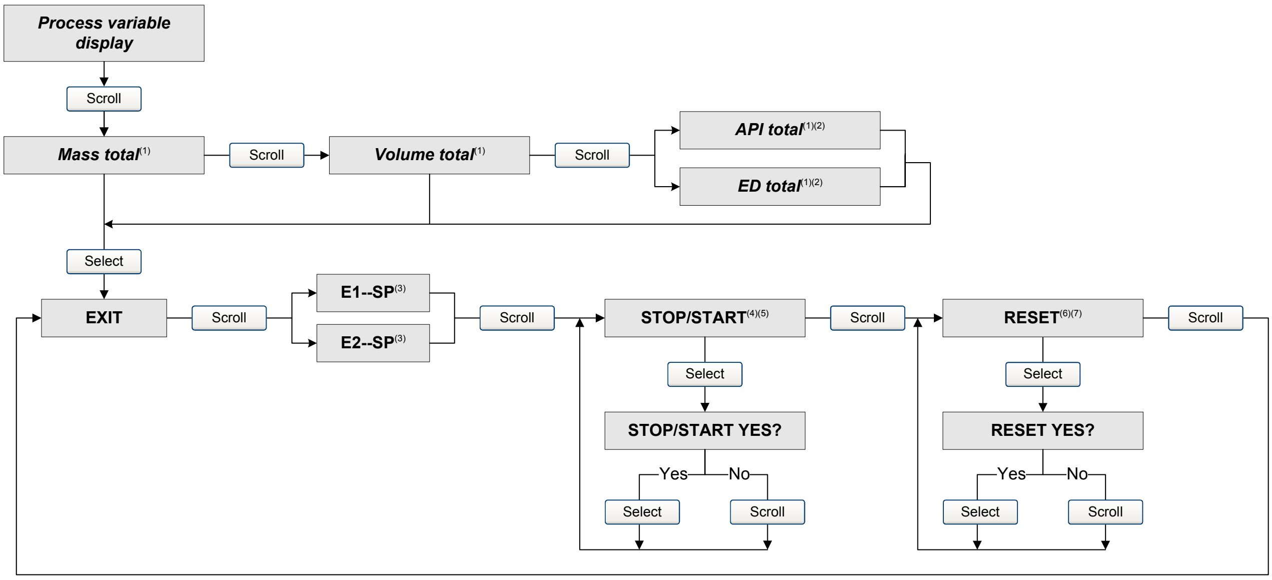
(1) These display functions may be enabled or disabled. See Section 8.14.
(2) This function is available only if the corresponding totalizer is configured as a display variable (see Section 8.15.1).
(3) If enabled in the ProLink II preferences.

With the display

You can use the display to start and stop all totalizers and inventories simultaneously, or to reset individual totalizers. See the flowchart in Figure 7-3. You cannot reset any inventories with the display.

The display must be configured to show the appropriate totalizer (see Section 8.15.1), and the corresponding display function must be enabled (see Section 8.14).

Figure 7-3 Controlling totalizers and inventories with the display



(1) *Displayed only if configured as a display variable (see Section 8.15.1).*
(2) *The petroleum measurement application or enhanced density application must be enabled.*
(3) *The Event Setpoint screens can be used to define or change Setpoint A for Event 1 or Event 2 (from the single-setpoint event model). These screens are displayed only for events defined on mass total or volume total. See Section 8.11 for more information. To change the setpoint for an event defined on mass total, you must enter the totalizer management menu from the mass total screen. To change the setpoint for an event defined on volume total, you must enter the totalizer management menu from the volume total screen.*
(4) *The display must be configured to allow stopping and starting (see Section 8.14).*
(5) *All totalizers and inventories will be stopped and started together, including API and enhanced density totalizers and inventories.*
(6) *The display must be configured to allow totalizer resetting (see Section 8.14).*
(7) *Only the totalizer currently shown on the display will be reset. No other totalizers will be reset, and no inventories will be reset. Be sure that the totalizer you want to reset is displayed before performing this reset.*

With ProLink II software

Using ProLink II, you can:

- Start and stop all totalizers and inventories together
- Reset all totalizers and inventories simultaneously, including API and ED totalizers
- Reset each totalizer and inventory separately (except API totalizers)

To control ED totalizers and inventories, choose **ProLink > ED Totalizer Control**. To control all other totalizer and inventory functions, choose **ProLink > Totalizer Control**.

To reset inventories using ProLink II, you must first enable this capability. To enable inventory reset using ProLink II:

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

With a Communicator

You can start and stop all totalizers and inventories, or reset individual (or all) totalizers with a Communicator. All of these functions are accessed from the Process Variables menu.

Chapter 8
Optional Configuration

8.1 Overview

This chapter describes transmitter configuration parameters that may or may not be used, depending on your application requirements. For required transmitter configuration, see Chapter 6.

For information about how to perform the procedures described in this chapter, see the flowcharts for your transmitter and communication tool, provided in the appendices to this manual.

Note: If you are using AMS, the AMS interface will be similar to the ProLink II interface.

8.2 Configuration map

Different transmitters support different parameters and features. Additionally, different configuration tools allow you to configure different features. Table 8-1 lists the optional configuration parameters. For each parameter, the table also lists the transmitters that support that parameter and a reference to the section where the parameter is discussed.

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

8.3 How to access a parameter for configuration

In general, all parameters discussed in this chapter can be configured either with ProLink II or the Communicator, but cannot be configured with the display. Exceptions are noted in the configuration map.

For information on the menu structure for each transmitter, and how to access a particular parameter, see the appendix for your transmitter, as listed below. Within that appendix, refer to the menu flowcharts for the communication tool you are using: ProLink II, the Communicator, or the display.

- Model 1500 AN – see Appendix C
- Model 2500 CIO – see Appendix D
- Model 1700/2700 AN – see Appendix E
- Model 1700/2700 IS – see Appendix F
- Model 2700 CIO – see Appendix G

Table 8-1 Configuration map

Topic	Subtopic	Transmitter 1500 AN	1700 AN	1700 IS	2500 CIO	2700 AN	2700 IS	2700 CIO	Section
Gas standard volume measurement		✓	✓	✓	✓	✓	✓	✓	8.4
Special measurement units		✓	✓	✓	✓	✓	✓	✓	8.5
Petroleum measurement application (API feature)					✓	✓	✓	✓	8.6
Cutoffs		✓	✓	✓	✓	✓	✓	✓	8.7
Damping		✓	✓	✓	✓	✓	✓	✓	8.8
Update rate		✓	✓	✓	✓	✓	✓	✓	8.9
Flow direction		✓	✓	✓	✓	✓	✓	✓	8.10
Events		✓	✓	✓	✓	✓	✓	✓	8.11
Slug flow		✓	✓	✓	✓	✓	✓	✓	8.12
Fault handling	Status alarm severity	✓	✓	✓	✓	✓	✓	✓	8.13.1
	Fault timeout	✓	✓	✓	✓	✓	✓	✓	8.13.2
Display functionality	Update period		✓(1)	✓(1)		✓(1)	✓(1)	✓(1)	8.14.1
	Language		✓(1)	✓(1)		✓(1)	✓(1)	✓(1)	8.14.2
	Enable and disable functions		✓(1)	✓(1)		✓(1)	✓(1)	✓(1)	8.14.3
	Scroll rate		✓(1)	✓(1)		✓(1)	✓(1)	✓(1)	8.14.4
	Password		✓(1)	✓(1)		✓(1)	✓(1)	✓(1)	8.14.5
	Display variables and precision		✓	✓		✓	✓	✓	8.14.6
Digital communications settings	Fault indicator	✓	✓	✓	✓	✓	✓	✓	8.15.1
	Modbus address	✓(1)	✓(1)		✓(1)	✓(1)			8.15.2
	RS-485 settings	✓	✓(1)		✓	✓(1)			8.15.3
	Floating-point byte order	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)	8.15.4
	Additional comm reponse delay	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)	✓(2)	8.15.5
	HART polling address	✓	✓(1)	✓(1)	✓	✓(1)	✓(1)	✓(1)	8.15.6
	Loop current mode	✓	✓	✓	✓	✓	✓	✓	8.15.7
	HART burst mode	✓	✓	✓	✓	✓	✓	✓	8.15.8
	PV, SV, TV, QV assignments	✓	✓	✓	✓	✓	✓	✓	8.15.9

Table 8-1 **Configuration map** *continued*

		Transmitter							
		1500	1700		2500	2700			
Topic	**Subtopic**	**AN**	**AN**	**IS**	**CIO**	**AN**	**IS**	**CIO**	**Section**
Device settings		✓	✓	✓	✓	✓	✓	✓	8.16
Sensor parameters		✓	✓	✓	✓	✓	✓	✓	8.17
Write-protect mode		✓(1)	✓(1)	✓(1)	✓(1)	✓(1)	✓(1)	✓(1)	8.18

(1) Can be configured with ProLink II, the Communicator, or the display.
(2) Can be configured only with ProLink II.

8.4 Configuring standard volume flow measurement for gas

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Special functionality is provided for measuring the standard volume flow of gases.

ProLink II is required to access this functionality. Other tools provide only limited support:

- The Communicator cannot be used to configure volume flow meaurement for gas or to select a standard gas volume flow measurement unit. If standard gas volume flow measurement has been configured, the Communicator will display the correct volume flow value, but will display "Unknown Enumerator" for the units label.
- The local display cannot be used to change the volume flow type. However, after the transmitter has been configured for standard gas volume flow measurement, the display can be used to select a standard gas volume flow measurement unit.

Standard gas volume flow and liquid volume flow are mutually exclusive settings. When the Vol Flow Type is set to Std Gas Volume, the units list contains the units that are most frequently used for gas measurement. If Liquid Volume is configured, gas measurement units are not available.

To configure the transmitter to use gas standard volume flow:

1. Choose **ProLink > Configure > Flow**.
2. Set **Vol Flow Type** to **Std Gas Volume**.
3. Select the measurement unit you want to use from the **Std Gas Vol Flow Units** list. The default is **SCFM**.
4. Configure the **Std Gas Vol Flow Cutoff** (see Section 8.7). The default is **0**.

You have two choices for entering the *standard density* of the gas you are going to measure (i.e., the density of the gas at reference conditions):

- If you know the standard density, you can enter that value in the **Std Gas Density** field. For optimal standard volume measurement accuracy, be sure the standard density you enter is correct and fluid composition is stable.
- If you do *not* know the standard density of the gas, you can use the Gas Wizard (see Section 8.4.1). The Gas Wizard can calculate the standard density of the gas that you are measuring.

8.4.1 Using the Gas Wizard

The Gas Wizard is a tool provided in ProLink II for calculating the standard density of the gas that you are measuring.

To use the Gas Wizard:

1. Choose **ProLink > Configure > Flow**.
2. Click **Gas Wizard**.
3. If your gas is listed in the **Choose Gas** list:
   a. Select the **Choose Gas** radio button.
   b. Select your gas.
4. If your gas is not listed, you must describe its properties.
   a. Select the **Enter Other Gas Property** radio button.
   b. Select the method that you will use to describe its properties: **Molecular Weight**, **Specific Gravity Compared to Air**, or **Density**.
   c. Provide the required information. Note that if you selected **Density**, you must enter the value in the configured density units and you must provide the temperature and pressure at which the density value was determined, using the configured temperature and pressure units.
5. Click **Next**.
6. 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.
7. 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. See Section 6.4.

8.5 Creating special measurement units

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

If you need to use a non-standard unit of measure, you can create one special measurement unit for mass flow, and one special measurement unit for liquid volume flow, and one special measurement unit for gas standard volume flow.

Note the following:

- You can create all special measurement units with ProLink II.
- Using the Communicator, you can create special measurement units for mass flow and liquid volume flow, but not for gas standard volume flow.
- You cannot create any special measurement units with the display.

Special measurement units can be viewed normally with the display and with ProLink II. The Communicator will display special measurement units for mass flow and liquid volume flow. For special measurement units for gas standard voume flow, the Communicator will display the correct value but will display “Spcl” for the units label.

8.5.1 About special measurement units

Special measurement units consist of:

- Base unit – A combination of:
  - Base mass or base volume unit – A measurement unit that the transmitter already recognizes (e.g., **kg**, **m3**, **l**, **SCF**)
  - Base time unit – A unit of time that the transmitter already recognizes (e.g., seconds, days)
- Conversion factor – The number by which the base unit will be divided to convert to the special unit
- Special unit – A non-standard volume flow or mass flow unit of measure that you want to be reported by the transmitter

The preceding terms are related by the following formula:

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

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

8.5.2 Special measurement unit procedure

To create a special measurement unit:

1. If necessary, set Volume Flow Type to match the type of special measurement unit you will create.
2. Identify the simplest base volume or mass and base time units for your special mass flow or volume flow unit. For example, to create the special volume flow unit *pints per minute*, the simplest base units are gallons per minute:
   - Base volume unit: *gallon*
   - Base time unit: *minute*
3. Calculate the conversion factor using the formula below:

$$\frac{1 \text{ (gallon per minute)}}{8 \text{ (pints per minute)}} = \mathbf{0.125} \text{ (conversion factor)}$$

Note: 1 gallon per minute = 8 pints per minute

4. Name the new special mass flow or volume flow measurement unit and its corresponding totalizer measurement unit:
   - Special volume flow measurement unit name: *Pint/min*
   - Volume totalizer measurement unit name: *Pints*

Note: Special measurement unit names can be up to 8 characters long (i.e., 8 numbers or letters), but only the first 5 characters appear on the display.

5. To apply the special measurement unit to mass flow or volume flow measurement, select **Special** from the list of measurement units (see Section 6.4.1 or 6.4.2).

8.6 Configuring the petroleum measurement application (API feature)

- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The *API parameters* determine the values that will be used in API-related calculations. The API parameters are available only if the petroleum measurement application is enabled on your transmitter.

8.6.1 About the petroleum measurement application

The petroleum measurement enables *Correction of Temperature on volume of Liquids*, or CTL. In other words, some applications that measure liquid volume flow or liquid density are particularly sensitive to temperature factors, and must comply with American Petroleum Institute (API) standards for measurement.

Terms and definitions

The following terms and definitions are relevant to the petroleum measurement application:

- *API* – American Petroleum Institute
- *CTL* – Correction of Temperature on volume of Liquids. The CTL value is used to calculate the VCF value
- *TEC* – Thermal Expansion Coefficient
- *VCF* – Volume Correction Factor. The correction factor to be applied to volume process variables. VCF can be calculated after CTL is derived

CTL derivation methods

There are two derivation methods for CTL:

- Method 1 is based on observed density and observed temperature.
- Method 2 is based on a user-supplied reference density (or thermal expansion coefficient, in some cases) and observed temperature.

API parameters

The API parameters are listed and defined in Table 8-2.

Table 8-2 API parameters

Variable	Description
Table type	Specifies the table that will be used for reference temperature and reference density unit. Select the table that matches your requirements. See *API reference tables*.
User defined TEC(1)	Thermal expansion coefficient. Enter the value to be used in CTL calculation.
Temperature units(2)	Read-only. Displays the unit used for reference temperature in the reference table.
Density units	Read-only. Displays the unit used for reference density in the reference table.
Reference temperature	Read-only unless Table type is set to 53*x* or 54*x*. If configurable: • Specify the reference temperature to be used in CTL calculation. • Enter reference temperature in °C.

(1) Configurable if Table Type is set to 6C, 24C, or 54C.
(2) In most cases, the temperature unit used by the API reference table should also be the temperature unit configured for the transmitter to use in general processing. To configure the temperature unit, see Section 6.4.4.

API reference tables

Reference tables are organized by reference temperature, CTL derivation method, liquid type, and density unit. The table selected here controls all the remaining options.

- Reference temperature:
  - If you specify a 5*x*, 6*x*, 23*x*, or 24*x* table, the default reference temperature is 60 °F, and cannot be changed.
  - If you specify a 53*x* or 54*x* table, the default reference temperature is 15 °C. However, you can change the reference temperature, as recommended in some locations (for example, to 14.0 or 14.5 °C).
- CTL derivation method:
  - If you specify an odd-numbered table (5, 23, or 53), CTL will be derived using method 1 described above.
  - If you specify an even-numbered table (6, 24, or 54), CTL will be derived using method 2 described above.
- The letters *A*, *B*, *C*, or *D* that are used to terminate table names define the type of liquid that the table is designed for:
  - *A* tables are used with generalized crude and JP4 applications.
  - *B* tables are used with generalized products.
  - *C* tables are used with liquids with a constant base density or known thermal expansion coefficient.
  - *D* tables are used with lubricating oils.
- Different tables use different density units:
  - Degrees API
  - Relative density (SG)
  - Base density (kg/m^3)

Table 8-3 summarizes these options.

Table 8-3 API reference temperature tables

Table	CTL derivation method	Base temperature	Density unit and range		
			Degrees API	Base density	Relative density
5A	Method 1	60 °F, non-configurable	0 to 100		
5B	Method 1	60 °F, non-configurable	0 to 85		
5D	Method 1	60 °F, non-configurable	–10 to +40		
23A	Method 1	60 °F, non-configurable			0.6110 to 1.0760
23B	Method 1	60 °F, non-configurable			0.6535 to 1.0760
23D	Method 1	60 °F, non-configurable			0.8520 to 1.1640
53A	Method 1	15 °C, configurable		610 to 1075 kg/m^3	
53B	Method 1	15 °C, configurable		653 to 1075 kg/m^3	
53D	Method 1	15 °C, configurable		825 to 1164 kg/m^3	

Table 8-3 API reference temperature tables *continued*

Table	CTL derivation method	Base temperature	Density unit and range		
			Degrees API	Base density	Relative density
			Reference temperature		Supports
6C	Method 2	60 °F, non-configurable	60 °F		Degrees API
24C	Method 2	60 °F, non-configurable	60 °F		Relative density
54C	Method 2	15 °C, configurable	15 °C		Base density in kg/m^3

Temperature data

For the temperature value to be used in CTL calculation, you can use the temperature data from the sensor, or you can poll an external temperature device:

- To use temperature data from the sensor, no action is required.
- To poll an external temperature device, configure polling for temperature as described in Section 9.4. When polling is enabled, the transmitter will automatically use the external temperature value for CTL calculation.

8.7 Configuring cutoffs

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Cutoffs are user-defined values below which the transmitter reports a value of zero for the specified process variable. Cutoffs can be set for mass flow, volume flow, or density.

Note: The density cutoff is available only with core processor software v2.0 or above and transmitter software rev3.0 or above.

See Table 8-4 for cutoff default values and related information. See Sections 8.7.1 and 8.7.2 for information on how the cutoffs interact with other transmitter measurements.

Table 8-4 Cutoff default values

Cutoff type	Default	Comments
Mass flow	0.0 g/s	Recommended setting: 0.5–1.0% of the sensor's rated maximum flow rate
Volume flow	0.0 L/s	Lower limit: 0 Upper limit: the sensor's flow calibration factor, in units of L/s, multiplied by 0.2
Gas standard volume flow	0.0	No limit
Density	0.2 g/cm^3	Range: 0.0–0.5 g/cm^3

8.7.1 Cutoffs and volume flow

If you are using liquid volume flow units (**Vol Flow Type** is set to **Liquid**):

- The density cutoff is applied to the volume flow calculation. Accordingly, if the density drops below its configured cutoff value, the volume flow rate will go to zero.
- The mass flow cutoff is not applied to the volume flow calculation. Even if the mass flow drops below the cutoff, and therefore the mass flow indicators go to zero, the volume flow rate will be calculated from the actual mass flow process variable.

If you are using gas standard volume flow units (**Vol Flow Type** is set to **Std Gas Volume**), neither the mass flow cutoff nor the density cutoff is applied to the volume flow calculation.

8.7.2 Interaction with the AO cutoffs

Both the primary mA output and the secondary mA output (if it is available on your transmitter) have cutoffs (the AO cutoffs). If the mA outputs are configured for mass flow, volume flow, or gas standard volume flow:

- And the AO cutoff is set to a greater value than the mass, volume, or gas standard volume cutoff, the mA output will report zero flow when the AO cutoff is reached.
- And the AO cutoff is set to a lower value than the mass, volume, or gas standard volume cutoff, when the mass, volume, or gas standard volume cutoff is reached, all outputs representing that process variable will report zero flow.

See Section 6.5.3 for more information on the AO cutoff(s).

8.8 Configuring the damping values

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

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.

When you specify a new damping value, it is automatically rounded down to the nearest valid damping value. Flow, density, and temperature have different valid damping values. Valid damping values are listed in Table 8-5.

Before setting the damping values, review Sections 8.8.1 through 8.8.3 for information on how the damping values interact with other transmitter measurements and parameters.

Table 8-5 Valid damping values

Process variable	Update rate(1)	Valid damping values
Flow (mass and volume)	Normal (20 Hz)	0, .2, .4, .8, ... 51.2
	Special (100 Hz)	0, .04, .08, .16, ... 10.24
Density	Normal (20 Hz)	0, .2, .4, .8, ... 51.2
	Special (100 Hz)	0, .04, .08, .16, ... 10.24
Temperature	Not applicable	0, .6, 1.2, 2.4, 4.8, ... 76.8

(1) See Section 8.8.3.

8.8.1 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.

8.8.2 Interaction with the added damping parameter

Both the primary mA output and the secondary mA output (if it is available on your transmitter) have a damping parameter (added damping). If damping is configured for flow, density, or temperature, the same process variable is assigned to an mA output, and added damping is also configured for the mA output, 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 6.5.5 for more information on the added damping parameter.

8.8.3 Interaction with the update rate

Flow and density damping values depend on the configured Update Rate (see Section 8.9). If you change the update rate, the damping values are automatically adjusted. Damping rates for Special are 20% of Normal damping rates. See Table 8-5.

Note: The specific process variable selected for the 100 Hz update rate is not relevant; all damping values are adjusted as described.

8.9 Configuring the update rate

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The *update rate* is the rate at which the transmitter polls the sensor for process data. Update Rate affects the transmitter's response time to changes in the process.

There are two settings for Update Rate: **Normal** and **Special**.

- When **Normal** is configured, most process variables are polled at the rate of 20 times per second (20 Hz).
- When **Special** is configured, a single, user-specified process variable is polled 100 times per second (100 Hz). Polling for some process variables and diagnostic/calibration data is dropped (see Section 8.9.1), and the remaining process variables are polled a minimum of 6 times per second (6.25 Hz).

If you set the update rate to **Special**, you must also specify which process variable will be polled at 100 Hz. Different 100 Hz variables are available, depending on which special applications are installed on your transmitter.

Note: For transmitters with transmitter software rev5.0 running the enhanced density application, the Special *update rate is not available.*

Note: Most users should select the Normal *update rate. Use the* Special *update rate only if required by your application. See Section 8.9.1.*

Note: If you change the update rate, the setting for damping is automatically adjusted. See Section 8.8.3.

8.9.1 Effects of Special mode

In Special mode:

- Not all process variables are updated. The process variables listed below are always updated:
  - Mass flow
  - Volume flow
  - Gas standard volume flow
  - Density
  - Temperature
  - Drive gain
  - LPO amplitude
  - Status (contains Event 1 and Event 2)
  - Raw tube frequency
  - Mass total
  - Volume total
  - Gas standard volume total
  - API temperature-corrected volume total
  - API temperature-corrected density
  - API temperature-corrected volume flow
  - API batch weighted average temperature
  - API batch weighted average density

  The process variables listed below are updated only when the petroleum measurement application is not enabled:
  - RPO amplitude
  - Board temperature
  - Core input voltage
  - Mass inventory
  - Volume inventory
  - Gas standard volume inventory

  All other process variables are not polled at all. The omitted process variables will remain at the values they held before Special mode was implemented.
- Calibration data is not refreshed.
- Discrete event status is not polled.
- The enhanced density application is not available.

Micro Motion recommends the following:

- Do not use Special mode unless required by your application. Contact Micro Motion before setting Update Rate to Special.
- If Special mode is required, ensure that all required data is being updated.
- Do not perform any calibrations while in Special mode.
- Do not restore the factory zero or prior zero.
- Do not use discrete events (the dual-setpoint event model) while in Special mode. Instead, use Event 1 and Event 2 from the single-setpoint event model. See Section 8.11.

8.10 Configuring the flow direction parameter

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

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 Bidirectional

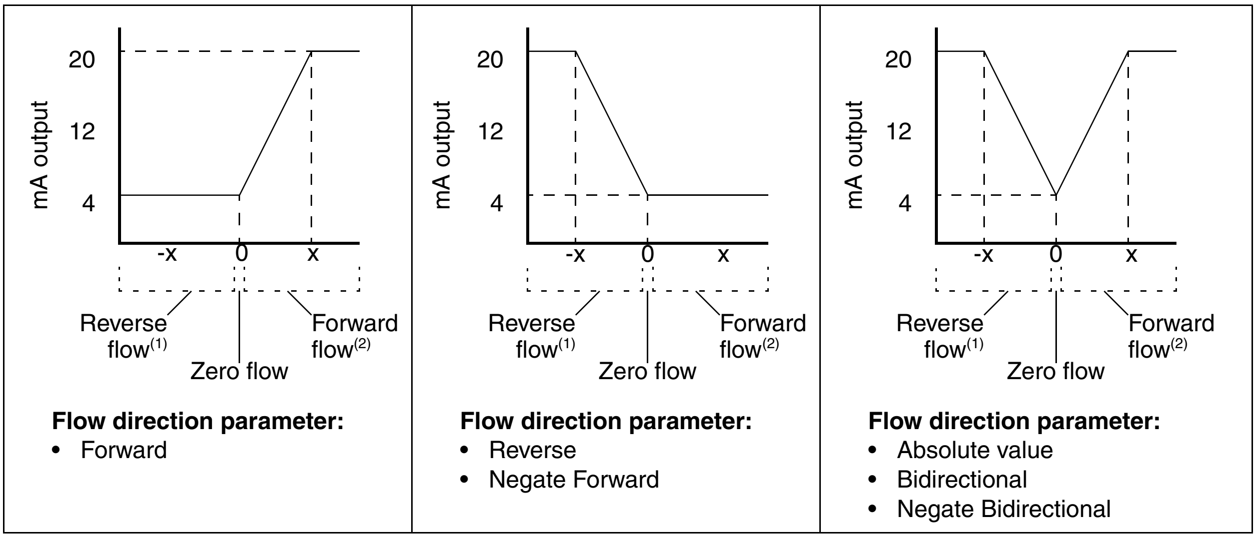
For the effect of flow direction on mA outputs:

- See Figure 8-1 if the 4 mA value of the mA output is set to 0.
- See Figure 8-2 if the 4 mA value of the mA output is set to a negative value.

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

For the effect of flow direction on frequency outputs, totalizers, and flow values reported via digital communication, see Table 8-6.

Figure 8-1 Effect of flow direction on mA outputs: 4mA value = 0

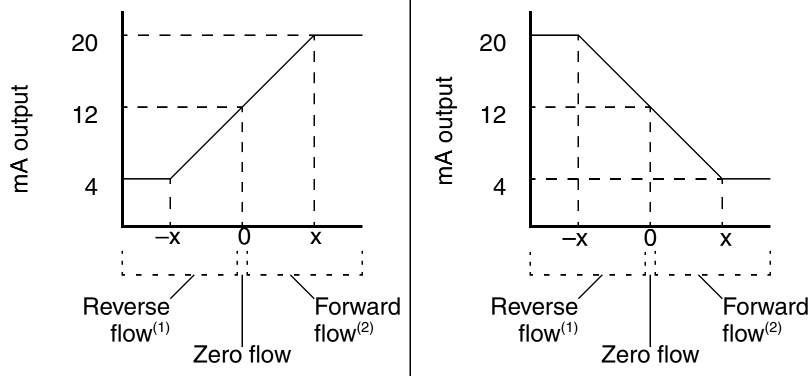


mA output configuration:
- 20 mA value = x
- 4 mA value = 0

To set the 4 mA and 20 mA values, see Section 6.5.2.

(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 8-2 Effect of flow direction on mA outputs: 4mA value < 0



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

mA output configuration:
- 20 mA value = x
- 4 mA value = –x
- –x < 0

To set the 4 mA and 20 mA values, see Section 6.5.2.

(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
- mA output: 4 mA = 0 g/s; 20 mA = 100 g/s

(See the first graph in Figure 8-1.)

As a result:
- Under conditions of reverse flow or zero flow, the mA output level is 4 mA.
- Under conditions of forward flow, up to a flow rate of 100 g/s, the mA output level varies between 4 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 • mA output: 4 mA = 0 g/s; 20 mA = 100 g/s (See the second graph in Figure 8-1.) As a result: • Under conditions of forward flow or zero flow, the mA output level is 4 mA. • Under conditions of reverse flow, up to a flow rate of 100 g/s, the mA output level varies between 4 mA and 20 mA in proportion to the absolute value of the flow rate. • Under conditions of reverse flow, if the absolute value of the flow rate equals or exceeds 100 g/s, the mA output will be proportional to the absolute value of the flow rate up to 20.5 mA, and will be level at 20.5 mA at higher absolute values.

Example 3	Configuration: • Flow direction = Forward • mA output: 4 mA = –100 g/s; 20 mA = 100 g/s (See the first graph in Figure 8-2.) As a result: • Under conditions of zero flow, the mA output is 12 mA. • Under conditions of forward flow, up to a flow rate of 100 g/s, the mA output varies between 12 mA and 20 mA in proportion to (the absolute value of) the flow rate. • Under conditions of forward flow, if (the absolute value of) the flow rate equals or exceeds 100 g/s, the mA output is proportional to the flow rate up to 20.5 mA, and will be level at 20.5 mA at higher flow rates. • Under conditions of reverse flow, up to a flow rate of 100 g/s, the mA output varies between 4 mA and 12 mA in inverse proportion to the absolute value of the flow rate. • Under conditions of reverse flow, if the absolute value of the flow rate equals or exceeds 100 g/s, the mA output is inversely proportional to the flow rate down to 3.8 mA, and will be level at 3.8 mA at higher absolute values.

Table 8-6 Effect of flow direction on frequency output, discrete output, totalizers, and digital communications

	Forward flow(1)			
Flow direction value	**Frequency output**	**Discrete output(2)**	**Flow totals**	**Flow values via digital comm.**
Forward	Increase	OFF	Increase	Positive
Reverse	0 Hz	OFF	No change	Positive
Bidirectional	Increase	OFF	Increase	Positive
Absolute value	Increase	OFF	Increase	Positive(3)
Negate Forward	Zero(3)	ON	No change	Negative
Negate Bidirectional	Increase	ON	Decrease	Negative
	Zero flow			
Flow direction value	**Frequency output**	**Discrete output**	**Flow totals**	**Flow values via digital comm.**
All	0 Hz	OFF	No change	0
	Reverse flow(4)			
Flow direction value	**Frequency output**	**Discrete output**	**Flow totals**	**Flow values via digital comm.**
Forward	0 Hz	ON	No change	Negative
Reverse	Increase	ON	Increase	Negative
Bidirectional	Increase	ON	Decrease	Negative
Absolute value	Increase	OFF	Increase	Positive(3)
Negate Forward	Increase	OFF	Increase	Positive
Negate Bidirectional	Increase	OFF	Increase	Positive

(1) Process fluid flowing in same direction as flow direction arrow on sensor.
(2) Applies only if the discrete output has been configured to indicate flow direction. See Section 6.7.2.
(3) Refer to the digital communications status bits for an indication of whether flow is positive or negative.
(4) Process fluid flowing in opposite direction from flow direction arrow on sensor.

8.11 Configuring events

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

An *event* occurs if the real-time value of a user-specified process variable varies with respect to a user-defined setpoint, e.g., above or below the setpoint.

8.11.1 Event models

There are two event models: the single-setpoint event model (Event 1 and Event 2), and the dual-setpoint event model (Discrete Events).

- To configure events using the single-setpoint event model, use the Events menu.
- To configure events using the dual-setpoint event model, use the Discrete Events menu.

Both event models are available on all Series 1000/2000 transmitters with transmitter software rev5.0 connected either to the standard core processor v2.1 or later or to the enhanced core processor. Earlier versions of the core processor or the transmitter software support only the single-setpoint event model.

The single-setpoint event model is provided for backward compatibility, and for reporting events when Update Rate is set to Special. Micro Motion recommends that the dual-setpoint event model be used for all new configurations and new installations. You can implement both events and discrete events in one transmitter.

Single-setpoint event model

You can configure up to two events. Both events can be defined on the same process variable if desired.

Events can be used only to indicate that the assigned process variable is above or below the setpoint.

If your transmitter has a discrete output, you can configure a discrete output so that it is active if the event is ON, and inactive if the event is OFF (see Section 6.7). For example, the discrete output can open or close a valve according to event status.

Dual-setpoint event model

You can configure up to five discrete events. More than one discrete event can be defined on one process variable if desired.

Events can be used to indicate that the assigned process variable is above or below the setpoint (defined by one setpoint), or in-range or out-of-range (defined by two setpoints).

If your transmitter has a discrete output, you can configure a discrete output so that it is active if the discrete event is ON, and inactive if the discrete event is OFF (see Section 6.7). For example, the discrete output can open or close a valve according to discrete event status.

Discrete events can be used to initiate specific transmitter actions. Possible actions include:

- Start zero
- Reset mass total
- Reset volume total
- Reset gas standard volume total
- Reset all totalizers
- Start/stop all totalizers and inventories

You can configure a discrete event to initiate multiple actions. For example, you can configure Discrete Event 1 to reset both the mass total and the volume total.

Discrete events are incompatible with Update Rate set to Special (see Section 8.9.1).

8.11.2 Procedure

Configuring an event includes the following steps:

1. Decide if you want to use the single-setpoint event model or the dual-setpoint event model, and use the appropriate menu.
2. Select the event to define.
3. Specify the Event Type. Event Type options are defined in Table 8-7.

Table 8-7 **Event types**

Type	Description
High (> A)	Default. Discrete event will occur if the assigned variable is greater than the setpoint (A).(1)
Low (< A)	Discrete event will occur if the assigned variable is less than the setpoint (A).(1)
In Range(2)	Discrete event will occur if the assigned variable is greater than or equal to the low setpoint (A) *and* less than or equal to the high setpoint (B).(3)
Out of Range(2)	Discrete event will occur if the assigned variable is less than or equal to the low setpoint (A) *or* greater than or equal to the high setpoint (B).(3)

(1) An event does not occur if the assigned variable is equal to the setpoint.
(2) Discrete events (dual-setpoint event model) only.
(3) An event occurs if the assigned variable is equal to the setpoint.

4. Assign a process variable to the event.
5. Specify the event's setpoint(s) – the value(s) at which the event will occur or switch state (ON to OFF, or vice versa).
   - If Event Type is High or Low, only one setpoint is used.
   - If Event Type is In Range or Out of Range, two setpoints are required.
6. If desired, configure a discrete output to switch states according to event status (see Section 6.7).
7. For discrete events only (dual-setpoint event model), use the discrete input interface (see Section 6.8) to assign one or more actions to the event, i.e., specify the action(s) that the transmitter will perform if the event occurs.

Example	Define Discrete Event 1 to stop all totalizers when the mass flow rate in forward or backward direction is less than 2 lb/min or greater than 20 lb/min. 1. Specify lb/min as the mass flow unit. 2. Set Flow Direction to Absolute Value. 3. Select Discrete Event 1. 4. Configure: • Event Type = Out of Range • Process Variable (PV) = Mass Flow Rate • Low Setpoint (A) = 2 • High Setpoint (B) = 20 5. Assign Start/Stop All Totals to Discrete Event 1.

8.11.3 Checking and reporting event status

There are several ways that event status can be reported:

- If your transmitter has a discrete output, the discrete output can be configured to switch states according to event or discrete event status (see Section 6.7).
- For Event 1 or Event 2 (single-setpoint event model), the display shows alarm code A108 (Event 1 triggered) or A109 (Event 2 triggered), unless these alarms are configured to be ignored (see Section 8.13).

Note: The status of Discrete Events 1–5 (dual-setpoint event model) is not shown on the display.

- Event status can be queried using digital communications:
  - ProLink II automatically displays event information on the Informational panel of the Status window.
  - The Communicator reports an alarm, and also shows event status in **Process Variables** > **View Status**.

8.11.4 Changing event setpoints from the display

For Event 1 or Event 2 from the single-setpoint event model only, the value of Setpoint A can be changed from the display, under the following circumstances:

- Mass total or volume total (gas or liquid) must be assigned to the event.
- Mass total or volume total must be configured as a display variable (see Section 8.14.6).

Then, to reset Setpoint A from the display:

1. Referring to the totalizer management flowchart in Figure 7-3, **Scroll** to the appropriate display screen:
   - To change the setpoint for an event defined on mass total, **Scroll** to the mass total screen.
   - To change the setpoint for an event defined on volume total, **Scroll** to the volume total screen.
2. **Select**.
3. Enter the new setpoint value. See Section 2.4.5 for instructions on entering floating-point values with the display.

8.12 Configuring slug flow limits and duration

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

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). Default value is 0.0 seconds; range is 0.0–60.0 seconds

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: This functionality is not available via the display menus.

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.

8.13 Configuring fault handling

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

There are three ways that the transmitter can report faults:

- By setting outputs to their configured fault levels (see Sections 6.5.5, 6.6.5, 6.7.3, and 8.15.1)
- By configuring a discrete output to indicate fault status (see Section 6.7.2)
- By posting an alarm to the active alarm log

Status alarm severity controls which of these methods is used. For some faults only, *fault timeout* controls when the fault is reported.

8.13.1 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 8-8.

Table 8-8 Alarm severity levels

Severity level	Transmitter action
Fault	If this condition occurs, an alarm will be generated and all outputs go to their configured fault levels. Output configuration is described in Chapter 6.
Informational	If this condition occurs, an alarm will be generated but output levels are not affected.
Ignore	If this condition occurs, no alarm will be generated (no entry is added to the active alarm log) and output levels are not affected.

Some alarms can be reclassified. For example:

- The default severity level for Alarm A20 (calibration factors unentered) is **Fault**, but you can reconfigure it to either **Informational** or **Ignore**.
- The default severity level for Alarm A102 (drive over-range) is **Informational**, but you can reconfigure it to either **Ignore** or **Fault**.

For a list of all status alarms and default severity levels, see Table 8-9. (For more information on status alarms, including possible causes and troubleshooting suggestions, see Table 12-5.)

To configure alarm severity, refer to the ProLink II and Communicator menu trees in the appropriate appendix for your transmitter model (Appendices C through G).

Note: You cannot set status alarm severity via the display menus.

Table 8-9 Status alarms and severity levels

Alarm code	Communicator message / *ProLink II message*	Default severity	Configurable	Affected by fault timeout
A001	EEprom Checksum Error (Core Processor)	Fault	No	No
	(E)EEPROM 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			
A013	Process too Noisy to Perform Auto Zero	Fault	Yes	No
	Zero Too Noisy			
A014	Transmitter Failed	Fault	No	No
	Transmitter Failed			
A016	Line RTD Temperature Out-Of-Range	Fault	Yes	Yes
	Line RTD Temperature Out-of-Range			

Table 8-9 **Status alarms and severity levels** *continued*

Alarm code	Communicator message / *ProLink II message*	Default severity	Configurable	Affected by fault timeout
A017	Meter RTD Temperature Out-Of-Range *Meter RTD Temperature Out-of-Range*	Fault	Yes	Yes
A018	EEprom Checksum Error (E)EPROM Checksum Error	Fault	No	No
A019	RAM Test Error *RAM or ROM TEST ERROR*	Fault	No	No
A020	Calibration Factors Unentered *Calibration Factors Unentered (FlowCal)*	Fault	Yes	No
A021	Unrecognized/Unentered Sensor Type *Incorrect Sensor Type (K1)*	Fault	No	No
A022[1]	(E)EPROM Config. DB Corrupt (Core Processor) *(E)EPROM Config. CB Corrupt (CP)*	Fault	No	No
A023[1]	(E)EPROM Totals Corrupt (Core Processor) *(E)EPROM Powerdown Totals Corrupt (CP)*	Fault	No	No
A024[1]	(E)EPROM Program Corrupt (Core Processor) *(E)EPROM Program Corrupt (CP)*	Fault	No	No
A025[1]	Protected Boot Sector Fault *Protected Boot Sector Fault (CP)*	Fault	No	No
A026	Sensor/Xmtr Communication Error *Sensor/Transmitter Communication Error*	Fault	No	No
A027	Security Breach *Security Breach*	Fault	No	No
A028	Sensor/Xmtr Communication Failure *Core Processor Write Failure*	Fault	No	No
A031[2]	Undefined *Low Power*	Fault	No	No
A032[2]	Meter Verification Fault Alarm *Meter Verification/Outputs In Fault*	Fault	No	No
A033[2]	Sensor OK / Tubes Stopped by Process *Sensor OK/Tubes Stopped by Process*	Fault	Yes	Yes
A100	Primary mA Output Saturated *Primary mA Output Saturated*	Info	Yes[3]	No
A101	Primary mA Output Fixed *Primary mA Output Fixed*	Info	Yes[3]	No
A102	Drive Over-Range / Partially Full Tube *Drive Overrange*	Info	Yes	No
A103[1]	Data Loss Possible *Data Loss Possible (Tot and Inv)*	Info	Yes	No

Table 8-9 Status alarms and severity levels *continued*

Alarm code	Communicator message / *ProLink II message*	Default severity	Configurable	Affected by fault timeout
A104	Calibration-In- Progress *Calibration in Progress*	Info	Yes(3)	No
A105	Slug Flow *Slug Flow*	Info	Yes	No
A106	Burst Mode Enabled *Burst Mode Enabled*	Info	Yes(3)	No
A107	Power Reset Occurred *Power Reset Occurred*	Info	Yes	No
A108(4)	Event #1 Triggered *Event 1 Triggered*	Info	Yes	No
A109(4)	Event #2 Triggered *Event 2 Triggered*	Info	Yes	No
A110	Frequency Output Saturated *Frequency Output Saturated*	Info	Yes(3)	No
A111	Frequency Output Fixed *Frequency Output Fixed*	Info	Yes(3)	No
A112(5)	Software Upgrade Recommended *S/W Upgrade Recommended*	Info	Yes	No
A113	Secondary mA Output Saturated *Secondary mA Output Saturated*	Info	Yes(3)	No
A114	Secondary mA Output Fixed *Secondary mA Output Fixed*	Info	Yes(3)	No
A115	External Input Error *External Input Error*	Info	Yes	No
A116	API Temperature Out-of-Limits *API: Temperature Outside Standard Range*	Info	Yes	No
A117	API Density Out-of-Limits *API: Density Outside Standard Range*	Info	Yes	No
A118	Discrete Output 1 Fixed *Discrete Output 1 Fixed*	Info	Yes(3)	No
A119	Discrete Output 2 Fixed *Discrete Output 2 Fixed*	Info	Yes(3)	No
A120	ED: Unable to fit curve data *ED: Unable to Fit Curve Data*	Info	No	No

Table 8-9 **Status alarms and severity levels** *continued*

Alarm code	Communicator message / *ProLink II message*	Default severity	Configurable	Affected by fault timeout
A121	ED: Extrapolation alarm *ED: Extrapolation Alarm*	Info	Yes	No
A131(2)	Meter Verification Info Alarm *Meter Verification/Outputs at Last Value*	Info	Yes	No
A132(2)	Simulation Mode Active *Simulation Mode Active*	Info	Yes(3)	No

(1) Applies only to systems with the standard core processor.
(2) Applies only to systems with the enhanced core processor.
(3) Can be set to either Info or Ignore, but cannot be set to Fault.
(4) Applies only to events configured using the single-setpoint event model (see Section 8.11.1).
(5) Applies only to systems with transmitter software earlier than rev5.0.

8.13.2 Fault timeout

By default, the transmitter immediately reports a fault when a fault is encountered. For specific faults, you can configure the transmitter to delay reporting the fault by changing the fault timeout to a non-zero value. If fault timeout is configured:

- During the fault timeout period, the transmitter continues to report its last valid measurement.
- The fault timeout applies only to the mA output, frequency output, and discrete output. Fault indication via digital communications is unaffected.

The fault timeout is not applicable to all faults. See Table 8-9 for information about which faults can be affected.

8.14 Configuring the display

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

If your transmitter has a display, you can enable or disable specific display functions, specify the process variables to be shown on the display, and set a variety of parameters that control display behavior.

8.14.1 Update period

The *update period* (or *display rate*) parameter controls how often the display is refreshed with current data. The default is 0.2 seconds. The range is 0.10 seconds to 10 seconds. The Update Period value applies to all process variables.

8.14.2 Language

The display can be configured to use any of the following languages for data and menus:

- English
- French
- German
- Spanish

8.14.3 Enabling and disabling display functions

Table 8-10 lists the display functions and describes their behavior when enabled or disabled.

Table 8-10 Display parameters

Parameter	Enabled	Disabled
Totalizer start/stop(1)(2)	Operators can start or stop totalizers using the display.	Operators cannot start or stop totalizers using the display.
Totalizer reset(1)	Operators can reset the mass and volume totalizers.	Operators cannot reset the mass and volume totalizers.
Auto scroll	The display automatically scrolls through each process variable at a configurable rate.	Operators must **Scroll** to view process variables.
Off-line menu	Operators can access the off-line menu (zero, simulation, and configuration).	Operators cannot access the off-line menu.
Off-line password(3)	Operators must enter the display password to access the off-line menu.	Operators can access the off-line menu without the display password.
Alarm menu	Operators can access the alarm menu (viewing and acknowledging alarms).	Operators cannot access the alarm menu.
Acknowledge all alarms	Operators are able to acknowledge all current alarms at once.	Operators must acknowledge alarms individually.
Backlight on/off	Display backlight is on.	Display backlight is off.
Alarm screen password(3)	Operators must enter the display password to access the alarm menu.	Operators can access the alarm menu without the display password.
LED blinking	The status LED will flash when there are unacknowledged alarms.	The status LED will not flash to indicate unacknowledged alarms. It will still flash to indicate calibration in progress.

(1) If the petroleum measurement application is installed on your transmitter, the display password is always required to start, stop, or reset a totalizer, even if neither password is enabled. If the petroleum measurement application is not installed, the display password is never required for these functions, even if one of the display passwords is enabled.
(2) This feature is available only with rev3.3 or higher of the transmitter software. For all other transmitters, totalizer reset and totalizer start/stop from the display cannot be disabled.
(3) See Section 2.4.4 for detailed information on the display password function.

8.14.4 Changing the scroll rate

The *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 8.14.6) 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 to configure the transmitter, you must enable Auto Scroll before you can configure Scroll Rate (see Section 8.14.3).

8.14.5 Changing the display password

The display password is a numeric code that can contain up to four digits. It is used for both the off-line password and the alarm screen password. See Section 2.4.4 for information on how the two passwords are implemented.

If you are using the Communicator or the display, you must enable either the off-line password or the alarm screen password before you can configure the password (see Section 8.14.3).

Note: If the petroleum measurement application is installed on your transmitter, the display password is always required to start, stop, or reset a totalizer, even if neither password is enabled. If the petroleum measurement application is not installed, the display password is never required for these functions, even if one of the passwords is enabled.

8.14.6 Changing the 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.

Additionally, you can configure display precision for each display variable. Display precision controls the number of digits to the right of the decimal place. The lower the precision, the larger a process change must be in order to be reflected in the displayed value. The range of the display precision is 0 to 5.

Note: The display cannot be used to configure display variables or display precision.

Table 8-11 shows an example of a display variable configuration. Notice that you can repeat variables, and you can also specify None. For information on how the display variables will appear on the display, see Appendix H.

Table 8-11 Example of a display variable configuration

Display variable	Process variable
Display variable 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	API Std volume flow
Display variable 8	API Std volume total
Display variable 9	External temperature
Display variable 10	External pressure
Display variable 11	Mass flow
Display variable 12	None
Display variable 13	None
Display variable 14	None
Display variable 15	None

8.15 Configuring digital communications

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The digital communications parameters control how the transmitter will communicate using digital communications (HART or Modbus).

The following digital communications parameters can be configured:

- Fault indicator
- HART polling address
- Modbus address
- RS-485 settings
- Burst mode
- PV, SV, TV, and QV assignments

8.15.1 Changing the digital communications fault indicator

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The transmitter can indicate fault conditions using a digital communications fault indicator. Table 8-12 lists the options for the digital communications fault indicator.

Table 8-12 Digital communication fault output indicators and values

ProLink II fault indicator options	Communicator fault indicator options	Fault output value
Upscale	Upscale	Process variables indicate the value is greater than the upper sensor limit. Totalizers stop counting.
Downscale	Downscale	Process variables indicate the value is less than the lower sensor limit. Totalizers stop counting.
Zero	IntZero-All 0	Flow rates, density, and temperature go to the value that represents zero flow. Totalizers stop counting.
Not-A-Number (NAN)	Not-a-Number	Process variables report IEEE NAN and Modbus scaled integers report **Max Int**. Totalizers stop counting.
Flow to Zero	IntZero-Flow 0	Flow rates go to the value that represents zero flow; other process variables are not affected. Totalizers stop counting.
None (default)	None	Process variables reported as measured.

8.15.2 Changing the Modbus address

- Model 1500 AN
- Model 1700 AN
- Model 2500 CIO
- Model 2700 AN

The transmitter's Modbus address is used by devices on a network to identify and communicate with the transmitter using Modbus protocol. The Modbus address must be unique on the network. If the transmitter will not be accessed using Modbus protocol, the Modbus address is not required.

Valid Modbus addresses are 1–247, excluding 111 (the address 111 is reserved for the service port).

Note: If you are using ProLink II, and you are connected to the transmitter over a Modbus connection, ProLink II will lose communication as soon as you click the Apply button. To reestablish communication, you must change the communication settings specified in the ProLink II Connect dialog box (see Chapter 3). This does not apply to service port connections.

8.15.3 Changing the RS-485 parameters

- Model 1500 AN
- Model 1700 AN
- Model 2500 CIO
- Model 2700 AN

RS-485 parameters control how the transmitter will communicate over its RS-485 terminals. The RS-485 parameters are listed in Table 8-13.

Table 8-13 RS-485 communication settings

	Transmitter	
Parameter	**1500 AN / 2500 CIO options**	**1700 AN / 2700 AN options**
Protocol	Modbus ASCII Modbus RTU (default)	Modbus ASCII Modbus RTU HART (default)
Parity	Odd (default) Even None	Odd (default) Even None
Stop bits	1 (default) 2	1 (default) 2
Baud rate	1200 to 38,400 (default: 9600)	1200 to 38,400 (default: 1200)

To enable RS-485 communications with the transmitter from a remote device:

1. Set the transmitter's digital communications parameters appropriately for your network.
2. Configure the remote device to use the specified parameters.

Note: Changing the RS-485 communication settings does not affect service port connections. Service port connections always use default settings.

Note: In some versions of ProLink II, a button named **Choose Typical HART Settings** *is provided. When this button is pressed, the settings for the RS-485 terminals are changed to the most common settings used for HART communications:*

- *Protocol: HART*
- *Parity: Odd*
- *Baud Rate: 1200*
- *Stop Bits: 1*

Note the following when setting RS-485 parameters:

- If HART protocol is selected, setting the address to any number other than 0 automatically fixes the mA output at 4 mA, unless the Loop Current parameter is set (see Section 8.15.7).
- If you are using ProLink II, and you are connected to the transmitter over a Modbus RS-485 connection, ProLink II will lose communication as soon as you click the **Apply** button. To reestablish communication, you must change the ProLink II communication settings to match the settings configured in the transmitter.
- If you are using the display:
  - And the off-line menu has been disabled, you will not be able to change the RS-485 options with the display. For information about enabling and disabling the off-line menu, see Section 8.14.3.
  - The address item allows users to enter the polling address. Valid addresses depend on the protocol selected earlier. Valid addresses for Modbus protocol must be in one of the following ranges: 1–247 (except 111). Valid addresses for HART protocol must be in the range 0–15. If Protocol is set to **NONE**, the address item will not appear.

8.15.4 Floating-point byte order

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Four bytes are used to transmit floating-point values. For contents of bytes, see Table 8-14.

Table 8-14 Byte contents in Modbus commands and responses

Byte	Bits	Definitions
1	S E E E E E E E	S = Sign E = Exponent
2	E M M M M M M M	E = Exponent M = Mantissa
3	M M M M M M M M	M = Mantissa
4	M M M M M M M M	M = Mantissa

The default byte order for the transmitter is 3–4–1–2. You may need to reset byte order to match the byte order used by a remote host or PLC. Byte order codes are listed in Table 8-15.

Notes: This parameter affects only Modbus communications. HART communications are not changed.

You cannot set byte order via the display or the Communicator.

Table 8-15 **Byte order codes and byte orders**

Byte order code	Byte order
0	1–2–3–4
1	3–4–1–2
2	2–1–4–3
3	4–3–2–1

8.15.5 Additional communications response delay

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Some hosts or PLCs operate at slower speeds than the transmitter. In order to synchronize communication with these devices, you can configure an additional time delay to be added to each response the transmitter sends to the remote host.

Note: This parameter affects only Modbus communications. HART communications are not changed.

The basic unit of delay is in terms of 2/3 of one character time as calculated for the current serial port baud rate setting and character transmission parameters. This basic delay unit is multiplied by the configured value to arrive at the total additional time delay. You can specify a value in the range 1 to 255.

Note: This functionality is not available via the display menus or the Communicator.

8.15.6 Changing the HART polling address

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The transmitter's HART polling address is used by devices on a network to identify and communicate with the transmitter using HART protocol. The HART polling address must be unique on the network. If the transmitter will not be accessed using HART protocol, the HART polling address is not required.

The HART polling address is used for both HART/Bell 202 and HART/RS-485 communications; i.e., for HART communication over either the primary mA output terminals or the RS-485 terminals (AN transmitters only).

Note: Devices using HART protocol to communicate with the transmitter may use either the HART polling address or the HART tag (see Section 8.16). You may configure either or both, as required by your other HART devices.

Valid HART polling addresses are 0–15.

Note: If you change the HART polling address to any value other than 0, check to make sure that the primary mA output is behaving as required. You may need to set the Loop Current Mode parameter (see Section 8.15.7).

8.15.7 Configuring the Loop Current Mode parameter

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

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

- If Loop Current Mode parameter is disabled, the mA output is fixed at 4 mA, and therefore cannot be used to report process data.
- If 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. This is designed to make it easier to configure the transmitter for legacy behavior. You may accept this change or clear the checkbox before clicking OK or Apply.

8.15.8 Configuring HART burst mode

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

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

To configure burst mode:

1. Enable burst mode.
2. Specify the burst mode output. Options are described in Table 8-16.

Table 8-16 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).
Dynamic vars & PV current(1)	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).
Transmitter vars	Fld dev var	The transmitter sends four process variables in each burst. See Step 3.

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

3. If you specified **Transmitter vars** or **Fld dev var** in Step 2, use ProLink II or the 375 Field Communicator to specify the four process variables to be sent in each burst.

Note: If you are using the 275 HART Communicator to configure the transmitter, you cannot change the default.

8.15.9 Configuring the PV, SV, TV, and QV assignments

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

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 primary 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 primary mA output is changed automatically, and vice versa. See Section 6.5.1.
- The SV is automatically reported through the secondary mA output, if the transmitter has a secondary mA output. It can also be queried via digital communications or reported via burst mode. If you change the SV, the process variable assigned to the secondary mA output is changed automatically, and vice versa. See Section 6.5.1.
- The TV is automatically reported through the frequency output, if the transmitter has a frequency output. It can also be queried via digital communications or reported via burst mode. If you change the TV, the process variable assigned to the frequency output is changed automatically, and vice versa. See Section 6.6.1.
- The QV is not reported through an output. It can be queried via digital communications or reported via burst mode.

Table 8-16 lists the valid process variable assignments for the PV, SV, TV, and QV on Series 1000 and Series 2000 transmitters.

Note: Series 1000 transmitters support only flow variables on all outputs.

Table 8-17 Process variable assignments for PV, SV, TV, and QV

	Series 1000				Series 2000			
Process variable	**PV**	**SV**	**TV**	**QV**	**PV**	**SV**	**TV**	**QV**
Mass flow	✓	✓	✓	✓	✓	✓	✓	✓
Volume flow	✓	✓	✓	✓	✓	✓	✓	✓
Temperature					✓	✓		✓
Density					✓	✓		✓
Drive gain					✓	✓		✓
Mass total				✓				✓
Volume total				✓				✓
Mass inventory				✓				✓
Volume inventory				✓				✓

Table 8-17 Process variable assignments for PV, SV, TV, and QV *continued*

	Series 1000				Series 2000			
Process variable	**PV**	**SV**	**TV**	**QV**	**PV**	**SV**	**TV**	**QV**
Tube frequency								✓
Meter temperature								✓
LPO amplitude								✓
RPO amplitude								✓
Board temperature								✓
External pressure					✓	✓		✓
External temperature					✓	✓		✓
Gas standard volume flow	✓	✓	✓	✓	✓	✓	✓	✓
Gas standard volume total				✓				✓
Gas standard volume inventory				✓				✓
Live zero								✓
API density(1)					✓	✓		✓
API volume flow(1)					✓	✓	✓	✓
API volume total(1)								✓
API volume inventory(1)								✓
API average density(1)					✓	✓		✓
API average temperature(1)					✓	✓		✓
API CTL(1)								✓
ED density at reference temperature(2)					✓	✓		✓
ED specific gravity(2)					✓	✓		✓
ED standard volume flow(2)					✓	✓	✓	✓
ED standard volume total(2)								✓
ED standard volume inventory(2)								✓
ED net mass flow(2)					✓	✓	✓	✓
ED net mass total(2)								✓
ED net mass inventory(2)								✓
ED net volume flow(2)					✓	✓	✓	✓
ED net volume total(2)								✓
ED net volume inventory(2)								✓
ED concentration(2)					✓	✓		✓
ED Baume(2)(3)					✓	✓		✓

(1) Available only if the petroleum measurement application is enabled on your transmitter.
(2) Available only if the enhanced density application is enabled on your transmitter.
(3) Available only on systems with the standard core processor.

8.16 Configuring device settings

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The device settings are used to describe the flowmeter components. Table 8-18 lists and defines the device settings.

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.

Table 8-18 Device settings

Parameter	Description
HART tag(1)	Also called the "software tag." Used by other devices on the network to identify and communicate with this transmitter via HART protocol. The HART tag must be unique on the network. If the transmitter will not be accessed using HART protocol, the HART tag is not required. Maximum length: 8 characters.
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.

(1) Devices using HART protocol to communicate with the transmitter may use either the HART address (see Section 8.15.6) or the HART tag. You may configure either or both, as required by your other HART devices.

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*

8.17 Configuring sensor parameters

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

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 changed:

- Serial number
- Model number
- Sensor material
- Liner material
- Flange

8.18 Configuring write-protect mode

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

When the transmitter is in write-protect mode, the configuration data stored in the transmitter and core processor cannot be changed until write-protect mode is disabled.

Chapter 9
Pressure Compensation, Temperature Compensation, and Polling

9.1 Overview

This chapter describes the following procedures:

- Configuring pressure compensation (see Section 9.2)
- Configuring external temperature compensation (see Section 9.3)
- Configuring polling (see Section 9.4)

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 Chapter 3 for more information.

Note: All Communicator key sequences in this section assume that you are starting from the "Online" menu. See Chapter 4 for more information.

9.2 Pressure compensation

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Series 1000/2000 transmitters 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 an optional procedure. Perform this procedure only if required by your application.

9.2.1 Options

There are two ways to configure pressure compensation:

- If the operating pressure is a known static value, you can enter the external pressure in the software, and not poll a pressure measurement device.
- If the operating pressure varies significantly, you configure the transmitter to poll for an updated pressure value from an external pressure measurement device. Polling requires HART/Bell 202 communications over the primary mA output.

Note: If you configure a static pressure value, ensure that it is accurate. If you configure polling for pressure, ensure that the pressure measurement device is accurate and reliable.

9.2.2 Pressure correction factors

When configuring pressure compensation, you must provide the flow calibration pressure – the pressure at which the flowmeter was calibrated (which therefore defines the pressure at which there will be no effect on the calibration factor). Refer to the calibration document shipped with your sensor. If the data is unavailable, use 20 psi.

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 $g/cm^3/psi$

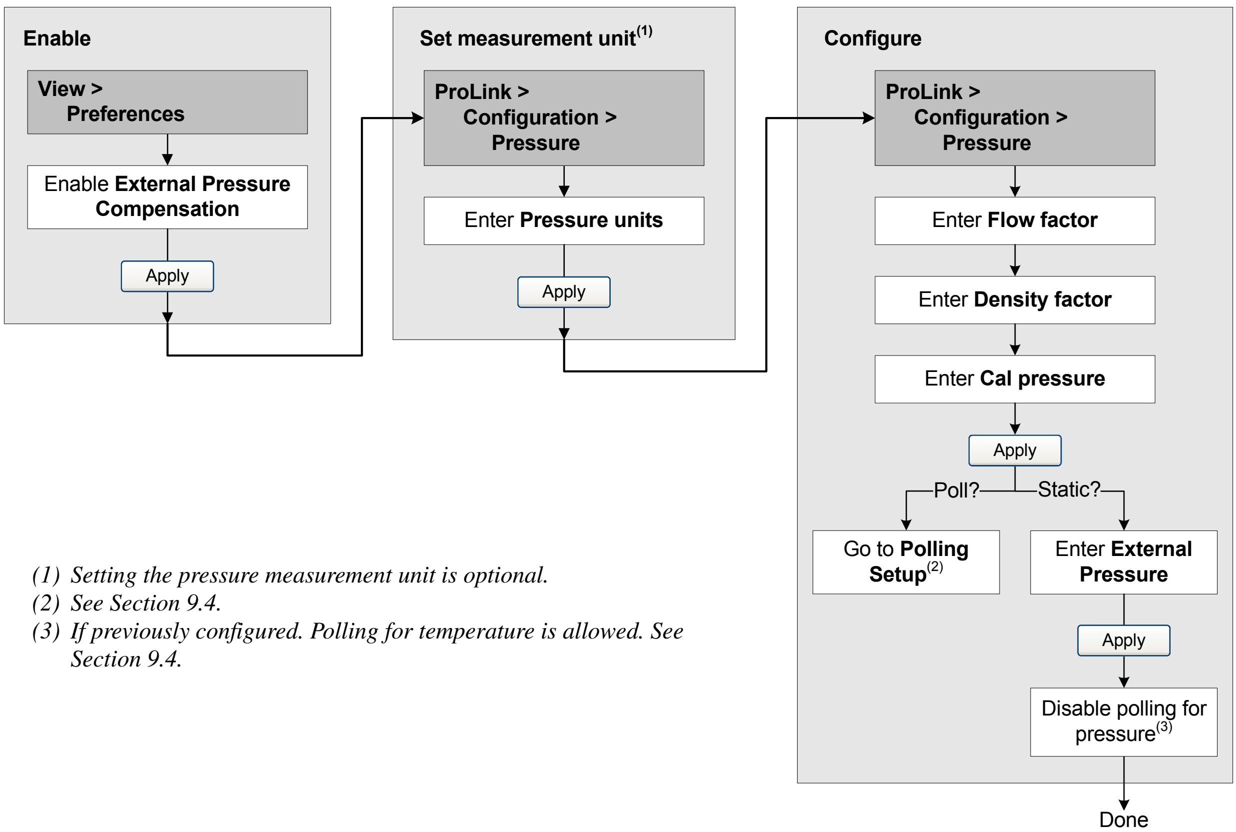
Not all sensors or applications require pressure correction factors. For the pressure correction values to be used, obtain the pressure effect values from the product data sheet for your sensor, then reverse the signs (e.g., if the pressure effect is 0.000004, enter a pressure correction factor of –0.000004).

9.2.3 Configuration

To enable and configure pressure compensation:

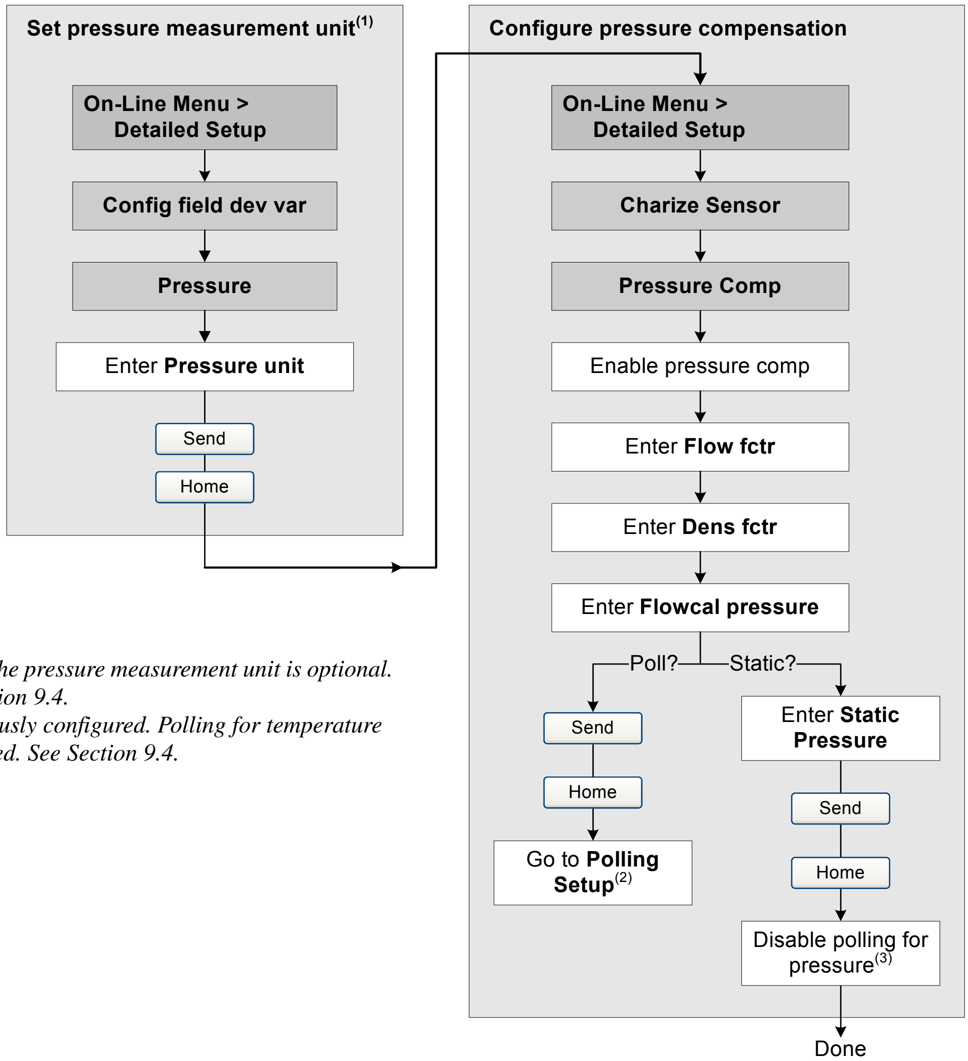
- With ProLink II, see Figure 9-1.
- With the Communicator, see Figure 9-2.

Figure 9-1 Configuring pressure compensation with ProLink II



(1) Setting the pressure measurement unit is optional.
(2) See Section 9.4.
(3) If previously configured. Polling for temperature is allowed. See Section 9.4.

Figure 9-2 **Configuring pressure compensation with the Communicator**



(1) Setting the pressure measurement unit is optional.
(2) See Section 9.4.
(3) If previously configured. Polling for temperature is allowed. See Section 9.4.

9.3 External temperature compensation

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Temperature data are used in several different calculations. Micro Motion sensors always report temperature data to the transmitter. For greater accuracy, you can configure the transmitter to use a different temperature value.

There are two ways to configure external temperature compensation:

- If the operating temperature is a known static value, you can enter the operating temperature in the software, and not poll a temperature measurement device.
- If the operating temperature varies significantly, you configure the transmitter to poll for an updated temperature value from an external temperature measurement device. Polling requires HART/Bell 202 communications over the primary mA output.

Note: If your core processor is v2.1 or earlier, and you configure the transmitter for external temperature compensation, the temperature value from the compensation procedure will replace the sensor value in all calculations that require temperature data. If your core processor is v2.2 or later, the temperature value from the compensation procedure is used only for enhanced density and petroleum measurement calculations.

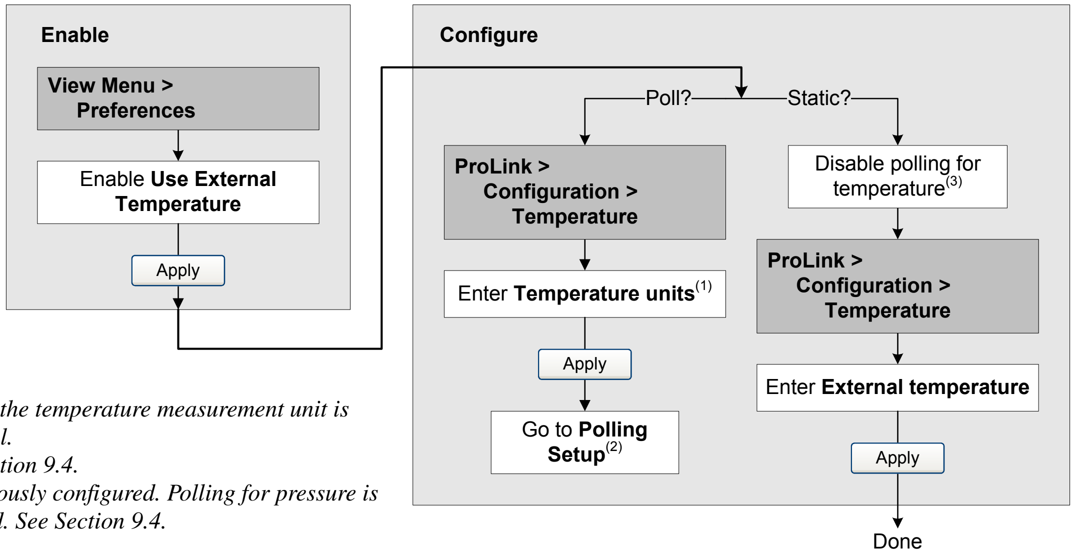
Note: If you configure a static temperature value, ensure that it is accurate. If you configure polling for temperature, ensure that the external temperature measurement device is accurate and reliable.

9.3.1 Configuration

To configure external temperature compensation:

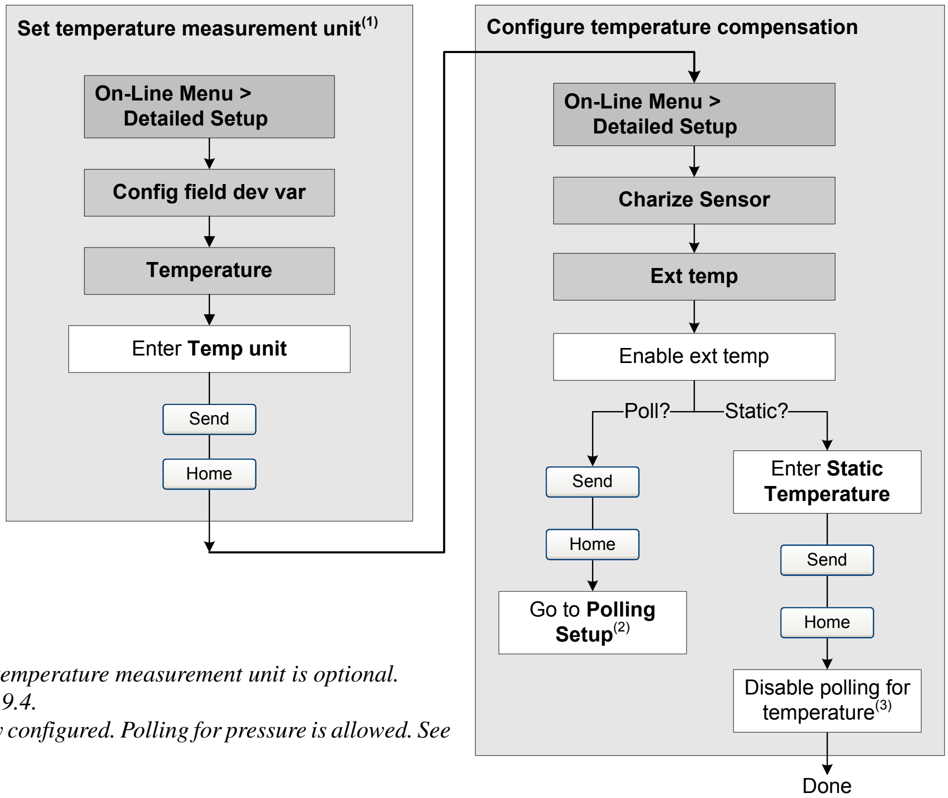
- With ProLink II, see Figure 9-3
- With the Communicator, see Figure 9-4

Figure 9-3 Configuring external temperature compensation with ProLink II



(1) Setting the temperature measurement unit is optional.
(2) See Section 9.4.
(3) If previously configured. Polling for pressure is allowed. See Section 9.4.

Figure 9-4 **Configuring external temperature compensation with the Communicator**



(1) Setting the temperature measurement unit is optional.
(2) See Section 9.4.
(3) If previously configured. Polling for pressure is allowed. See Section 9.4.

9.4 Configuring polling

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

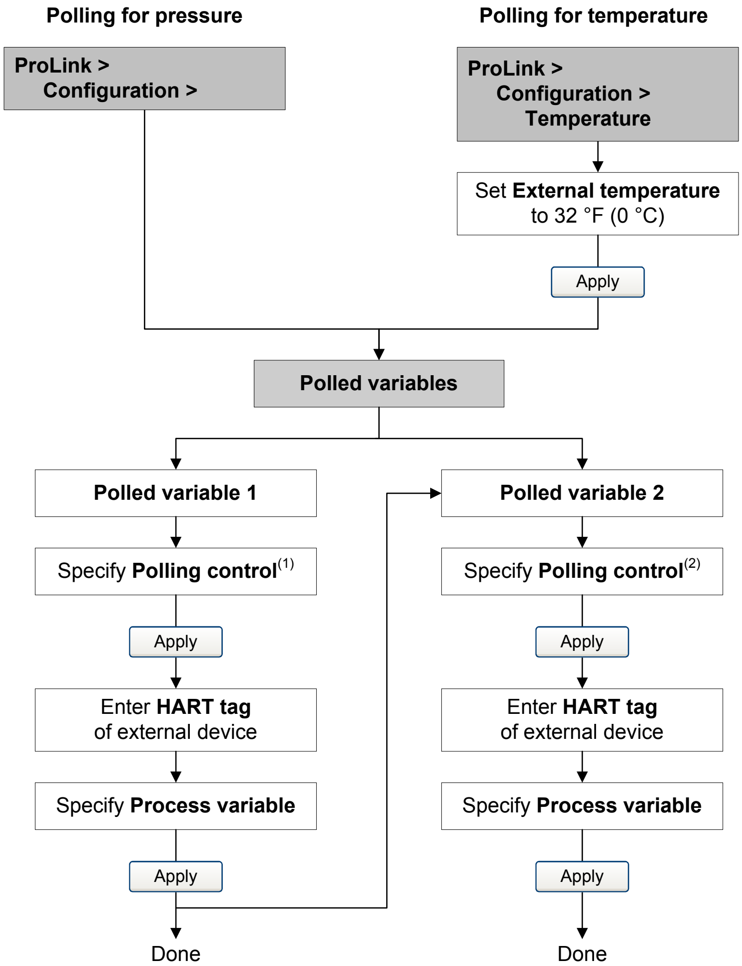
Polling requires HART protocol over the Bell 202 physical layer. You must ensure that the primary mA output has been wired for HART protocol. See the installation manual for your transmitter.

To configure polling:

- With ProLink II, see Figure 9-5
- With the Communicator, see Figure 9-5

Note: Before setting up polling, verify that pressure compensation or external temperature compensation has been enabled as required (see Sections 9.2 and 9.3).

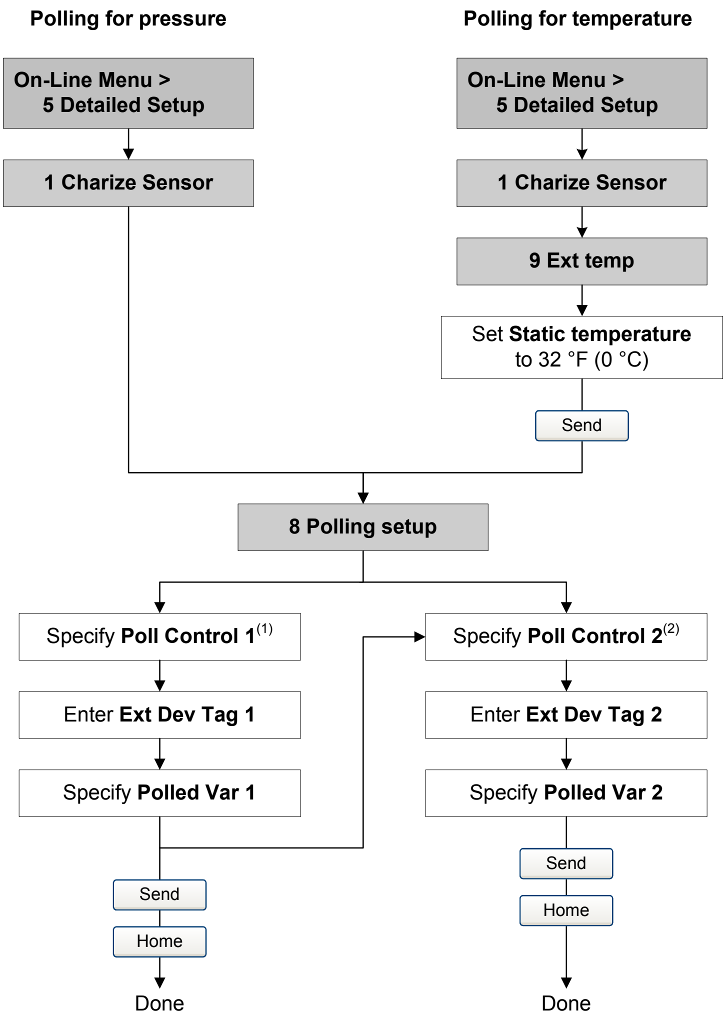
Figure 9-5 Configuring polling with ProLink II



(1) *Choose Primary if the external device will probably be accessed by another device acting as a secondary master (e.g., a Communicator). Choose Secondary if the external device will probably be accessed by another device acting as a primary master.*

(2) *If you are configuring both Polled Variable 1 and Polled Variable 2, use the same Polling Control setting for both. If you do not, Poll as Primary will be used for both devices.*

Figure 9-6 Configuring polling with the Communicator



(1) Choose Primary if the external device will probably be accessed by another device acting as a secondary master (e.g., a Communicator). Choose Secondary if the external device will probably be accessed by another device acting as a primary master.

(2) If you are configuring both Polled Variable 1 and Polled Variable 2, use the same Poll Control setting for both. If you do not, Poll as Primary will be used for both devices.

Chapter 10
Measurement Performance

10.1 Overview

This chapter describes the following procedures:

- Meter verification – see Section 10.3
- Meter validation and adjusting meter factors – see Section 10.4
- Density calibration – see Section 10.5
- Temperature calibration – see Section 10.6

This chapter provides basic information and procedural flowcharts for each configuration step. For more details about how to perform each procedure, see the flowcharts for your transmitter and communication tool, provided in the appendices to this manual.

Notes: 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 Chapter 3 for more information.

All Communicator key sequences in this section assume that you are starting from the "Online" menu. See Chapter 4 for more information.

10.2 Meter verification, meter validation, and calibration

There are three procedures:

- *Meter verification* – establishing confidence in the sensor's performance by analyzing secondary variables that are highly correlated with flow and density calibration factors
- *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

All Series 1000/2000 transmitters can be validated and calibrated. If the transmitter is connected to an enhanced core processor, meter verification may be supported depending on whether the transmitter was ordered with this option.

These three procedures are discussed and compared in Sections 10.2.1 through 10.2.4. Before performing any of these procedures, review these sections to ensure that you will be performing the appropriate procedure for your purposes.

10.2.1 Meter verification

Meter verification evaluates the structural integrity of the sensor tubes by comparing current tube stiffness to the stiffness measured at the factory. Stiffness is defined as the load per unit deflection, or force divided by displacement. Because a change in structural integrity changes the sensor's response to mass and density, this value can be used as an indicator of measurement performance. Changes in tube stiffness are typically caused by erosion, corrosion, or tube damage.

Notes: To use meter verification, the transmitter must be paired with an enhanced core processor, and the meter verification option must be purchased for the transmitter.

Meter verification either holds the last output value or causes the outputs to go to the configured fault values during the procedure (approximately 4 minutes).

Micro Motion recommends that you perform meter verification on a regular basis.

10.2.2 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 and measures standard. You may need to calculate and adjust meter factors periodically to comply with regulations.

10.2.3 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 (see Section 5.5)
- 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.

Transmitters 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.

10.2.4 Comparison and recommendations

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

- Process interruption
  - Meter verification requires approximately four minutes to perform. During these four minutes, flow can continue (provided sufficient stability is maintained); however, outputs will not report process data.
  - Meter validation for density does not interrupt the process at all. However, meter validation for mass flow or volume flow requires process down-time for the length of the test.
  - 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
  - Meter verification does not require external measurements.
  - 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 verification is an indicator of sensor condition, but does not change flowmeter internal measurement in any way.
  - 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 restore the factory zero at a later time. You cannot return to the previous zero (if different from the factory zero), density calibration values, or temperature calibration values unless you have manually recorded them.

Micro Motion recommends obtaining the meter verification transmitter option and performing meter verification on a regular basis.

10.3 Performing meter verification

Note: To use meter verification, the transmitter must be paired with an enhanced core processor, and the meter verification option must be purchased for the transmitter.

The meter verification procedure can be performed on any process fluid. It is not necessary to match factory conditions. Meter verification is not affected by any parameters configured for flow, density, or temperature.

During the test, process conditions must be stable. To maximize stability:

- Maintain a constant temperature and pressure.
- Avoid changes to fluid composition (e.g., two-phase flow, settling, etc.).
- Maintain a constant flow. For higher test certainty, reduce or stop flow.

If stability varies outside test limits, the meter verification procedure will be aborted. Verify the stability of the process and retry the test.

During meter verification, you must choose to fix the outputs at either the configured fault levels or the last measured value. The outputs will remain fixed for the duration of the test (approximately four minutes). Disable all control loops for the duration of the procedure, and ensure that any data reported during this period is handled appropriately.

10.3.1 Running the meter verification test

To run a meter verification test:

- With ProLink II, see Figure 10-1.
- With the display, see Figure 10-2.
- With the 375 Field Communicator, see Figure 10-3 (requires 375 Field Communicator device rev 5, DD rev 1).

10.3.2 Specification uncertainty limit and test results

The result of the meter verification test will be a percent uncertainty of normalized tube stiffness. The default limit for this uncertainty is ±4.0%. This limit is stored in the transmitter, and can be changed with ProLink II when optional test parameters are entered. For most installations, it is advisable to leave the specification uncertainty limit at the default value.

When the test is completed, the result will be reported as Pass, Fail/Caution (depending on whether you are using the display, the Communicator, or ProLink II), or Abort:

- *Pass* – The test result is within the specification uncertainty limit. If transmitter zero and configuration match factory values, the sensor will meet factory specifications for flow and density measurement. It is expected that meters will pass meter verification every time the test is run.
- *Fail/Caution* – The test result is not within the specification uncertainty limit. Micro Motion recommends that you immediately re-run the meter verification test. If the meter passes the second test, the first Fail/Caution result can be ignored. If the meter fails the second test, the flow tubes may be damaged. Use the knowledge of your process to consider the type of damage and determine the appropriate action. These actions might include removing the meter from service and physically inspecting the tubes. At minimum, you should perform a flow validation (see Section 10.4) and a density calibration (see Section 10.5).
- *Abort* – A problem occurred with the meter verification test (e.g., process instability). Check your process and retry the test.

ProLink II provides more detailed test data. See Section 10.3.3.

10.3.3 Additional ProLink II tools for meter verification

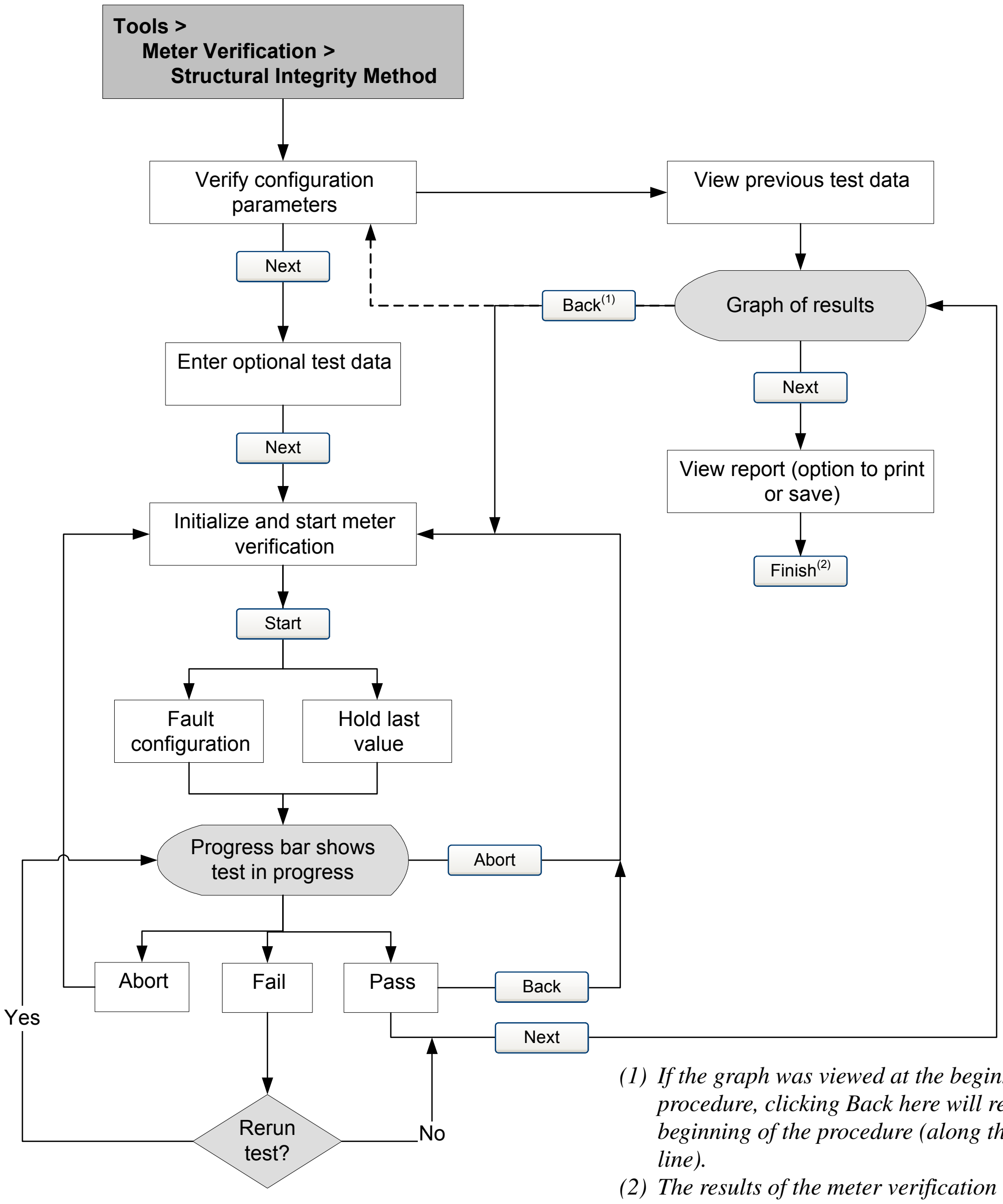
In addition to the Pass, Fail/Caution, and Abort result provided by the display, ProLink II can provide the following additional meter verification tools:

- *Test metadata* – ProLink II allows you to enter a large amount of metadata about each test so that past tests can be audited easily. ProLink II will prompt you for this optional data during the test.
- *Visibility of configuration and zero changes* – ProLink II has a pair of indicators that show whether the transmitter's configuration or zero has changed since the last meter verification test. The indicators will be green if configuration and zero are the same, and red otherwise. You can find out more information about changes to configuration and zero by clicking the button next to each indicator.
- *Plotted data points* – ProLink II shows the exact stiffness uncertainty on a graph. This allows you to see not only whether the meter is operating within specification, but also where the results fall within the specified limits. (The results are shown as two data points: LPO and RPO. The trending of these two points can help identify if local or uniform changes are occurring to the flow tubes.)
- *Trending* – ProLink II has the ability to store a history of meter verification data points. This history is displayed on the results graph. The rightmost data points are the most recent. This history lets you see how your meter is trending over time, which can be an important way of detecting meter problems before they become severe. You can view the graph of past results at either the beginning or the end of the meter verification procedure. The graph is shown automatically at the end. Click **View Previous Test Data** to view the graph at the beginning.
- *Data manipulation* – You can manipulate the graphed data in various ways by double-clicking the graph. When the graph configuration dialog is open, you can also export the graph in a number of formats (including "to printer") by clicking **Export**.
- *Detailed report form* – At the end of a meter verification test, ProLink II displays a detailed report of the test, which includes the same recommendations for pass/caution/abort results found in Section 10.3.2. You have the options of printing the report or saving it to disk as an HTML file.

More information about using ProLink II to perform meter verification can be found in the ProLink II manual and in the on-line ProLink II help system.

Note: Historical data (e.g., previous test results or whether zero has changed) are stored on the computer on which ProLink II is installed. If you perform meter verification on the same transmitter from a different computer, the historical data will not be visible.

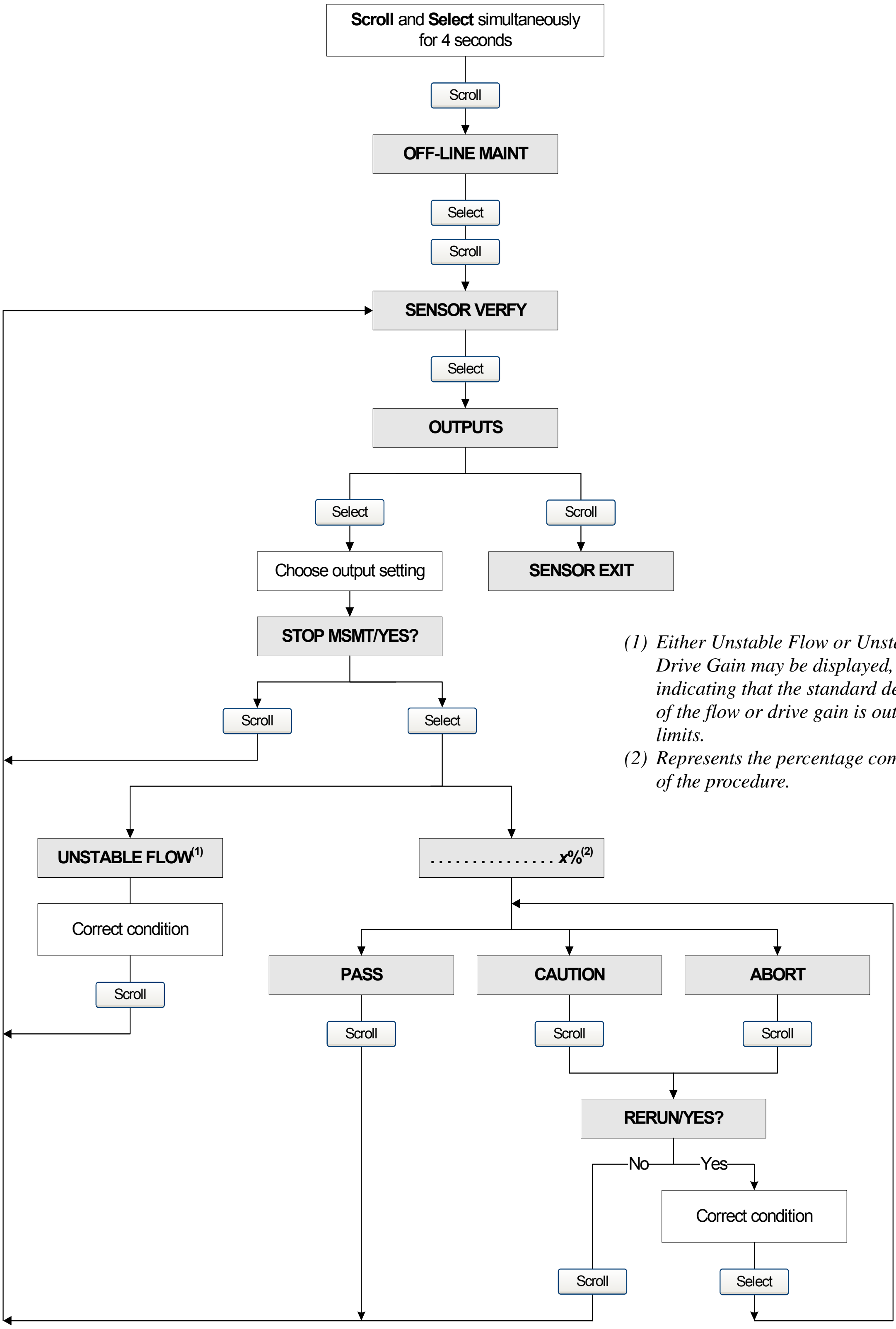
Figure 10-1 **Meter verification – ProLink II**



(1) If the graph was viewed at the beginning of the procedure, clicking Back here will return to the beginning of the procedure (along the dotted line).

(2) The results of the meter verification test are not saved until Finish is clicked.

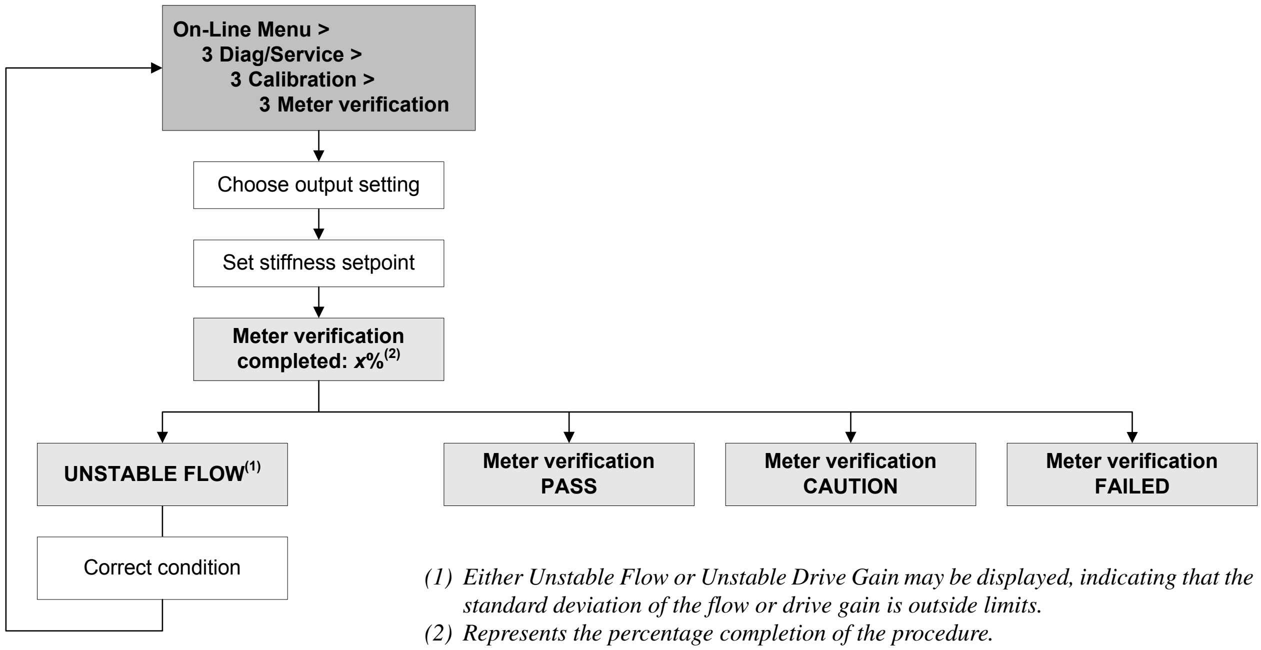
Figure 10-2 **Meter verification – Display**



(1) Either Unstable Flow or Unstable Drive Gain may be displayed, indicating that the standard deviation of the flow or drive gain is outside limits.

(2) Represents the percentage completion of the procedure.

Figure 10-3 Meter verification – Communicator



(1) Either Unstable Flow or Unstable Drive Gain may be displayed, indicating that the standard deviation of the flow or drive gain is outside limits.
(2) Represents the percentage completion of the procedure.

10.4 Performing meter validation

To perform meter validation, measure a sample of the process fluid and compare the measurement with the flowmeter's reported value.

Use the following formula to calculate a meter factor:

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

Valid values for meter factors range from **0.8** to **1.2**. If the calculated meter factor exceeds these limits, contact Micro Motion customer service.

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: $$\text{MassFlowMeterFactor} = 1 \times \frac{250}{250.27} = 0.9989$$ 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: $$\text{MassFlowMeterFactor} = 0.9989 \times \frac{250.25}{250.07} = 0.9996$$ The new mass flow meter factor is 0.9996.

10.5 Performing density calibration

Density calibration includes the following calibration points:

- All sensors:
  - D1 calibration (low-density)
  - D2 calibration (high-density)
- T-Series sensors only:
  - D3 calibration (optional)
  - D4 calibration (optional)

For T-Series sensors, the optional D3 and D4 calibrations could improve the accuracy of the density measurement. If you choose to perform the D3 and D4 calibration:

- Do not perform the D1 or D2 calibration.
- Perform D3 calibration if you have one calibrated fluid.
- Perform both D3 and D4 calibrations if you have two calibrated fluids (other than air and water).

The calibrations that you choose must be performed without interruption, in the order listed here.

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.

10.5.1 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. If you are calibrating a T-Series sensor, the D1 fluid must be air and the D2 fluid must be water.

⚠ CAUTION

For T-Series sensors, the D1 calibration must be performed on air and the D2 calibration must be performed on water.

For D3 density calibration, the D3 fluid must meet the following requirements:

- Minimum density of 0.6 g/cm^3
- Minimum difference of 0.1 g/cm^3 between the density of the D3 fluid and the density of water. The density of the D3 fluid may be either greater or less than the density of water.

For D4 density calibration, the D4 fluid must meet the following requirements:

- Minimum density of 0.6 g/cm^3
- Minimum difference of 0.1 g/cm^3 between the density of the D4 fluid and the density of the D3 fluid. The density of the D4 fluid must be greater than the density of the D3 fluid.
- Minimum difference of 0.1 g/cm^3 between the density of the D4 fluid and the density of water. The density of the D4 fluid may be either greater or less than the density of water.

10.5.2 Density calibration procedures

To perform a D1 and D2 density calibration:

- With ProLink II, see Figure 10-4.
- With a Communicator, see Figure 10-5.

To perform a D3 density calibration or a D3 and D4 density calibration:

- With ProLink II, see Figure 10-6.
- With a Communicator, see Figure 10-7.

Figure 10-4 D1 and D2 density calibration – ProLink II

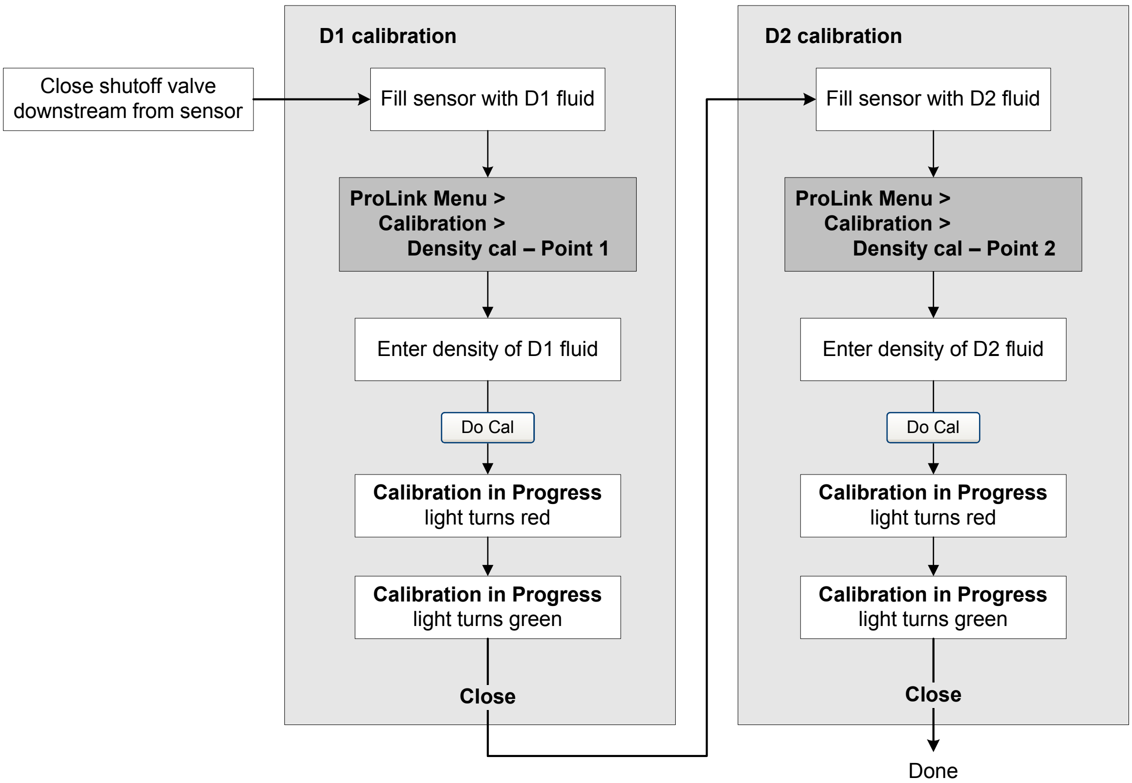


Figure 10-5 **D1 and D2 density calibration – Communicator**

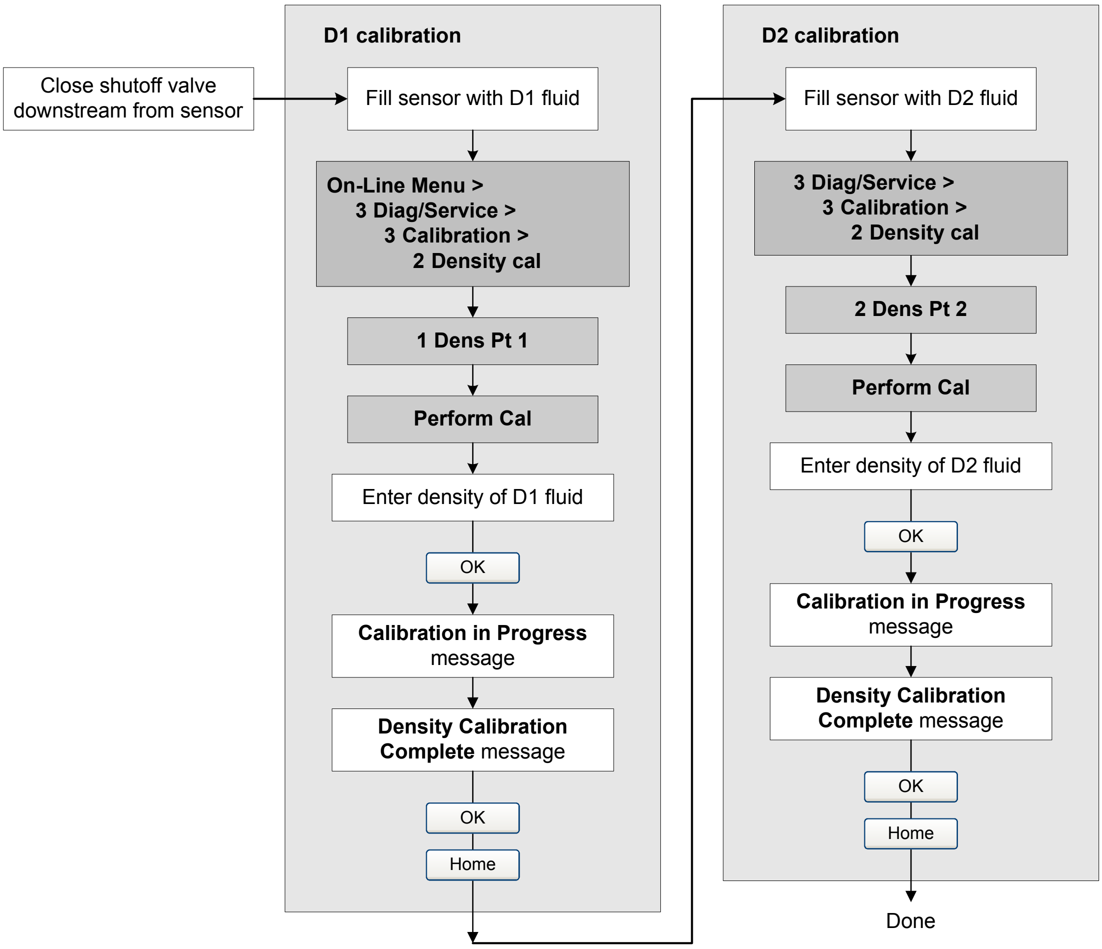


Figure 10-6 **D3 or D3 and D4 density calibration – ProLink II**

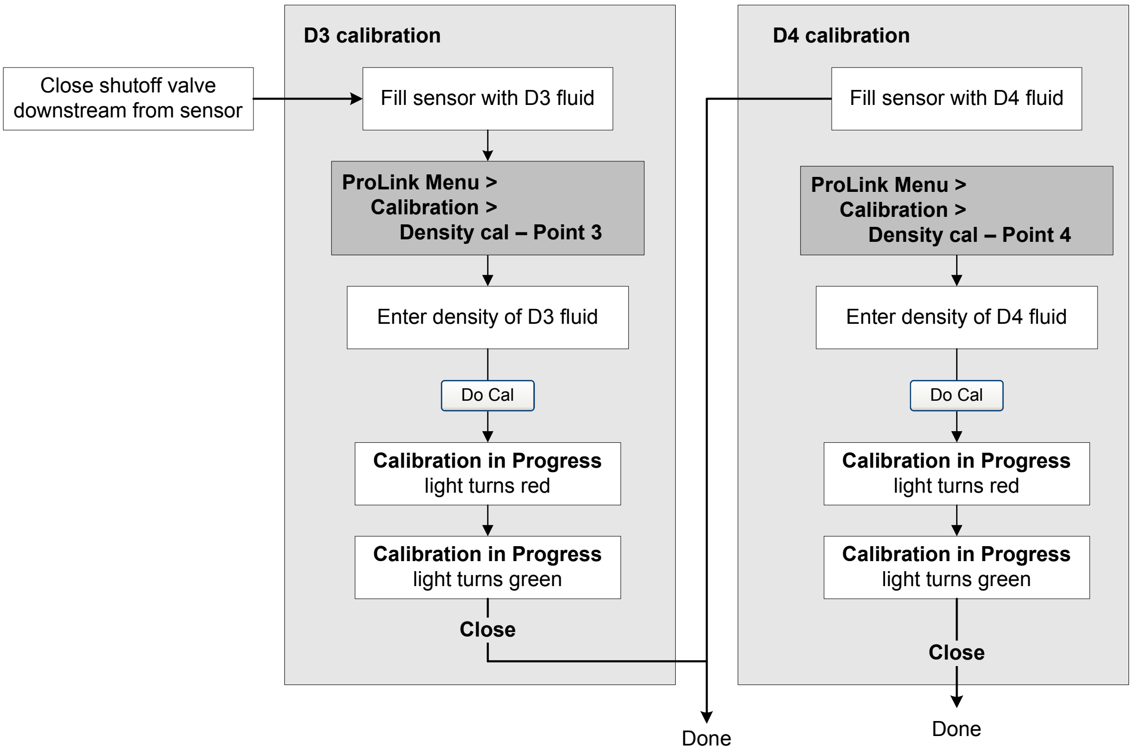
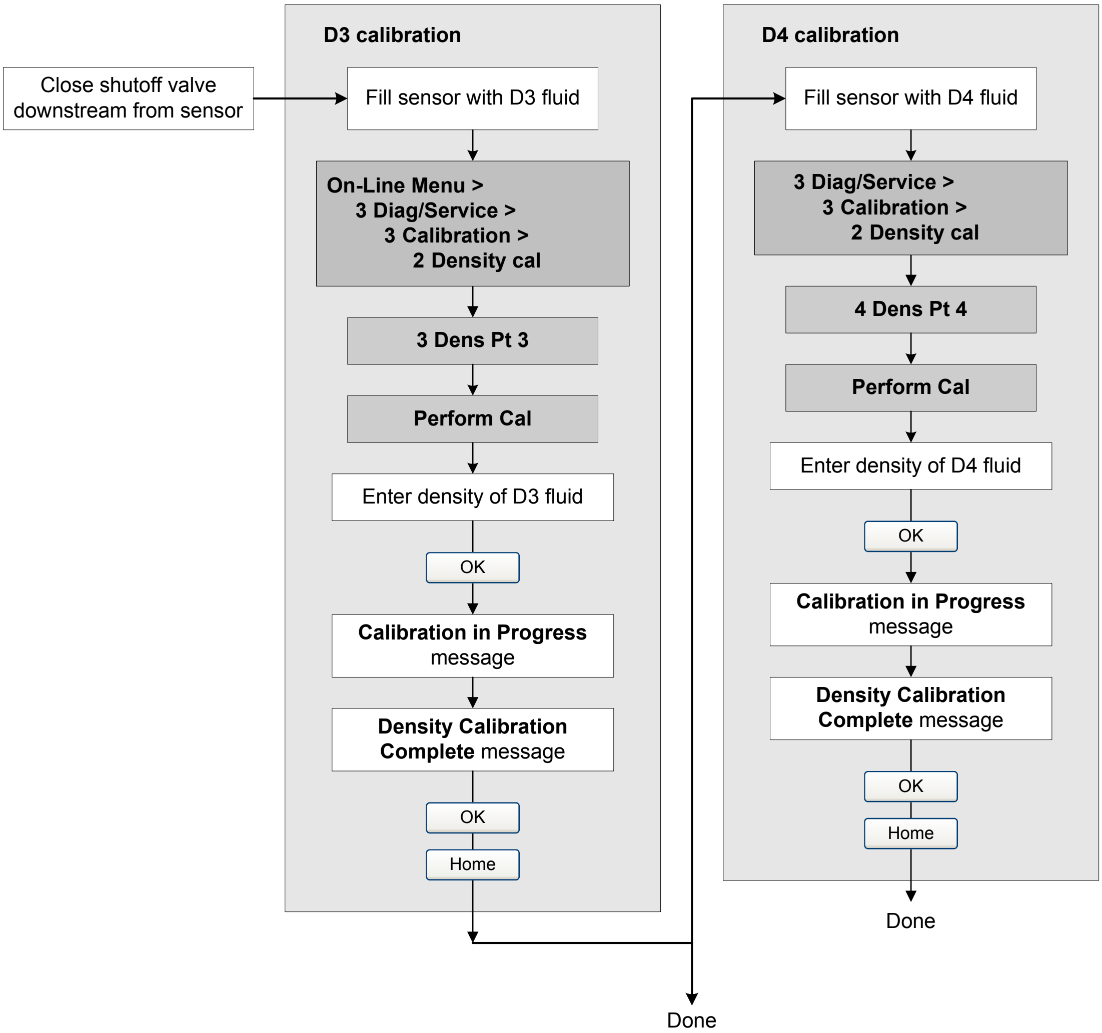


Figure 10-7 D3 or D3 and D4 density calibration – Communicator

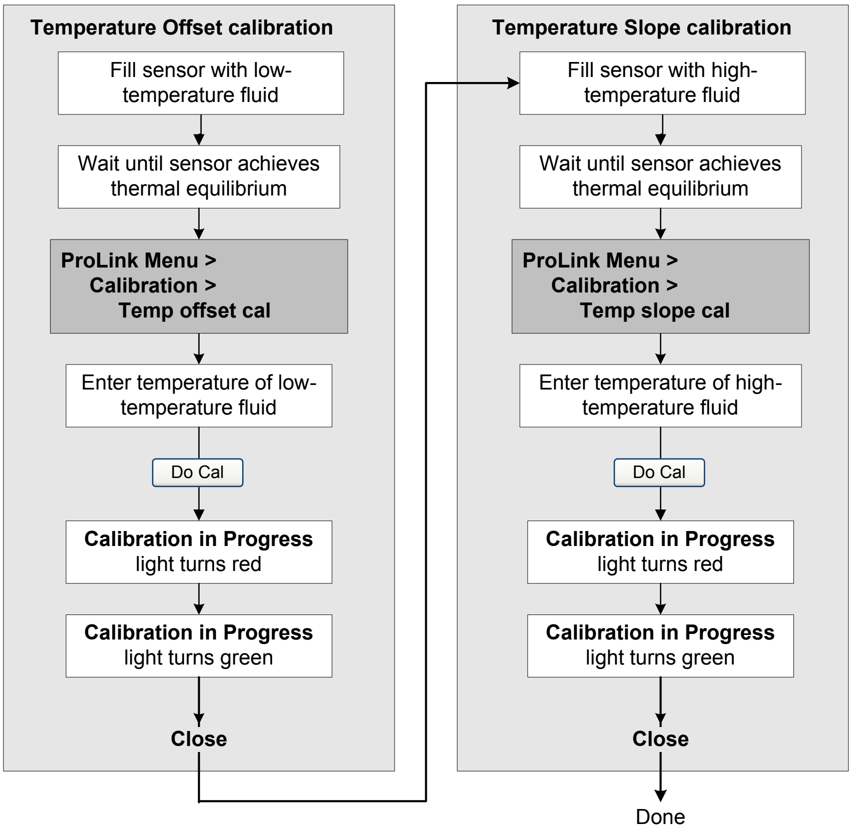


10.6 Performing temperature calibration

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

You can calibrate for temperature with ProLink II. See Figure 10-8.

Figure 10-8 **Temperature calibration – ProLink II**



Chapter 11
Custody Transfer

11.1 Overview

The following transmitters can be ordered with a custody transfer configuration:

- Model 2700 AN
- Model 2700 CIO
- Model 2500 CIO

A transmitter is appovable for custody transfer if it matches the following model code pattern:

2700(R, C, or B)(A, B, or C)****W***
or
2500******W***

See Section 1.3.1 for information about how to interpret transmitter model codes.

Notes: The 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 applicable safety requirements. See Chapter 3 for more information.

For transmitters with software versions lower than 5.0, the transmitter behavior and options may be different than what is described in this chapter. See Section 1.3.2 for information on determining your transmitter's software version.

11.2 Locale-specific commissioning

When commissioning a weights and measures-approved custody transfer transmitter, local laws and guidelines must be followed. Contact the weights and measures authority in your country for information on how a custody transfer transmitter must be commissioned.

11.3 Configuring the weights and measures approval agency

The transmitter must be configured for either National Type Evaluation Program (NTEP) compliance, which is customary for the United States, or Organization of Legal Metrology (OIML) compliance, which is customary for most other world areas. By default, the transmitter is configured for OIML compliance.

The weights and measures agency can be configured in ProLink II. Choose **ProLink > Configuration**, click the **System** tab, and choose an area from the **Approval** list in the **Weights and Measures** box.

11.4 Special restrictions when using custody transfer transmitters

Some of the transmitter's functionality is restricted when it is ordered with a custody transfer configuration. These restrictions include:

- Restricted I/O – The inputs/outputs of your transmitter may be disabled or their use may be restricted. Therefore, certain functionality described in this manual may not be available. The behavior of the transmitter's outputs differs depending on whether the transmitter is in secure mode or security breach mode (see Sections 11.6 and 11.7).
- Locking clamps – The Model 2700 transmitter can be ordered with locking clamps (see Figure 11-1) so that a weights and measures authority can mechanically seal the housing against unauthorized access. If your transmitter is equipped with locking clamps, you may not be able to open the housing.

Figure 11-1 Model 2700 transmitter with locking clamp

- Alarm password – Transmitters configured for OIML compliance may require a password when accessing the alarm menu on the display. Compliance with PTB type approval under German law for custody transfer of gas requires the alarm menu password to be enabled.

11.5 Switching between security breach and secure mode

Secure mode is enabled and disabled with ProLink II software. To switch between secure and security breach modes, choose **Plugins > Enable/Disable Custody Transfer**. In addition, a hardware seal may be used by a weights and measures authority.

Note: If this option is not available in ProLink II, it means the transmitter was ordered without the custody transfer configuration.

11.6 Security breach mode

The transmitter leaves the factory with an active alarm (code A027). This alarm indicates a security breach. In other words, the transmitter is not yet secure for custody transfer. This allows the operator or a weights and measures authority to perform essential transmitter configuration before "locking" the transmitter into secure mode.

If the transmitter has a status LED, the LED will flash red when the transmitter is first started, indicating that the transmitter is in security breach mode. After the alarm is acknowledged, the status LED will be solid red, and will remain solid red until the transmitter is secured.

Note: If the LED blinking option is disabled, the status LED will not flash to indicate security breach mode.

In security breach mode, it is possible to perform a number of actions, including zeroing, loop test, output trim, resetting totalizers (not inventories), and basic configuration. These functions (except resetting totalizers) will become unavailable after the transmitter has been secured.

Note: It is not possible to perform a loop test of the frequency output with an NTEP-compliant transmitter, even when in security breach mode.

11.6.1 Transmitter outputs in security breach mode

While in security breach mode, the following conditions apply to the transmitter's outputs:

- The totalizers (including the totalizer on the local display, if present) will not increment or decrement.
- If OIML compliance was selected, the security breach is handled like a fault alarm. Outputs and digital communications are set to their configured fault levels.
- If NTEP compliance was selected:
  - The frequency output is inactive (no pulses are emitted, even during fault conditions).
  - The flow rate is set to zero. Other changes may occur as a consequence of zero flow.

In addition to the LED, these special output functions help identify a transmitter that is not yet secure, and prevent a non-secure transmitter from being used effectively in a custody transfer application.

11.6.2 Configuring the totalizers in security breach mode

While in security breach mode, you can configure how totalizers can be reset. Transmitters can have their totalizers reset from the local display, via digital communication, both of these, or neither of these (i.e., no totalizer resetting).

To configure totalizer resetting in ProLink II, choose **ProLink > Configuration**, click the **System** tab, and select a totalizer resetting scheme from the **Totalizer Reset Options** list.

11.7 Secure mode

When a custody transfer transmitter is ready to be put into service, it must be placed into "secure" mode. A hardware signature is imprinted in the transmitter to prevent unauthorized changes, and many of the configuration features of the transmitter are disabled. The status LED will turn green (in the absence of any other fault condition) to indicate that the security breach alarm has been cleared. At this time, a weights and measures authority may mechanically seal the housing against access using the locking clamps.

The hardware signature "marries" the core processor to the transmitter. Attempting to replace the core processor will cause a Sensor/Xmtr Communication Error alarm (A026). Any change in the core processor's configuration will trigger a security breach alarm (A027). These alarms will persist until the transmitter is placed into security breach mode and then back into secure mode.

11.7.1 Transmitter outputs in secure mode

The following outputs are approved in secure mode:

- Frequency output for the transmission of volume or mass information, and for fault indication (available only on Models 2700 CIO and 2500 CIO)
- RS-485 output for connection to a host approved by the local weights and measures authority (available only on Models 2700 AN and 2500 CIO, and only with NTEP)
- 4–20 mA output for the transmission of density information. This output can support the reading of pressure information when using HART Bell 202.
- Local display (if the transmitter has a display) can indicate totals, inventories, mass flow, volume flow, and density.

11.7.2 Operating the totalizers in secure mode

The following characteristics apply to totalizers while the transmitter is in secure mode:

- It is possible to reset the mass and volume flow totalizers when in secure mode, but this is possible only when the flow rate is zero. The inventories cannot be reset. Resetting any one total will reset all the totals.
- The methods available for resetting the totalizers are configured while in security breach mode (see Section 11.6.2). The resetting methods cannot be changed while in secure mode.
- The totalizers cannot be stopped when the transmitter is in secure mode.

11.7.3 Displaying totalizer and inventory values

If NTEP compliance is selected, the display handles both totalizer and inventory values in the usual manner.

If OIML compliance is selected, the display handles inventory values in the usual manner, but applies special handling to the presentation of large totalizer values:

- The decimal point position is fixed to the precision configured for the corresponding display variable (see Section 8.15.1).

Note: The display does not allow the comma character, so the period character is always used to represent the decimal point.

- When the maximum value for the configured display precision is reached, all the digits roll over from 9 to 0, but the decimal point does not move and the number of digits on the display does not increase. For example, the value **99999.999** rolls over to **00000.000**.
- When the value on the display rolls over, the internal totalizer value is also reset to 0.
- The mass and volume totalizers will not necessarily roll over together.

Chapter 12
Troubleshooting

12.1 Overview

This chapter describes guidelines and procedures for troubleshooting the meter. 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 Chapter 3 for more information.

⚠ WARNING

Using the service port to communicate with the transmitter in a hazardous area can cause an explosion.

Before using the service port to communicate with the transmitter in a hazardous area, make sure the atmosphere is free of explosive gases.

Note: All Communicator key sequences in this section assume that you are starting from the "Online" menu. See Chapter 4 for more information.

12.2 Guide to troubleshooting topics

Refer to Table 12-1 for a list of troubleshooting topics discussed in this chapter.

Table 12-1 Troubleshooting topics and locations

Section	Topic
Section 12.4	*Transmitter does not operate*
Section 12.5	*Transmitter does not communicate*
Section 12.6	*Zero or calibration failure*
Section 12.7	*Fault conditions*
Section 12.8	*HART output problems*
Section 12.9	*I/O problems*
Section 12.10	*Simulation mode*

Table 12-1 Troubleshooting topics and locations *continued*

Section	Topic
Section 12.11	*Transmitter status LED*
Section 12.12	*Status alarms*
Section 12.13	*Checking process variables*
Section 12.14	*Diagnosing wiring problems*
Section 12.14.1	*Checking the power supply wiring*
Section 12.14.2	*Checking the sensor-to-transmitter wiring*
Section 12.14.3	*Checking for RF interference*
Section 12.14.4	*Checking for RF interference*
Section 12.14.5	*Checking the HART communication loop*
Section 12.15	*Checking the communication device*
Section 12.16	*Checking the output wiring and receiving device*
Section 12.17	*Checking slug flow*
Section 12.18	*Checking output saturation*
Section 12.19	*Setting the Loop Current Mode parameter*
Section 12.20	*Checking the flow measurement unit*
Section 12.21	*Checking the upper and lower range values*
Section 12.22	*Checking the frequency output scale and method*
Section 12.23	*Checking the characterization*
Section 12.24	*Checking the calibration*
Section 12.25	*Checking the test points*
Section 12.26	*Checking the core processor*
Section 12.27	*Checking sensor coils and RTD*

12.3 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.

12.4 Transmitter does not operate

If the transmitter does not operate at all (i.e., the transmitter is not receiving power and cannot communicate over the HART network, or the status LED is not lit), perform all of the procedures in Section 12.14.

If the procedures do not indicate a problem with the electrical connections, contact the Micro Motion Customer Service Department. See Section 12.3.

12.5 Transmitter does not communicate

If the transmitter does not appear to be communicating on the HART network, the network wiring may be faulty. Perform the procedures in Section 12.14.5.

12.6 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 12.12 for specific remedies for status alarms indicating calibration failure.

12.7 Fault conditions

If the analog or digital outputs indicate a fault condition (by transmitting a fault indicator), determine the exact nature of the fault by checking the status alarms with a Communicator or ProLink II software, or the display if available on your transmitter. Once you have identified the status alarm(s) associated with the fault condition, refer to Section 12.12.

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

(Model 1700/2700 transmitters only) After cycling power, an A107 alarm will be reported and the status LED will be flashing. This indicates that a power reset has occurred, and is normal. Acknowledge the alarm as described in Section 7.6.

12.8 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 you discover that the configuration is incorrect, change the necessary transmitter settings. See Chapter 6 and Chapter 8 for the procedures to change the appropriate 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 12.3.

12.9 I/O problems

If you are experiencing problems with the mA, frequency, or discrete outputs, or the discrete input, use Table 12-2 to identify an appropriate remedy.

Table 12-2 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 12.14.1.
	Fault condition present if fault indicators are set to downscale or internal zero	Check the fault indicator settings to verify whether or not the transmitter is in a fault condition. See Section 6.5.4 to check the mA fault indicator, or Section 6.6.6 to check the frequency fault indicator. If a fault condition is present, see Section 12.7.
	Channel not configured for desired output (CIO transmitters, Channel B or C only)	Verify channel configuration for associated output terminals.

Table 12-2 I/O problems and remedies *continued*

Symptom	Possible cause	Possible remedy
mA output < 4 mA	Process condition below LRV	Verify process. Change the LRV. See Section 6.5.2.
	Fault condition if fault indicator is set to internal zero	Check the fault indicator settings to verify whether or not the transmitter is in a fault condition. See Section 6.5.4. If a fault condition is present, see Section 12.7.
	Open in wiring	Verify all connections.
	Bad mA receiving device	Check the mA receiving device or try another mA receiving device. See Section 12.16.
	Channel not configured for mA operation (CIO transmitters only)	Verify channel configuration.
	Bad output circuit	Measure DC voltage across output to verify that output is active.
	Output not powered (IS transmitters only)	Check transmitter wiring. See the installation manual for your transmitter.
No frequency output	Process condition below cutoff	Verify process. Change the cutoff. See Section 8.7.
	Fault condition if fault indicator is set to downscale or internal zero	Check the fault indicator settings to verify whether or not the transmitter is in a fault condition. See Section 6.6.6. If a fault condition is present, see Section 12.7.
	Slug flow	See Section 12.17.
	Flow in reverse direction from configured flow direction parameter	Verify process. Check flow direction parameter. See Section 8.10. Verify sensor orientation. Ensure that flow direction arrow on sensor case matches process flow.
	Bad frequency receiving device	Check the frequency receiving device or try another frequency receiving device. See Section 12.16.
	Incorrect terminal configuration	FO can be configured on different terminals. Verify configuration.
	Output level not compatible with receiving device	See your transmitter installation manual. Verify that the output level and the required receiving input level are compatible.
	Bad output circuit	Perform loop test. See Section 5.3.
	Incorrect internal/external power configuration	Internal means that the transmitter will supply power. External means that an external pull-up resistor and source are required. Refer to your transmitter installation manual for wiring. Verify configuration is correct for desired application (see Chapter 6).
	Incorrect pulse width configuration	Verify pulse width setting. See Section 6.6.3.
	Output not powered (IS transmitters only)	Check transmitter wiring. See the installation manual for your transmitter.

Table 12-2 I/O problems and remedies *continued*

Symptom	Possible cause	Possible remedy
Constant mA output	Non-zero HART address (multi-drop communications) (primary mA output only)	Set HART address to zero. See Section 12.19.
	Output is fixed in a test mode	Exit output from test mode. See Section 5.3.
	Burst mode enabled (primary mA output only)	Disable burst mode. See Section 8.15.8.
	Zero calibration failure	Cycle power. Stop flow and rezero. See Section 5.5.
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 6.5.4. If a fault condition is present, see Section 12.7.
	LRV and URV not set correctly	Check the LRV and URV. See Section 12.21.
Consistently incorrect mA measurement	Output not trimmed correctly	Trim the output. See Section 5.4.
	Incorrect flow measurement unit configured	Verify flow measurement unit configuration. See Section 12.20.
	Incorrect process variable configured	Verify process variable assigned to mA output. See Section 6.5.1.
	LRV and URV not set correctly	Check the LRV and URV. See Section 12.21.
mA reading correct at low currents but wrong at higher currents	mA loop resistance may be too high	Verify mA output 1 or mA output 2 load resistance is below maximum supported load (see installation manual for your transmitter).
Consistently incorrect frequency measurement	Output not scaled correctly	Check frequency output scale and method. See Section 12.22. Verify voltage and resistance match the frequency output load resistance value chart (see your transmitter installation manual).
	Incorrect flow measurement unit configured	Verify flow measurement unit configuration. See Section 12.20.
Erratic frequency measurement	RF (radio frequency) interference from environment	See Section 12.14.4.
Cannot zero with Zero button (Model 1500/2500 transmitters only)	Not pressing Zero button for sufficient interval	Button must be depressed for 0.5 seconds to be recognized. Depress button until LED starts to flash yellow, then release button.
	Core processor in fault mode	Correct core processor faults and retry.
Cannot connect to terminals 33 & 34 in service port mode (Model 1500/2500 transmitters only)	Terminals not in service port mode	Terminals are accessible in service port mode ONLY for a 10-second interval after power-up. Cycle power and connect during this interval.
	Leads reversed	Switch leads and try again.
	Transmitter installed on multidrop network	All Model 2500 devices on network default to address=111 during 10-second service port interval. Disconnect or power down other devices, or use RS-485 communications.
Cannot establish Modbus communication on terminals 33 & 34 (Model 1500/2500 transmitters only)	Incorrect Modbus configuration	After 10-second interval on power-up, the transmitter switches to Modbus communications. Default settings are: • Address=1 • Baud rate=9600 • Parity=odd Verify configuration. Default settings can be changed using ProLink II v2.0 or higher.
	Leads reversed	Switch leads and try again.

Table 12-2 I/O problems and remedies *continued*

Symptom	Possible cause	Possible remedy
FO phase on Channel C does not change with flow direction (Config IO transmitters only)	Wrong configuration setting	FO mode must be set to Quadrature for phase to automatically track flow direction.
DI is fixed and does not respond to input switch (Config IO transmitters only)	Possible internal/external power configuration error	Internal means that the Configurable I/O will supply power. External means that an external pull-up resistor and source are required. Verify configuration setting is correct for desired application.
Cannot configure Channel B for DO1 operation (Config IO transmitters only)	Channel C is configured as FO	FO and DO1 use the same circuitry and cannot run simultaneously. Configure Channel B as FO and Channel C as DO2.
Cannot configure Channel C for FO operation (Config IO transmitters only)	Channel B is configured as DO1	FO and DO1 use the same circuitry and cannot run simultaneously. Configure Channel B as FO and Channel C as DO2.

12.10 Simulation mode

Simulation allows you to set the outputs to simulate process data for mass flow, temperature, and density. Simulation mode has several uses:

- It can help determine if a problem is located in the transmitter or elsewhere in the system. 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, you can determine the point at which the noise is introduced.
- It can be used to analyze system response or to tune the loop.

If simulation mode is active, the simulated values are used instead of process data from the sensor. Therefore, simulation will affect, for example:

- All mass flow, temperature, or density values shown on the display or reported via outputs or digital communications
- The mass total and mass inventory values
- All volume calculations and data, including reported values, volume totals, and volume inventories

Accordingly, do not enable simulation when your process cannot tolerate these effects, and be sure to disable simulation when you have finished testing.

Note: Simulation mode requires the enhanced core processor.

Simulation mode is available via ProLink II and the Communicator. To set up simulation, follow the steps below:

1. Enable simulation mode.
2. 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.
3. Repeat Step 2 for temperature and density.

To use simulation mode for problem location, enable simulation mode and check the signal at various points between the transmitter and the receiving device.

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

12.11 Transmitter status LED

12.11.1 Model 1500/2500 transmitters

The Model 1500/2500 transmitter includes a LED that indicates transmitter status. See Table 12-3.

If the status LED indicates an alarm condition:

1. View the alarm code using ProLink II or a Communicator.
2. Identify the alarm (see Section 12.12).
3. Correct the condition.

Table 12-3 Model 1500/2500 transmitter status reported by the status LED

Status LED state	Alarm priority	Definition
Green	No alarm	Normal operating mode
Flashing yellow	No alarm	Zero in progress
Yellow	Low severity alarm	• Alarm condition: will not cause measurement error • Outputs continue to report process data
Red	High severity alarm	• Alarm condition: will cause measurement error • Outputs go to configured fault indicators

12.11.2 Model 1700/2700 transmitters with displays

The display on the Model 1700/2700 transmitter includes a LED that indicates transmitter status. See Table 12-4.

If the status LED indicates an alarm condition:

1. View the alarm code using the procedures described in Section 7.5.
2. Identify the alarm (see Section 12.12).
3. Correct the condition.
4. If required, acknowledge the alarm using the procedures described in Section 7.6.

Table 12-4 Model 1700/2700 transmitter status reported by the status LED

Status LED state	Alarm priority
Green	No alarm – normal operating mode
Flashing green(1)	Unacknowledged corrected condition
Yellow	Acknowledged low severity alarm
Flashing yellow(1)	Unacknowledged low severity alarm
Red	Acknowledged high severity alarm
Flashing red(1)	Unacknowledged high severity alarm

(1) If the LED blinking option has been turned off, the LED will not flash to indicate unacknowledged alarms. See Section 8.14 for information about configuring the display.

12.12 Status alarms

Status alarm codes are reported on the display (for transmitters that have displays), and status alarms can be viewed with ProLink II or the Communicator.

A list of status alarms and possible remedies is provided in Table 12-5.

Table 12-5 Status alarms and remedies

Alarm code	Communicator	ProLink II software	Possible remedy
A001	EEPROM Checksum (Core Processor)	(E)EEPROM Checksum Error (CP)	Cycle power to the meter.
			The meter might need service. Contact Micro Motion. See Section 12.3.
A002	RAM Error (Core Processor)	RAM Error (CP)	Cycle power to the meter.
			The meter might need service. Contact Micro Motion. See Section 12.3.
A003	Sensor Not Responding (No Tube Interrupt)	Sensor Failure	Check the test points. See Section 12.25.
			Check the sensor coils. See Section 12.27.
			Check wiring to sensor. See Section 12.14.2.
			Check for slug flow. See Section 12.17.
			Check sensor tubes.
A004	Temperature Sensor Out-of-Range	Temperature Sensor Failure	Check the test points. See Section 12.25.
			Check the sensor RTD reading(s). See Section 12.27.
			Check wiring to sensor. See Section 12.14.2.
			Verify meter characterization. See Section 6.2.
			Verify that process temperature is within range of sensor and transmitter.
			Contact Micro Motion. See Section 12.3.
A005	Input Over-Range	Input Overrange	Check the test points. See Section 12.25.
			Check the sensor coils. See Section 12.27.
			Verify process.
			Make sure that the appropriate measurement unit is configured. See Section 12.20.
			Verify 4 mA and 20 mA values. See Section 12.21.
			Verify calibration factors in transmitter configuration. See Section 6.2.
			Re-zero the transmitter.
A006	Transmitter Not Characterized	Not Configured	Check the characterization. Specifically, verify the FCF and K1 values. See Section 6.2.
			If the problem persists, contact Micro Motion. See Section 12.3.

Table 12-5 Status alarms and remedies *continued*

Alarm code	Communicator	ProLink II software	Possible remedy
A008	Density outside limits	Density Overrange	Check the test points. See Section 12.25.
			Check the sensor coils. See Section 12.27.
			Verify process. Check for air in the flow tubes, tubes not filled, foreign material in tubes, or coating in tubes.
			Verify calibration factors in transmitter configuration. See Section 6.2.
			Perform density calibration. See Section 10.5.
A009	Transmitter Initializing/Warming Up	Transmitter Initializing/Warming Up	Allow the meter to warm up. The error should disappear once the meter is ready for normal operation. If alarm does not clear, make sure that the sensor is completely full or completely empty. Verify sensor configuration and wiring to sensor.
A010	Calibration Failure	Calibration Failure	If alarm appears during a transmitter zero, ensure that there is no flow through the sensor, then retry.
			Cycle power to the meter, then retry.
A011	Excess calibration correction, zero too low	Zero too Low	Ensure that there is no flow through the sensor, then retry.
			Cycle power to the meter, then retry.
A012	Excess calibration correction, zero too high	Zero too High	Ensure that there is no flow through the sensor, then retry.
			Cycle power to the meter, then retry.
A013	Process too noisy to perform auto zero	Zero too Noisy	Remove or reduce sources of electromechanical noise, then attempt the calibration or zero procedure again. Sources of noise include: • Mechanical pumps • Pipe stress at sensor • Electrical interference • Vibration effects from nearby machinery
			Cycle power to the meter, then retry. See Section 12.24.
A014	Transmitter Failed	Transmitter Failed	Cycle power to the meter.
			The transmitter might need service. Contact Micro Motion. See Section 12.3.
A016	Line RTD Overrange	Line Temp Out-of-range	Check the test points. See Section 12.25.
			Check the sensor coils. See Section 12.27.
			Check wiring to sensor. See Section 12.14.2.
			Make sure the appropriate sensor type is configured. See Section 6.2.
			Contact Micro Motion. See Section 12.3.
A017	Meter RTD Temperature Out-Of-Range	Meter RTD Temperature Out-Of-Range	Check the test points. See Section 12.25.
			Check the sensor coils. See Section 12.27.
			Contact Micro Motion. See Section 12.3.
A018	EEPROM Checksum Error	(E)EPROM Checksum Error	Cycle power to the meter.
			The transmitter might need service. Contact Micro Motion. See Section 12.3.

Table 12-5 Status alarms and remedies *continued*

Alarm code	Communicator	ProLink II software	Possible remedy
A019	RAM Test Error	RAM or ROM TEST ERROR	Cycle power to the meter.
			The transmitter might need service. Contact Micro Motion. See Section 12.3.
A020	Calibration Factors Unentered	Cal Factor Unentered	Check the characterization. Specifically, verify the FCF value. See Section 6.2.
A021	Unrecognized/ Unentered Sensor Type	Incorrect Sensor Type (K1)	Check the characterization. Specifically, verify the K1 value. See Section 6.2.
A022(1)	(E)EPROM Config. DB Corrupt (Core Processor)	(E)EPROM Config. CB Corrupt (CP)	Cycle power to the meter.
			The transmitter might need service. Contact Micro Motion. See Section 12.3.
A023(1)	E)EPROM Totals Corrupt (Core Processor)	(E)EPROM Powerdown Totals Corrupt (CP)	Cycle power to the meter.
			The transmitter might need service. Contact Micro Motion. See Section 12.3.
A024(1)	(E)EPROM Program Corrupt (Core Processor)	(E)EPROM Program Corrupt (CP)	Cycle power to the meter.
			The transmitter might need service. Contact Micro Motion. See Section 12.3.
A025(1)	Protected Boot Sector Fault (CP)	Protected Boot Sector Fault (CP)	Cycle power to the meter.
			The transmitter might need service. Contact Micro Motion. See Section 12.3.
A026	Sensor/Xmtr Communication Error	Sensor/Transmitter Comm Failure	If the transmitter has the custody transfer application installed, the core processor may have been disconnected or replaced. See Section 11.7.
			Check the wiring between the transmitter and the core processor (see Section 12.14.2). The wires may be swapped. After swapping wires, cycle power to the meter.
			Check for noise in wiring or transmitter environment.
			Check the core processor LED. See Section 12.26.
			Check that the core processor is receiving power. See Section 12.14.1.
			Perform the core processor resistance test. See Section 12.26.2.
A027	Security Breach	Security Breach	Weights and Measures security seal has been broken. Alarm can be cleared by user, but authorized procedure is required to reestablish security. See Chapter 11.
A028	Sensor/Xmtr Communication Failure	Core Processor Write Failure	Cycle power to the meter.
			The transmitter might need service or upgrading. Contact Micro Motion. See Section 12.3.
A031(2)	Undefined	Low Power	The core processor is not receiving enough power. Check the power supply to the transmitter, and check power wiring between the transmitter and the core processor (4-wire remote installations only).
A032(2)	Meter Verification Fault Alarm	Meter Verification/Outputs In Fault	Meter verification in progress, with outputs set to fault. Allow the procedure to complete. If desired, abort the procedure and restart with outputs set to last measured value.

Table 12-5 Status alarms and remedies *continued*

Alarm code	Communicator	ProLink II software	Possible remedy
A033[(2)]	Sensor OK / Tubes Stopped by Process	Sensor OK / Tubes Stopped by Process	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	See Section 12.18.
A101	Primary mA Output Fixed	Primary mA Output Fixed	Check the HART polling address. See Section 12.19.
			Exit mA output trim. See Section 5.4.
			Exit mA output loop test. See Section 5.3.
			Check to see if the output has been fixed via digital communication.
A102	Drive Over-Range / Partially Full Tube	Drive Overrange	Excessive drive gain. See Section 12.25.3.
			Check the sensor coils. See Section 12.27.
A103	Data Loss Possible	Data Loss Possible (Tot and Inv)	Cycle power to the meter.
			View the entire current configuration to determine what data were lost. Configure any settings with missing or incorrect data.
			The transmitter might need service. Contact Micro Motion. See Section 12.3.
A104	Calibration-In-Progress	Calibration in Progress	Allow the meter to complete calibration.
A105	Slug Flow	Slug Flow	See Section 12.17.
A106	Burst Mode Enabled	Burst Mode Enabled	No action required.
A107	Power Reset Occurred	Power Reset Occurred	No action required.
A108[(3)]	Event #1 Triggered	Event 1 Triggered	Be advised of alarm condition.
			If you believe the event has been triggered erroneously, verify the Event 1 settings. See Section 8.11.
A109[(3)]	Event #2 Triggered	Event 2 Triggered	Be advised of alarm condition.
			If you believe the event has been triggered erroneously, verify the Event 2 settings. See Section 8.11.
A110	Frequency Output Saturated	Frequency Output Saturated	See Section 12.18.
A111	Frequency Output Fixed	Frequency Output Fixed	Exit frequency output loop test.
A112[(4)]	Software upgrade recommended	S/W Upgrade Recommended	Contact Micro Motion to get a Series 1000/2000 transmitter software upgrade. See Section 12.3. Note that the device is still functional.
A113	Secondary mA Output Saturated	Secondary mA Output Saturated	See Section 12.18.
A114	Secondary mA Output Fixed	Secondary mA Output Fixed	Exit mA output loop test. See Section 5.3.
			Exit mA output trim. See Section 5.4.
			Check to see if the output has been fixed via digital communication.

Table 12-5 Status alarms and remedies *continued*

Alarm code	Communicator	ProLink II software	Possible remedy
A115	External Input Error	External Input Error	HART polling connection to external device has failed. Ensure that external device is available: • Verify device operation. • Verify wiring.
			Verify polling configuration. See Section 9.4.
A116	API Temperature Out-of-Limits	API: Temperature Outside Standard Range	Verify process.
			Verify API reference table and temperature configuration. See Section 8.6.
A117	API Density Out-of-Limits	API: Density Outside Standard Range	Verify process.
			Verify API reference table and density configuration. See Section 8.6.
A118	Discrete Output 1 Fixed	Discrete Output 1 Fixed	Exit discrete output loop test. See Section 5.3.
A119	Discrete Output 2 Fixed	Discrete Output 2 Fixed	Exit discrete output loop test. See Section 5.3.
A120	ED: Unable to Fit Curve Data	ED: Unable to Fit Curve Data	Verify enhanced density configuration.
A121	ED: Extrapolation Alarm	ED: Extrapolation Alarm	Verify process temperature.
			Verify process density.
			Verify enhanced density configuration.
A131(2)	Meter Verification Info Alarm	Meter Verification/Outputs at Last Value	Meter verification in progress, with outputs set to last measured value. Allow the procedure to complete. If desired, abort the procedure and restart with outputs set to fault.
A132(2)	Simulation Mode Active	Simulation Mode Active	Disable simulation mode. See Section 12.10.
NA	Density FD cal in progress	NA	Be advised that density calibration is in progress.
NA	Density 1st point cal in progress	NA	Be advised that density calibration is in progress.
NA	Density 2nd point cal in progress	NA	Be advised that density calibration is in progress.
NA	Density 3rd point cal in progress	NA	Be advised that density calibration is in progress.
NA	Density 4th point cal in progress	NA	Be advised that density calibration is in progress.
NA	Mech. zero cal in progress	NA	Be advised that zero calibration is in progress.
NA	Flow is in reverse direction	NA	Be advised that the process is flowing in reverse direction.

(1) Applies only to systems with the standard core processor.
(2) Applies only to systems with the enhanced core processor.
(3) Applies only to events configured using the single-setpoint event model (see Section 8.11.1).
(4) Applies only to systems with transmitter software earlier than rev5.0.

12.13 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. Record the following process variables:

- 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 the Micro Motion Customer Service Department for assistance. See Section 12.3.

Unusual values for process variables may indicate a variety of different problems. Table 12-6 lists several possible problems and remedies.

Table 12-6 Process variables problems and possible remedies

Symptom	Cause	Possible 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 meter. See Section 5.5.
	Bad flow calibration factor	Verify characterization. See Section 6.2.

Table 12-6 Process variables problems and possible remedies *continued*

Symptom	Cause	Possible remedy
Erratic non-zero flow rate under no-flow conditions	RF interference	Check environment for RF interference. See Section 12.14.4.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact.
	Incorrectly grounded 9-wire cable (in 9-wire remote installations and remote core processor with remote transmitter installations)	Verify 9-wire cable installation. Refer to Appendix B for diagrams, and see the installation manual for your transmitter.
	Vibration in pipeline at rate close to sensor tube frequency	Check environment and remove source of vibration.
	Improper sensor grounding (T-Series sensors only)	Verify that the sensor is grounded to earth ground.
	Leaking valve or seal	Check pipeline.
	Inappropriate measurement unit	Check configuration. See Section 12.20.
	Inappropriate damping value	Check configuration. See Section 6.5.5 and Section 8.8.
	Slug flow	See Section 12.17.
	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes or replace the sensor.
	Moisture in sensor junction box	Open junction box and allow it to dry. Do not use contact cleaner. When closing, ensure integrity of gaskets and O-rings, and grease all O-rings.
	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.
	Incorrect sensor orientation	Sensor orientation must be appropriate to process fluid. See the installation manual for your sensor.

Table 12-6 Process variables problems and possible remedies *continued*

Symptom	Cause	Possible remedy
Erratic non-zero flow rate when flow is steady	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.
	Inappropriate measurement unit	Check configuration. See Section 12.20.
	Inappropriate damping value	Check configuration. See Section 6.5.5 and Section 8.8.
	Excessive or erratic drive gain	See Section 12.25.3 and Section 12.25.4.
	Slug flow	See Section 12.17.
	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes or replace the sensor.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact.
Inaccurate flow rate or batch total	Bad flow calibration factor	Verify characterization. See Section 6.2.
	Inappropriate measurement unit	Check configuration. See Section 12.20.
	Bad sensor zero	Rezero the meter. See Section 5.5.
	Bad density calibration factors	Verify characterization. See Section 6.2.
	Bad flowmeter grounding	See Section 12.14.3.
	Slug flow	See Section 12.17.
	Problem with receiving device	See Section 12.16.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact.
Inaccurate density reading	Problem with process fluid	Use standard procedures to check quality of process fluid.
	Bad density calibration factors	Verify characterization. See Section 6.2.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact.
	Bad flowmeter grounding	See Section 12.14.3.
	Slug flow	See Section 12.17.
	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 or replace the sensor.

Table 12-6 Process variables problems and possible remedies *continued*

Symptom	Cause	Possible remedy
Temperature reading significantly different from process temperature	RTD failure	Check for alarm conditions and follow troubleshooting procedure for indicated alarm. Verify “Use external temperature” configuration and disable if appropriate. See Section 9.3.
	Incorrect calibration factor	Verify that the temperature calibration factor is set correctly. See Section 12.24.
Temperature reading slightly different from process temperature	Temperature calibration required	Perform temperature calibration. See Section 10.6.
Unusually high density reading	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes or replace the sensor.
	Incorrect K2 value	Verify characterization. See Section 6.2.
Unusually low density reading	Slug flow	See Section 12.17.
	Incorrect K2 value	Verify characterization. See Section 6.2.
Unusually high tube frequency	Sensor erosion	Contact Micro Motion. See Section 12.3.
Unusually low tube frequency	Plugged flow tube	Purge the flow tubes or replace the sensor.
Unusually low pickoff voltages	Several possible causes	See Section 12.25.5.
Unusually high drive gain	Several possible causes	See Section 12.25.3.

12.14 Diagnosing wiring problems

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

⚠ WARNING

Removing the wiring compartment covers in explosive atmospheres while the power is on can subject the transmitter to environmental conditions that can cause an explosion.

Before removing the wiring compartment cover in explosive atmospheres, be sure to shut off the power and wait five minutes.

12.14.1 Checking the power supply wiring

To check the power supply wiring:

1. Verify that the correct external fuse is used. An incorrect fuse can limit current to the transmitter and keep it from initializing.
2. Power down the transmitter.
3. If the transmitter is in a hazardous area, wait five minutes.
4. Ensure that the power supply wires are connected to the correct terminals. Refer to Appendix B for diagrams.

5. Verify that the power supply wires are making good contact, and are not clamped to the wire insulation.
6. (Model 1700/2700 transmitters only) Inspect the voltage label on the inside of the field-wiring compartment. Verify that the voltage supplied to the transmitter matches the voltage specified on the label.
7. Use a voltmeter to test the voltage at the transmitter's power supply terminals. Verify that it is within the specified limits. For DC power, you may need to size the cable. Refer to Appendix B for diagrams, and see your transmitter installation manual for power supply requirements.

12.14.2 Checking the sensor-to-transmitter wiring

To check the sensor-to-transmitter wiring, verify that:

- The transmitter is connected to the sensor according to the wiring information provided in your transmitter installation manual. Refer to Appendix B for diagrams.
- The wires are making good contact with the terminals.

If the wires are incorrectly connected:

1. Power down the transmitter.
2. If the transmitter is in a hazardous area, wait five minutes.
3. Correct the wiring.
4. Restore power to the transmitter.

12.14.3 Checking grounding

The sensor and the transmitter must be grounded. If the core processor is installed as part of the transmitter or the sensor, it is grounded automatically. If the core processor is installed separately, it must be grounded separately. See your sensor and transmitter installation manuals for grounding requirements and instructions.

12.14.4 Checking for RF interference

If you are experiencing RF (radio frequency) interference on your frequency output or discrete output, use one of the following solutions:

- Eliminate the RF source. Possible causes include a source of radio communications, or a large transformer, pump, motor, or anything else that can generate a strong electrical or electromagnetic field, in the vicinity of the transmitter.
- Move the transmitter.
- Use shielded cable for the frequency output.
  - Terminate output cable shielding at the input device. If this is not possible, terminate the output shielding at the cable gland or conduit fitting.
  - Do not terminate shield inside the wiring compartment.
  - 360° termination of shielding is not necessary.

12.14.5 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. Remove analog loop wiring.
3. Install a 250 Ω resistor across the primary mA output terminals.
4. Check for voltage drop across the resistor (4–20 mA = 1–5 VDC). If voltage drop < 1 VDC, add resistance to achieve voltage drop > 1 VDC.
5. Connect the Communicator directly across the resistor and attempt to communicate (poll).

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

- Contact Micro Motion. See Section 12.3.
- 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.

12.15 Checking the communication device

Ensure that your communication device is compatible with your transmitter.

Communicator

The 275 HART Communicator or 375 Field Communicator is required, and must contain the appropriate device description. Some of the newest functionality (e.g., meter verification) is not yet supported by the Communicator.

Note: For the Model 2500 transmitter, the 275 HART Communicator uses the device description for the Model 2700 transmitter with configurable input/outputs. See Chapter 4 for more information.

Note: The 268 SMART FAMILY Interface is not compatible with Series 1000/2000 transmitters.

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 correct device description for your transmitter is listed. If the correct device description is not found, a Generic Device menu is displayed.
   - Model 1500/2500 transmitters: You must obtain a 375 Field Communicator. Contact Micro Motion customer support.
   - Model 1700/2700 transmitters: The 275 HART Communicator must be upgraded. Contact Micro Motion customer support.

ProLink II

ProLink II v2.0 or later is required. The original version of ProLink is not compatible with Series 1000/2000 transmitters. To access most new functionality (e.g., meter verification), ProLink II v2.5 is required.

If you are using the enhanced core processor and you connect directly to the core processor's RS-485 terminals (see Figure B-4 or Figure B-14) instead of to the transmitter, ProLink II v2.4 or later is required. This connection type is sometimes used for troubleshooting.

To check the version of ProLink II:

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

AMS

Your AMS software must have Device Revisions 1 to 3. Contact Emerson Process Management.

12.16 Checking the output wiring and receiving device

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

- Check the output level at the transmitter.
- Check the wiring between the transmitter and the receiving device.
- Try a different receiving device.

12.17 Checking slug flow

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. Slug flow limits and duration can help the transmitter suppress extreme changes in reading.

Note: Default slug flow limits are 0.0 and 5.0 g/cm^3. Raising the low slug flow limit or lowering the high slug flow limit will increase the possibility of slug flow conditions.

If slug limits have been configured, and slug flow occurs:

- A slug flow alarm is generated.
- All outputs that are configured to represent flow rate hold their last "pre-slug flow" value for the configured slug flow duration.

If the slug flow condition clears before the slug-flow duration expires:

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

If the slug flow condition does not clear before the slug-flow duration expires, outputs that represent flow rate report a flow rate of zero.

If slug time is configured for 0.0 seconds, outputs that represent flow rate will report zero flow as soon as slug flow is detected.

If slug flow occurs:

- Check process for cavitation, flashing, or leaks.
- Change the sensor orientation.
- Monitor density.
- If desired, enter new slug flow limits (see Section 8.12).
- If desired, increase slug duration (see Section 8.12).

12.18 Checking output saturation

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

- The output variable is outside appropriate limits for the process.
- The unit of flow needs to be changed.
- Sensor flow tubes are not filled with process fluid.
- Sensor flow tubes are plugged.

If an output saturation alarm occurs:

- Bring flow rate within sensor limit.
- Check the measurement unit. You may be able to use a smaller or larger unit.
- Check the sensor:
  - Ensure that flow tubes are full.
  - Purge flow tubes.
- For the mA outputs, change the mA URV and LRV (see Section 6.5.2).
- For the frequency output, change the scaling (see Section 6.6).

12.19 Setting the Loop Current Mode parameter

Depending on the setting of the Loop Current Mode parameter, the primary 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.

See Section 8.15.6.

12.20 Checking the flow measurement unit

Using an incorrect flow measurement unit can cause the transmitter to produce unexpected output levels, with unpredictable effects on the process. Make sure that the configured flow measurement unit is correct. Check the abbreviations; for example, *g/min* represents grams per minute, not gallons per minute. See Section 6.4.

12.21 Checking the upper and lower range values

A saturated mA output or incorrect mA measurement could indicate a faulty URV or LRV. Verify that the URV and LRV are correct and change them if necessary. See Section 6.5.2.

12.22 Checking the frequency output scale and method

A saturated frequency output or an incorrect frequency measurement could indicate a faulty frequency output scale and/or method. Verify that the frequency output scale and method are correct and change them if necessary. See Section 6.6.

12.23 Checking the characterization

A transmitter that is incorrectly characterized for its sensor might produce inaccurate output values. If the meter appears to be operating correctly but sends inaccurate output values, an incorrect characterization could be the cause.

If you discover that any of the characterization data are wrong, perform a complete characterization. See Section 6.2.

12.24 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.

The calibration procedures in this manual are designed for calibration to a regulatory standard. See Chapter 10. To calibrate for true accuracy, always use a measurement source that is more accurate than the meter. Contact the Micro Motion Customer Service Department for assistance.

Note: Micro Motion recommends using meter factors, rather than calibration, to prove the meter against a regulatory standard or to correct measurement error. Contact Micro Motion before calibrating your meter. For information on meter performance verification, see Chapter 10.

12.25 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 meter 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.

12.25.1 Obtaining the test points

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

With a Communicator

To obtain the test points with a Communicator:

1. Select **Diag/Service**.
2. Select **Test Points**.
3. Select **Drive**.
   a. Write down the drive gain.
   b. Press **EXIT**.
4. Select **LPO**.
   a. Write down the left pickoff voltage.
   b. Press **EXIT**.
5. Select **RPO**.
   a. Write down the right pickoff voltage.
   b. Press **EXIT**.
6. Select **Tube**.
   a. Write down the tube frequency.
   b. Press **EXIT**.

With ProLink II software

To obtain the test points with ProLink II software:

1. Select **Diagnostic Information** from the **ProLink** menu.
2. Write down the values you find in the **Tube Frequency** box, the **Left Pickoff** box, the **Right Pickoff** box, and the **Drive Gain** box.

12.25.2 Evaluating the test points

Use the following guidelines to evaluate the test points:

- If the drive gain is unstable, refer to Section 12.25.3.
- If the value for the left or right pickoff does not equal the appropriate value from Table 12-7, based on the sensor flow tube frequency, refer to Section 12.25.5.
- If the values for the left and right pickoffs equal the appropriate values from Table 12-7, based on the sensor flow tube frequency, record your troubleshooting data and contact the Micro Motion Customer Service Department for assistance. See Section 12.3.

Table 12-7 Sensor pickoff values

Sensor[1]	Pickoff value
ELITE Model CMF sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model D, DL, and DT sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model F025, F050, F100 sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model F200 sensors (compact case)	2.0 mV peak-to-peak per Hz based on sensor flow tube frequency
Model F200 sensors (standard case)	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model H025, H050, H100 sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model H200 sensors	2.0 mV peak-to-peak per Hz based on sensor flow tube frequency
Model R025, R050, or R100 sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model R200 sensors	2.0 mV peak-to-peak per Hz based on sensor flow tube frequency
Micro Motion T-Series sensors	0.5 mV peak-to-peak per Hz based on sensor flow tube frequency
CMF400 I.S. sensors	2.7 mV peak-to-peak per Hz based on sensor flow tube frequency
CMF400 sensors with booster amplifiers	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency

(1) If your sensor is not listed, contact Micro Motion. See Section 12.3.

12.25.3 Excessive drive gain

See Table 12-8 for a list of possible causes of excessive drive gain.

Table 12-8 Excessive drive gain causes and remedies

Cause	Possible remedy
Excessive slug flow	See Section 12.17.
Plugged flow tube	Purge the flow tubes or replace the sensor.
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.
Drive board or module failure, cracked flow tube, or sensor imbalance	Contact Micro Motion. See Section 12.3.
Mechanical binding at sensor	Ensure sensor is free to vibrate.
Open drive or left pickoff sensor coil	Contact Micro Motion. See Section 12.3.
Flow rate out of range	Ensure that flow rate is within sensor limits.
Incorrect sensor characterization	Verify characterization. See Section 6.2.

12.25.4 Erratic drive gain

See Table 12-9 for a list of possible causes of erratic drive gain.

Table 12-9 Erratic drive gain causes and remedies

Cause	Possible remedy
Wrong K1 characterization constant for sensor	Re-enter the K1 characterization constant. See Section 6.2.
Polarity of pick-off reversed or polarity of drive reversed	Contact Micro Motion. See Section 12.3.
Slug flow	See Section 12.17.
Foreign material caught in flow tubes	Purge flow tubes or replace sensor.

12.25.5 Low pickoff voltage

See Table 12-10 for a list of possible causes of low pickoff voltage.

Table 12-10 Low pickoff voltage causes and remedies

Cause	Possible remedy
Faulty wiring runs between the sensor and core processor	Verify wiring. Refer to Appendix B for diagrams, and see your transmitter installation manual.
Process flow rate beyond the limits of the sensor	Verify that the process flow rate is not out of range of the sensor.
Slug flow	See Section 12.17.
No tube vibration in sensor	Check for plugging.
	Ensure sensor is free to vibrate (no mechanical binding).
	Verify wiring.
	Test coils at sensor. See Section 12.27.
Moisture in the sensor electronics	Eliminate the moisture in the sensor electronics.
The sensor is damaged	Contact Micro Motion.

12.26 Checking the core processor

Two core processor procedures are available:

- You can check the core processor LED. The core processor has an LED that indicates different meter conditions. See Table 12-11.
- You can perform the core processor resistance test to check for a damaged core processor.

12.26.1 Checking the core processor LED

To check the core processor LED:

1. Determine your installation type. See Section 1.3 and refer to Appendix B for diagrams.
2. Maintain power to the transmitter.
3. If you have a 4-wire remote installation or a remote core processor with remote transmitter installation:
   a. Remove the core processor lid. The core processor is intrinsically safe and can be opened in all environments.
   b. Check the core processor LED against the conditions described in Table 12-11 (standard core processor) or Table 12-12 (enhanced core processor).
   c. To return to normal operation, replace the lid.

4. If you have an integral installation (Model 1700/2700 transmitters only):
   a. Loosen the four cap screws that fasten the transmitter to the base (see Figure B-9).
   b. Rotate the transmitter counter-clockwise so that the cap screws are in the unlocked position.
   c. Gently lift the transmitter straight up, disengaging it from the cap screws. Do not disconnect or damage the wires that connect the transmitter to the core processor.
   d. Check the core processor LED against the conditions described in Table 12-11.
   e. To return to normal operation:
      - Gently lower the transmitter onto the base, inserting the cap screws into the slots. Do not pinch or stress the wires.
      - Rotate the transmitter clockwise so that the cap screws are in the locked position.
      - Tighten the cap screws, torquing to 20 to 30 in-lbs (2,3 to 3,4 N-m).
5. If you have a 9-wire remote installation (Model 1700/2700 transmitters only):
   a. Remove the end-cap (see Figure B-11).
   b. Inside the core processor housing, loosen the three screws that hold the core processor mounting plate in place. Do not remove the screws. Rotate the mounting plate so that the screws are in the unlocked position.
   c. Holding the tab on the mounting plate, slowly lower the mounting plate so that the top of the core processor is visible. Do not disconnect or damage the wires that connect the core processor to the transmitter.
   d. Check the core processor LED against the conditions described in Table 12-11.
   e. To return to normal operation:
      - Gently slide the mounting plate into place. Do not pinch or stress the wires.
      - Rotate the mounting plate so that the screws are in the locked position.
      - Tighten the screws, torquing to 6 to 8 in-lbs (0,7 to 0,9 N-m).
      - Replace the end-cap.

Note: When reassembling the meter components, be sure to grease all O-rings.

Table 12-11 Standard core processor LED behavior, meter conditions, and remedies

LED behavior	Condition	Possible remedy
1 flash per second (ON 25%, OFF 75%)	Normal operation	No action required.
1 flash per second (ON 75%, OFF 25%)	Slug flow	See Section 12.17.
Solid ON	Zero or calibration in progress	If calibration is in progress, no action required. If no calibration is in progress, contact Micro Motion. See Section 12.3.
	Core processor receiving between 11.5 and 5 volts	Check power supply to transmitter. See Section 12.14.1, and refer to Appendix B for diagrams.

Table 12-11 Standard core processor LED behavior, meter conditions, and remedies *continued*

LED behavior	Condition	Possible remedy
3 rapid flashes, followed by pause	Sensor not recognized	Check wiring between transmitter and sensor (9-wire remote installation or remote core processor with remote transmitter installation). Refer to Appendix B for diagrams, and see your transmitter installation manual.
	Improper configuration	Check sensor characterization parameters. See Section 6.2.
	Broken pin between sensor and core processor	Contact Micro Motion. See Section 12.3.
4 flashes per second	Fault condition	Check alarm status.
OFF	Core processor receiving less than 5 volts	• Verify power supply wiring to core processor. Refer to Appendix B for diagrams. • If transmitter status LED is lit, transmitter is receiving power. Check voltage across terminals 1 (VDC+) and 2 (VDC–) in core processor. If reading is less than 1 VDC, verify power supply wiring to core processor. Wires may be switched. See Section 12.14.1, and refer to Appendix B for diagrams. Otherwise, contact Micro Motion (see Section 12.3). • If transmitter status LED is not lit, transmitter is not receiving power. Check power supply. See Section 12.14.1, and refer to Appendix B for diagrams. If power supply is operational, internal transmitter, display, or LED failure is possible. Contact Micro Motion. See Section 12.3.
	Core processor internal failure	Contact Micro Motion. See Section 12.3.

Table 12-12 Enhanced core processor LED behavior, meter conditions, and remedies

LED behavior	Condition	Possible remedy
Solid green	Normal operation	No action required.
Flashing yellow	Zero in progress	If calibration is in progress, no action required. If no calibration is in progress, contact Micro Motion. See Section 12.3.
Solid yellow	Low severity alarm	Check alarm status.
Solid red	High severity alarm	Check alarm status.
Flashing red (80% on, 20% off)	Tubes not full	If alarm A105 (slug flow) is active, see Section 12.17.
		If alarm A033 (tubes not full) is active, verify process. Check for air in the flow tubes, tubes not filled, foreign material in tubes, or coating in tubes.
Flashing red (50% on, 50% off)	Electronics failed	Contact Micro Motion. See Section 12.3.

Table 12-12 Enhanced core processor LED behavior, meter conditions, and remedies *continued*

LED behavior	Condition	Possible remedy
Flashing red (50% on, 50% off, skips every 4th)	Sensor failed	Contact Micro Motion. See Section 12.3.
OFF	Core processor receiving less than 5 volts	• Verify power supply wiring to core processor. Refer to Appendix B for diagrams. • If transmitter status LED is lit, transmitter is receiving power. Check voltage across terminals 1 (VDC+) and 2 (VDC–) in core processor. If reading is less than 1 VDC, verify power supply wiring to core processor. Wires may be switched. See Section 12.14.1, and refer to Appendix B for diagrams. Otherwise, contact Micro Motion (see Section 12.3). • If transmitter status LED is not lit, transmitter is not receiving power. Check power supply. See Section 12.14.1, and refer to Appendix B for diagrams. If power supply is operational, internal transmitter, display, or LED failure is possible. Contact Micro Motion. See Section 12.3.
	Core processor internal failure	Contact Micro Motion. See Section 12.3.

12.26.2 Core processor resistance test

To perform the core processor resistance test:

1. Determine your installation type. See Section 1.3 and refer to Appendix B for diagrams.
2. Power down the transmitter.
3. If you have a 4-wire remote installation or a remote core processor with remote transmitter installation, remove the core processor lid.
4. If you have an integral installation (Model 1700/2700 transmitters only):
   a. Loosen the four cap screws that fasten the transmitter to the base (see Figure B-9).
   b. Rotate the transmitter counter-clockwise so that the cap screws are in the unlocked position.
   c. Gently lift the transmitter straight up, disengaging it from the cap screws.
5. If you have a 9-wire remote installation (Model 1700/2700 transmitters only):
   a. Remove the end-cap (see Figure B-11).
   b. Inside the core processor housing, loosen the three screws that hold the core processor mounting plate in place. Do not remove the screws. Rotate the mounting plate so that the screws are in the unlocked position.
   c. Holding the tab on the mounting plate, slowly lower the mounting plate so that the top of the core processor is visible.
6. At the core processor, disconnect the 4-wire cable between the core processor and the transmitter.
7. Measure the resistance between core processor terminals 3 and 4 (RS-485A and RS-485B). See Figure 12-1. Resistance should be 40 kΩ to 50 kΩ.

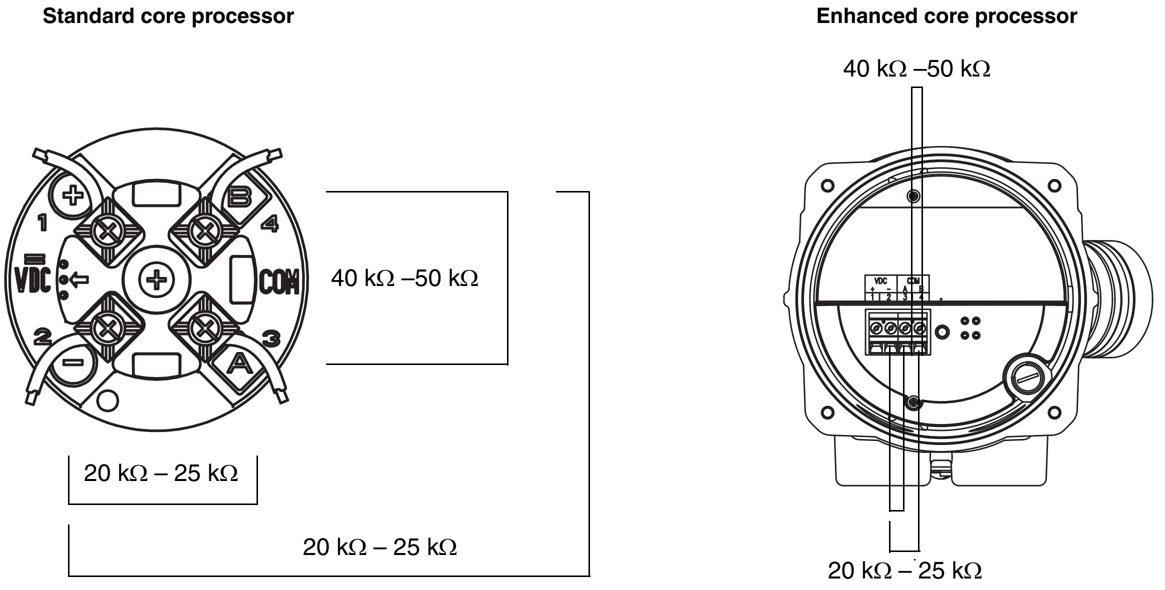
8. Measure the resistance between core processor terminals 2 and 3 (VDC– and RS-485A). Resistance should be 20 kΩ to 25 kΩ.
9. Measure the resistance between core processor terminals 2 and 4 (VDC– and RS-485B). Resistance should be 20 kΩ to 25 kΩ.
10. If any resistance measurements are lower than specified, the core processor may not be able to communicate with a transmitter or a remote host. Contact Micro Motion (see Section 12.3).

To return to normal operation:

1. Reconnect the 4-wire cable between the core processor and the transmitter (for Model 1500/2500 transmitters, see Figure B-3 or Figure B-4, for Model 1700/2700 transmitters, see Figure B-13 or Figure B-14).
2. If you have a 4-wire remote installation or a remote core processor with remote transmitter installation, replace the core processor lid.
3. If you have an integral installation:
   a. Gently lower the transmitter onto the base, inserting the cap screws into the slots. Do not pinch or stress the wires.
   b. Rotate the transmitter clockwise so that the cap screws are in the locked position.
   c. Tighten the cap screws, torquing to 20 to 30 in-lbs (2,3 to 3,4 N-m).
4. If you have a 9-wire remote installation:
   a. Gently slide the mounting plate into place. Do not pinch or stress the wires.
   b. Rotate the mounting plate so that the screws are in the locked position.
   c. Tighten the screws, torquing to 6 to 8 in-lbs (0,7 to 0,9 N-m).
   d. Replace the end-cap.
5. Restore power to the transmitter.

Note: When reassembling the meter components, be sure to grease all O-rings.

Figure 12-1 Core processor resistance test



12.27 Checking sensor coils and RTD

Problems with sensor coils can cause several alarms, including sensor failure and a variety of out-of-range conditions. Testing the sensor coils involves testing the terminal pairs and testing for shorts to case.

12.27.1 9-wire remote or remote core processor with remote transmitter installation

If you have a 9-wire remote installation or a remote core processor with remote transmitter (see Section 1.3 and refer to Appendix B for diagrams):

1. Power down the transmitter.
2. If the transmitter is in a hazardous area, wait five minutes.
3. Remove the end-cap from the core processor housing.
4. Unplug the terminal blocks from the terminal board.
5. Using a digital multimeter (DMM), check the pickoff coils listed in Table 12-13 by placing the DMM leads on the unplugged terminal blocks for each terminal pair. Record the values.

Table 12-13 Coils and test terminal pairs

	Test terminal pair	
Coil	**Colors**	**Numbers**
Drive coil	Brown to red	3 — 4
Left pickoff coil (LPO)	Green to white	5 — 6
Right pickoff coil (RPO)	Blue to gray	7 — 8
Resistance temperature detector (RTD)	Yellow to violet	1 — 2
Lead length compensator (LLC) (all sensors except CMF400 I.S. and T-Series) Composite RTD (T-Series sensors only) Fixed resistor (CMF400 I.S. sensors only)	Yellow to orange	1 — 9

6. There should be no open circuits, i.e., no infinite resistance readings. The LPO and RPO readings should be the same or very close (± 5 ohms). If there are any unusual readings, repeat the coil resistance tests at the sensor junction box to eliminate the possibility of faulty cable. The readings for each coil pair should match at both ends.
7. Leave the core processor terminal blocks disconnected. At the sensor, remove the lid of the junction box and test each sensor terminal for a short to case by placing one DMM lead on the terminal and the other lead on the sensor case. With the DMM set to its highest range, there should be infinite resistance on each lead. If there is any resistance at all, there is a short to case.

8. Test terminal pairs as follows:
   a. Brown against all other terminals except Red
   b. Red against all other terminals except Brown
   c. Green against all other terminals except White
   d. White against all other terminals except Green
   e. Blue against all other terminals except Gray
   f. Gray against all other terminals except Blue
   g. Orange against all other terminals except Yellow and Violet
   h. Yellow against all other terminals except Orange and Violet
   i. Violet against all other terminals except Yellow and Orange

Note: D600 sensors and CMF400 sensors with booster amplifiers have different terminal pairs. Contact Micro Motion for assistance (see Section 12.3).

   There should be infinite resistance for each pair. If there is any resistance at all, there is a short between terminals.

9. See Table 12-14 for possible causes and solutions.
10. If the problem is not resolved, contact Micro Motion (see Section 12.3).
11. To return to normal operation:
   a. Plug the terminal blocks into the terminal board.
   b. Replace the end-cap on the core processor housing.
   c. Replace the lid on the sensor junction box.

Note: When reassembling the meter components, be sure to grease all O-rings.

Table 12-14 Sensor and cable short to case possible causes and remedies

Possible cause	Solution
Moisture inside the sensor junction box	Make sure that the junction box is dry and no corrosion is present.
Liquid or moisture inside the sensor case	Contact Micro Motion. See Section 12.3.
Internally shorted feedthrough (sealed passage for wiring from sensor to sensor junction box)	Contact Micro Motion. See Section 12.3.
Faulty cable	Replace cable.
Improper wire termination	Verify wire terminations inside sensor junction box. See Micro Motion's *9-Wire Flowmeter Cable Preparation and Installation Guide* or the sensor documentation.

12.27.2 4-wire remote or integral installation

If you have a 4-wire remote installation or an integral installation (see Section 1.3 and refer to Appendix B for diagrams):

1. Power down the transmitter.
2. If the transmitter is in a hazardous environment, wait five minutes.
3. If you have a 4-wire remote installation, remove the core processor lid.

4. If you have an integral installation (Model 1700/2700 transmitters only):
   a. Loosen the four cap screws that fasten the transmitter to the base (see Figure B-9).
   b. Rotate the transmitter counter-clockwise so that the cap screws are in the unlocked position.
   c. Gently lift the transmitter straight up, disengaging it from the base.

Note: You may disconnect the 4-wire cable between the core processor and the transmitter, or leave it connected.

5. If you have a standard core processor or an integral Model 1700/2700 – Loosen the captive screw (2.5 mm) in the center of the core processor. Carefully remove the core processor from the sensor by grasping it and lifting it straight up. **Do not twist or rotate the core processor**.
6. If you have an enhanced core processor – Loosen the two captive screws (2.5 mm) that hold the core processor in the housing. Gently lift the core processor out of the housing, then disconnect the sensor cable from the feedthrough pins. **Do not damage the feedthrough pins**.

⚠ CAUTION

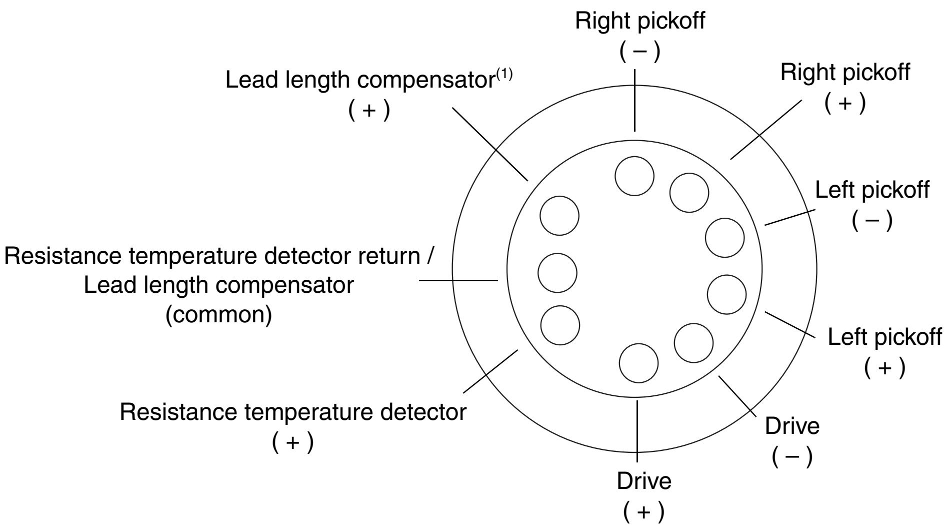
If the core processor (feedthrough) pins are bent, broken, or damaged in any way, the core processor will not operate.

To avoid damage to the core processor (feedthrough) pins:

- Do not twist or rotate the core processor when lifting it.
- When replacing the core processor (or sensor cable) on the pins, be sure to align the guide pins and mount the core processor (or sensor cable) carefully.

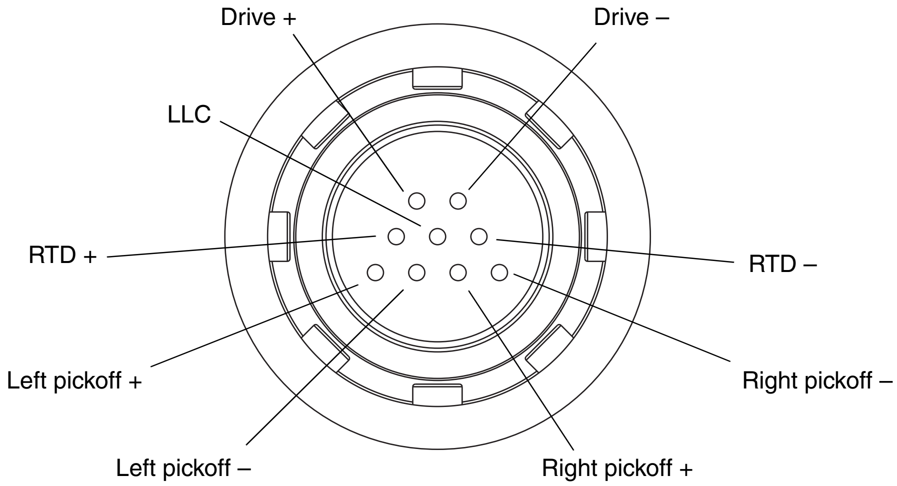
7. Using a digital multimeter (DMM), check the pickoff coil resistances by placing the DMM leads on the pin pairs. Refer to Figure 12-2 (standard core processor) or Figure 12-3 (enhanced core processor) to identify the pins and pin pairs. Record the values.

Figure 12-2 Sensor pins – Standard core processor



(1) LLC for all sensors except T-Series and CMF400 I.S. For T-Series sensors, functions as composite RTD. For CMF400 I.S. sensors, functions as fixed resistor.

Figure 12-3 Sensor pins – Enhanced core processor



8. There should be no open circuits, i.e., no infinite resistance readings. The LPO and RPO readings should be the same or very close (± 5 ohms).
9. Using the DMM, check between each pin and the sensor case. With the DMM set to its highest range, there should be infinite resistance on each lead. If there is any resistance at all, there is a short to case. See Table 12-14 for possible causes and solutions.
10. Test terminal pairs as follows:
    a. Drive + against all other terminals except Drive –
    b. Drive – against all other terminals except Drive +
    c. Left pickoff + against all other terminals except Left pickoff –
    d. Left pickoff – against all other terminals except Left pickoff +
    e. Right pickoff + against all other terminals except Right pickoff –
    f. Right pickoff – against all other terminals except Right pickoff +
    g. RTD + against all other terminals except LLC + and RTD/LLC
    h. LLC + against all other terminals except RTD + and RTD/LLC
    i. RTD/LLC against all other terminals except LLC + and RTD +

Note: D600 sensors and CMF400 sensors with booster amplifiers have different terminal pairs. Contact Micro Motion for assistance (see Section 12.3).

    There should be infinite resistance for each pair. If there is any resistance at all, there is a short between terminals. See Table 12-14 for possible causes and solutions.

11. If the problem is not resolved, contact Micro Motion (see Section 12.3).

To return to normal operation:

1. If you have a standard core processor or integral Model 1700/2700:
    a. Align the three guide pins on the bottom of the core processor with the corresponding holes in the base of the core processor housing.
    b. Carefully mount the core processor on the pins, taking care not to bend any pins.

2. If you have an enhanced core processor:
   a. Plug the sensor cable onto the feedthrough pins, being careful not to bend or damage any pins.
   b. Replace the core processor in the housing.
3. Tighten the captive screw(s) to 6 to 8 in-lbs (0,7 to 0,9 N-m) of torque.
4. If you have a 4-wire remote installation, replace the core processor lid.
5. If you have an integral installation:
   a. Gently lower the transmitter onto the base, inserting the cap screws into the slots. Do not pinch or stress the wires.
   b. Rotate the transmitter clockwise so that the cap screws are in the locked position.
   c. Tighten the cap screws, torquing to 20 to 30 in-lbs (2,3 to 3,4 N-m).

Note: When reassembling the meter components, be sure to grease all O-rings.

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.

The default values listed here apply to all Version 5.0 transmitters using a Version 3.2 enhanced core processor.

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	0.8 sec	0.0–51.2 sec	User-entered value is corrected to nearest lower value in list of preset values. For gas applications, Micro Motion recommends a value of 3.2.
	Flow calibration factor	1.00005.13		For T-Series sensors, this value represents the FCF and FT factors concatenated. See Section 6.2.2.
	Mass flow units	g/s		
	Mass flow cutoff	0.0 g/s		Recommended setting is 0.5–1.0% of the sensor's rated maximum flow rate.
	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.
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	1.6 sec	0.0–51.2 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	0.0–38.4 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		
Pressure	Pressure units	PSI		
	Flow factor	0.00000		
	Density factor	0.00000		
	Cal pressure	0.00000		
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		

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

Type	Setting	Default	Range	Comments
Variable mapping	Primary variable	Mass flow		
	Secondary variable	• Series 1000: Mass flow • Series 2000: Density		
	Tertiary variable	Mass flow		
	Quaternary variable	• Series 1000: Mass flow • Series 2000: Volume flow		
Update rate	Update rate	Normal	Normal or Special	Normal = 20 Hz Special = 100 Hz
Primary mA output	Primary variable	Mass flow		
	LRV	–200 g/s		See below
	URV	200 g/s		See below
	AO cutoff	0.00000 g/s		
	AO added damping	0.00000 sec		
	LSL	–200 g/s		Read-only
	USL	200 g/s		Read-only
	Min Span	0.3 g/s		Read-only
	Fault action	Downscale		
	AO fault level – downscale	• AN: 2.0 mA • CIO: 2.0 mA • IS: 3.2 mA	1.0–3.6 mA	
	AO fault level – upscale	22.0 mA	21.0–24.0 mA	
	Last measured value timeout	0.00 sec		
Secondary mA output	Secondary variable	Density		
	LRV	0.00 g/cm^3		See below
	URV	10.00 g/cm^3		See below
	AO cutoff	Not-A-Number		
	AO added damping	0.00000 sec		
	LSL	0.00 g/cm^3		Read-only
	USL	10.00 g/cm^3		Read-only
	Min Span	0.05 g/cm^3		Read-only
	Fault action	Downscale		
	AO fault level – downscale	• AN: 2.0 mA • CIO: 2.0 mA • IS: 3.2 mA	1.0–3.6 mA	
	AO fault level – upscale	22.0 mA	21.0–24.0 mA	

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

Type	Setting	Default	Range	Comments
LRV	Mass flow	–200.000 g/s		
	Volume flow	–0.200 l/s		
	Density	0.000 g/cm^3		
	Temperature	–240.000 °C		
	Drive gain	0.000%		
	Gas standard volume flow	–423.78 SCFM		
	External temperature	–240.000 °C		
	External pressure	0.000 psi		
URV	Mass flow	200.000 g/s		
	Volume flow	0.200 l/s		
	Density	10.000 g/cm^3		
	Temperature	450.000 °C		
	Drive gain	100.000%		
	Gas standard volume flow	423.78 SCFM		
	External temperature	450.000 °C		
	External pressure	100.000 psi		
Frequency output	Tertiary variable	Mass flow		
	Frequency factor	1,000.00 Hz	.001–10,000.00 Hz	
	Rate factor	16,666.67 g/s		
	Frequency pulse width	277 mSec	0–277 mSec	
	Scaling method	Freq=Flow		
	Frequency fault action	Downscale		
	Frequency fault level – upscale	15,000 Hz	10.0–15,000 Hz	
	Frequency output polarity	Active high		
	Frequency output mode	Single		Default and not configurable if only one channel is configured for frequency
		Quadrature		If both Channel B and Channel C are configured for frequency
	Last measured value timeout	0.0 sec	0.0–60.0 sec	
Discrete output	Assignment	• DO1: Forw./Rev. • DO2: Flow switch	n/a Mass flow 0.0 g/s	
	Fault indicator	None		
	Power	Internal		
	Polarity	Active high		
Discrete input	Assignment	None		CIO transmitters only
	Power	Internal		
	Polarity	Active low		

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

Type	Setting	Default	Range	Comments
Display	Variable 1	Mass flow rate		
	Variable 2	Mass totalizer		
	Variable 3	Volume flow rate		
	Variable 4	Volume totalizer		
	Variable 5	Density		
	Variable 6	Temperature		
	Variable 7–15	None		
	Update period	200 millisec	100–10,000 millisec	
	Display totalizer reset	Disabled		
	Display auto scroll	Disabled		
	Display backlight	Enabled		
	Display variable precision	• 2 decimal places for temperature process variables • 4 decimal places for all other process variables	0–5	
	Display offline menu	Enabled		
	Display offline password	Disabled		
	Display alarm screen password	Disabled		
	Display alarm menu	Enabled		
	Display acknowledge all alarms	Enabled		
	Display LED blinking	Enabled		
	Display password	1234	0000–9999	
	Auto scroll rate	10 sec		
	Display totalizer start/stop	Disabled		
Digital comm	Fault setting	None		
	HART address	0		
	Loop current mode	Enabled		
	Modbus address	1		
	Write protection	Disabled		

Appendix B
Flowmeter Installation Types and Components

B.1 Overview

This appendix provides illustrations of different flowmeter installations and components, for:

- Model 1500/2500 transmitters
- Model 1700/2700 transmitters

B.2 Model 1500/2500 transmitters

B.2.1 Installation diagrams

Model 1500/2500 transmitters can be installed in two different ways:

- 4-wire remote
- Remote core processor with remote transmitter

See Figure B-1.

B.2.2 Component diagrams

In remote core processor with remote transmitter installations, the core processor is installed stand-alone. See Figure B-2.

B.2.3 Wiring and terminal diagrams

A 4-wire cable is used to connect the core processor to the transmitter. See Figure B-3.

Figure B-5 shows the transmitter's power supply terminals.

Figure B-6 shows the output terminals for the Model 1500 transmitter.

Figure B-7 shows the output terminals for the Model 2500 transmitter.

Figure B-1 Installation types – Model 1500/2500 transmitters

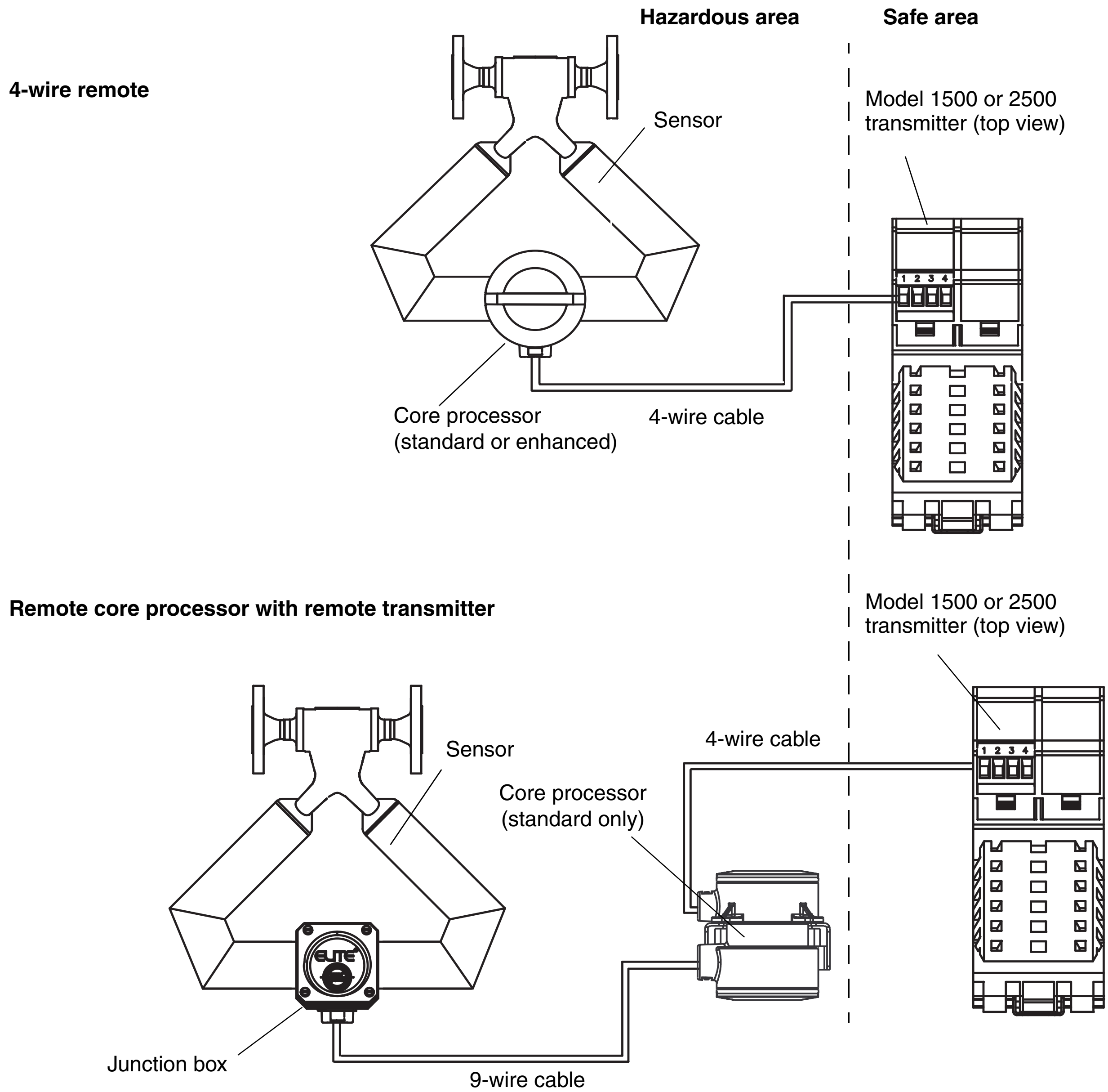


Figure B-2 **Remote core processor components**

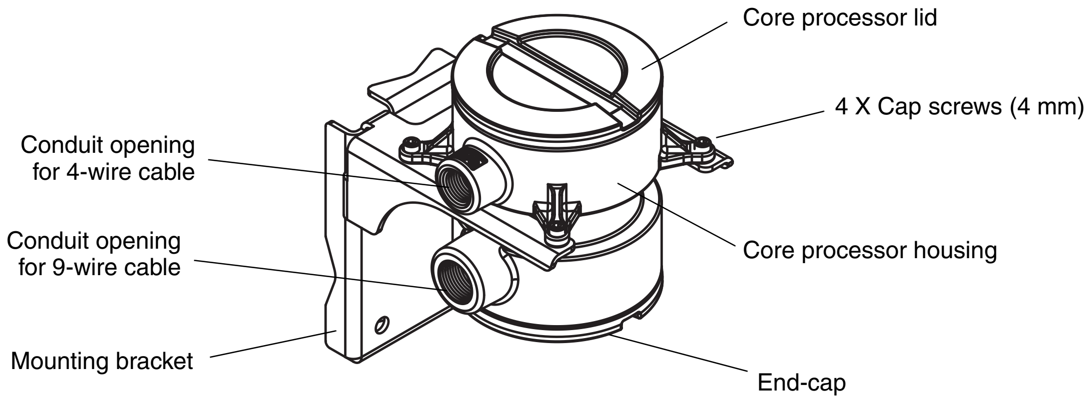


Figure B-3 **4-wire cable between Model 1500/2500 transmitter and standard core processor**

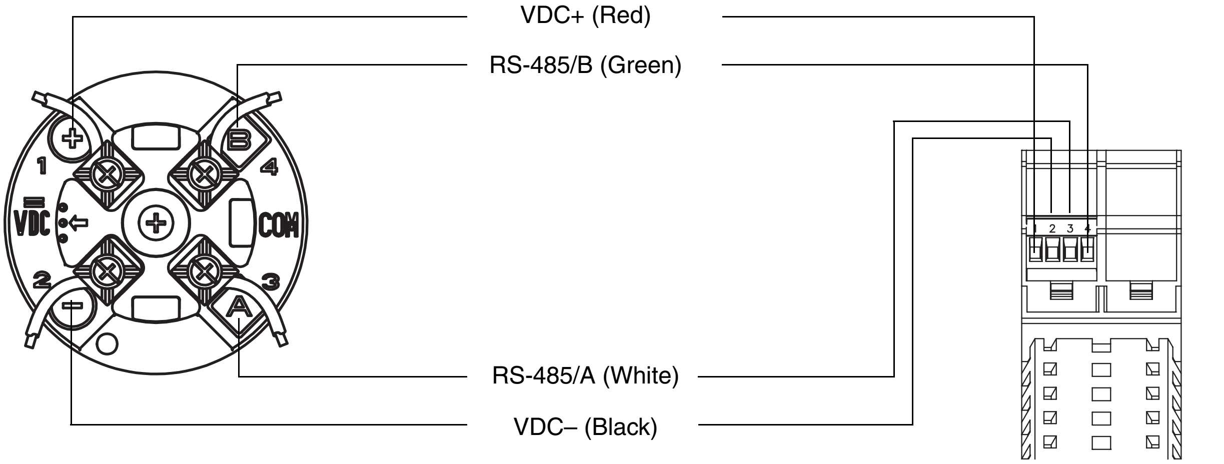


Figure B-4 4-wire cable between Model 1500/2500 transmitter and enhanced core processor

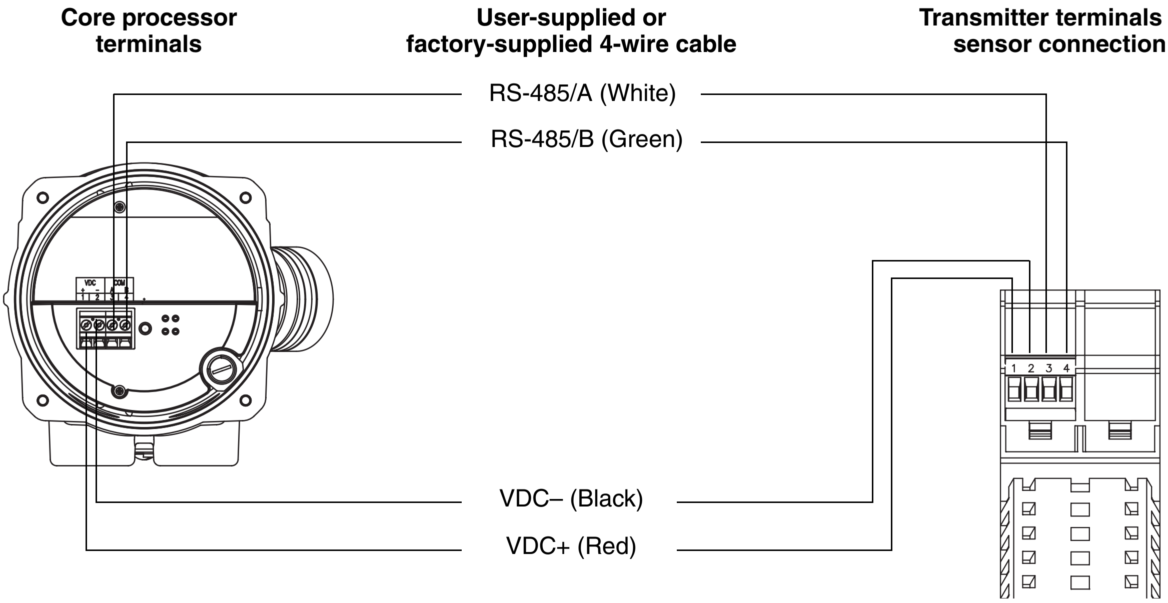


Figure B-5 Power supply terminals – Model 1500/2500

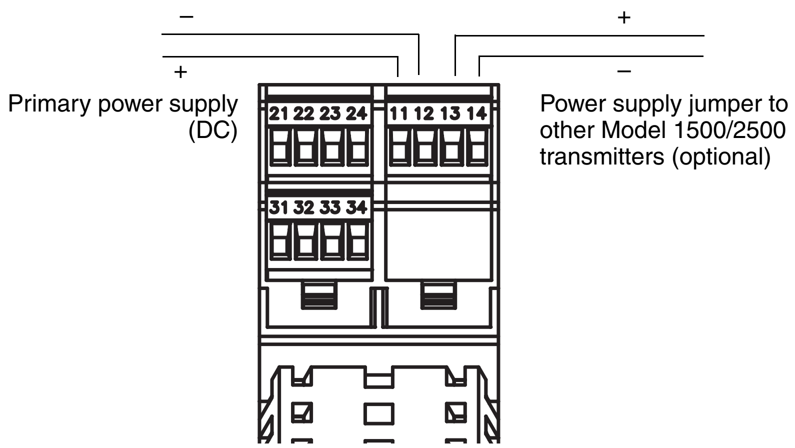


Figure B-6 Terminal configuration – Model 1500

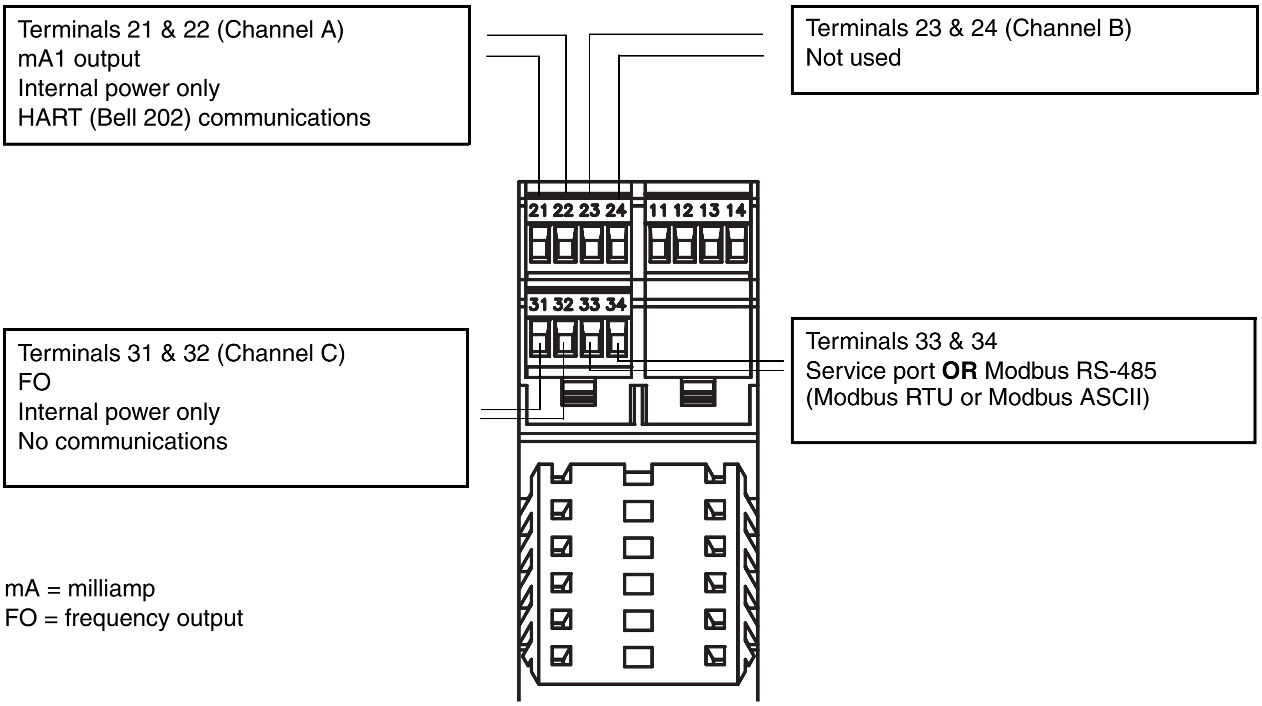
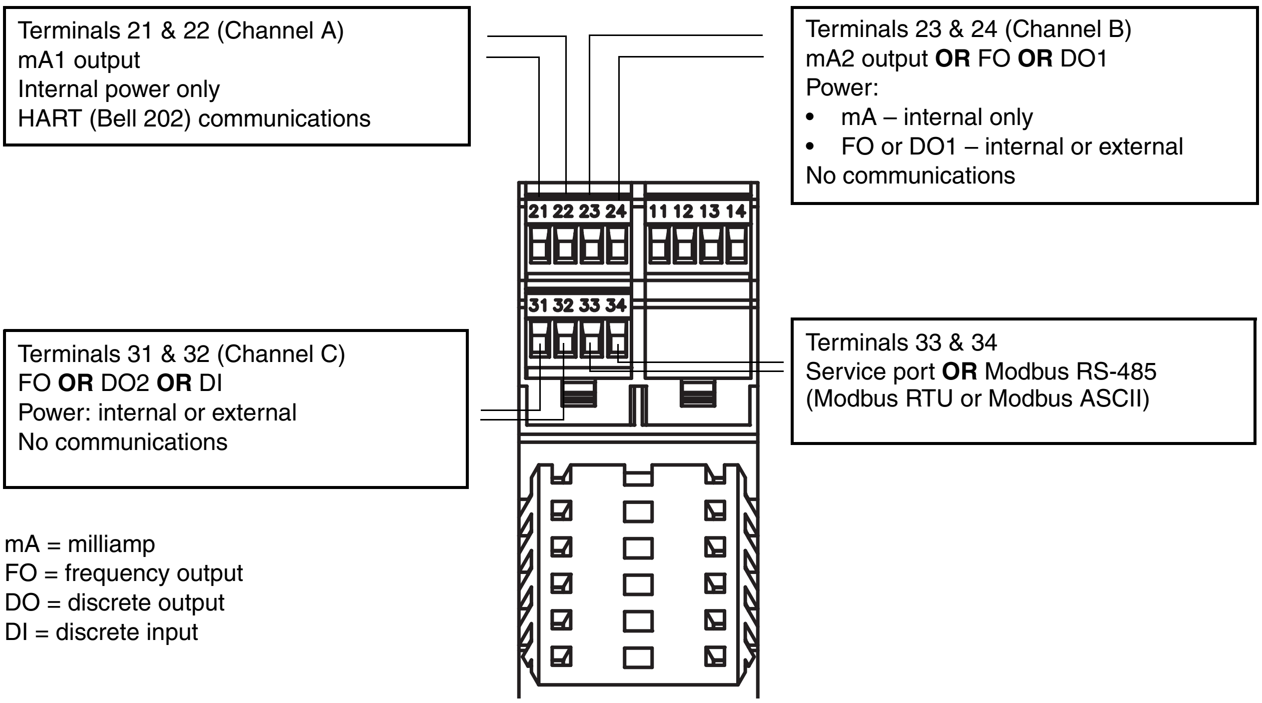


Figure B-7 Terminal configuration – Model 2500



B.3 Model 1700/2700 transmitters

B.3.1 Installation diagrams

Model 1700/2700 transmitters can be installed in four different ways:

- Integral
- 4-wire remote
- 9-wire remote
- Remote core processor with remote transmitter

See Figure B-8.

B.3.2 Component diagrams

Figure B-9 shows the transmitter and core processor components in integral installations.

Figure B-10 shows the transmitter components in 4-wire remote installations and remote core processor with remote transmitter installations.

Figure B-11 shows the transmitter/core processor assembly in 9-wire remote installations.

In remote core processor with remote transmitter installations, the core processor is installed stand-alone. See Figure B-12.

B.3.3 Wiring and terminal diagrams

In 4-wire remote and remote core processor with remote transmitter installations, a 4-wire cable is used to connect the core processor to the transmitter's mating connector. See Figure B-13.

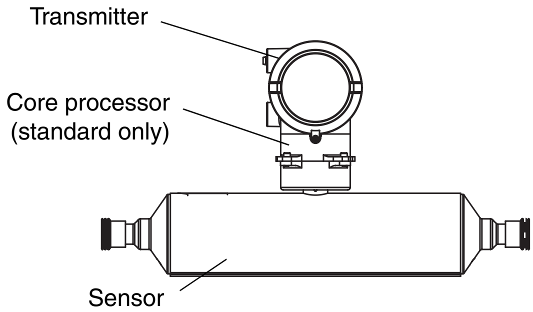
In 9-wire remote installations, a 9-wire cable is used to connect the junction box on the sensor to the terminals on the transmitter/core processor assembly. See Figure B-15.

Figure B-16 shows the transmitter's power supply terminals.

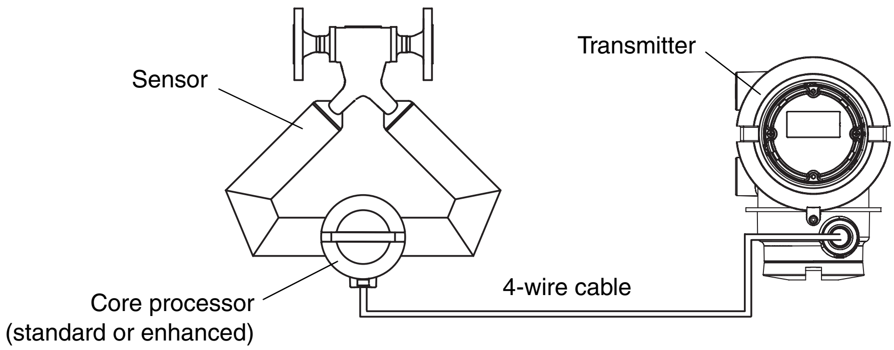
Figure B-16 shows the output terminals for the Model 1700/2700 transmitter.

Figure B-8 Installation types – Model 1700/2700 transmitters

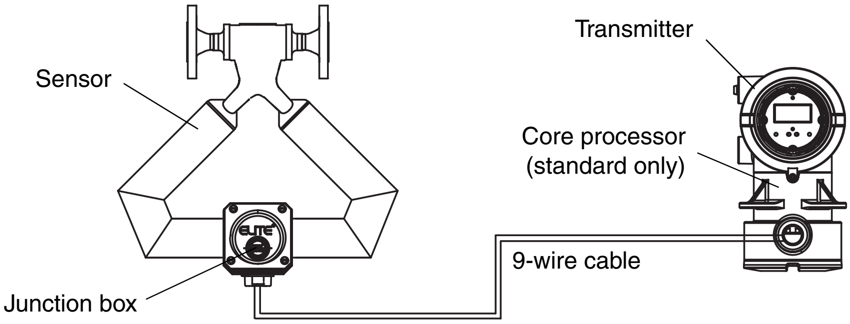
Integral



4-wire remote



9-wire remote



Remote core processor with remote transmitter

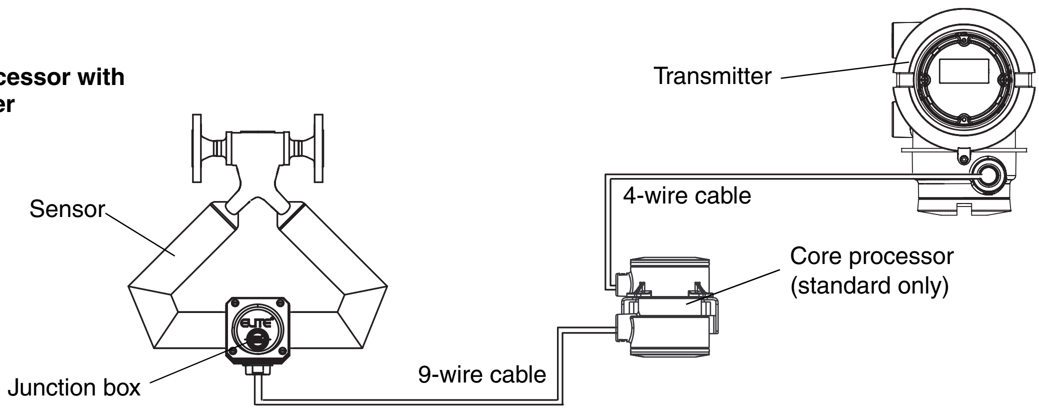


Figure B-9 Transmitter and core processor components – Integral installations

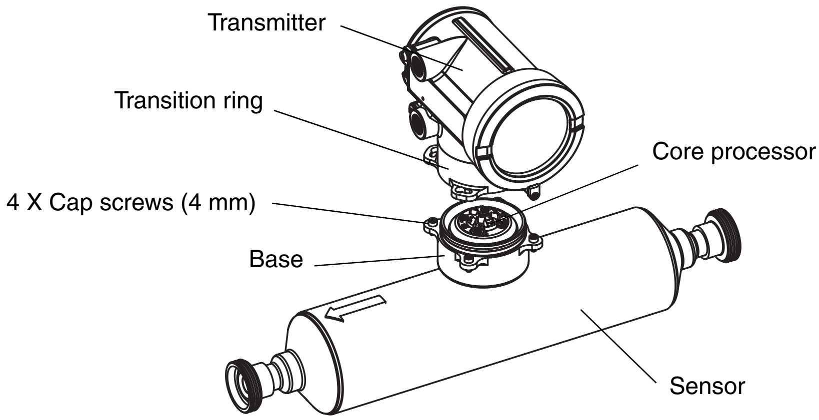


Figure B-10 Transmitter components, junction end-cap removed – 4-wire remote and remote core processor with remote transmitter installations

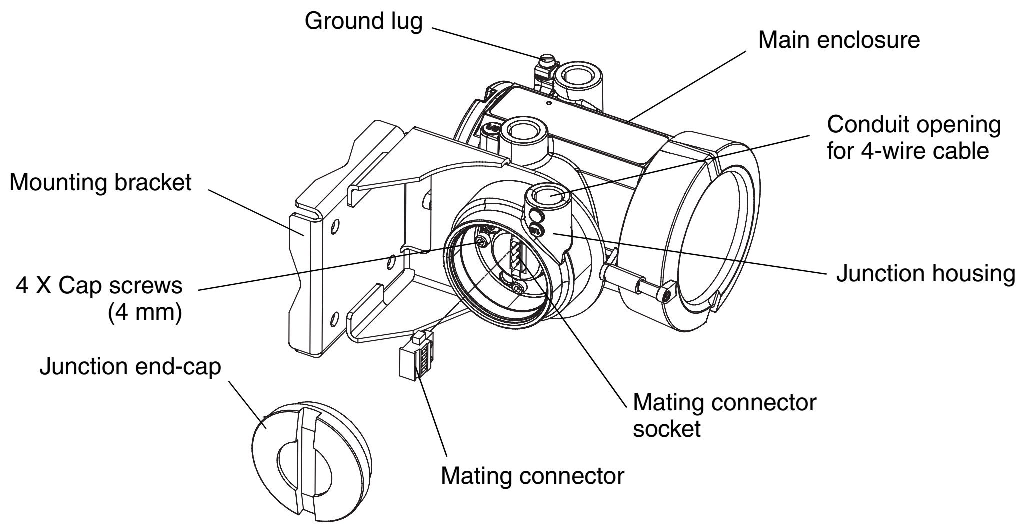


Figure B-11 **Transmitter/core processor assembly exploded view – 9-wire remote installations**

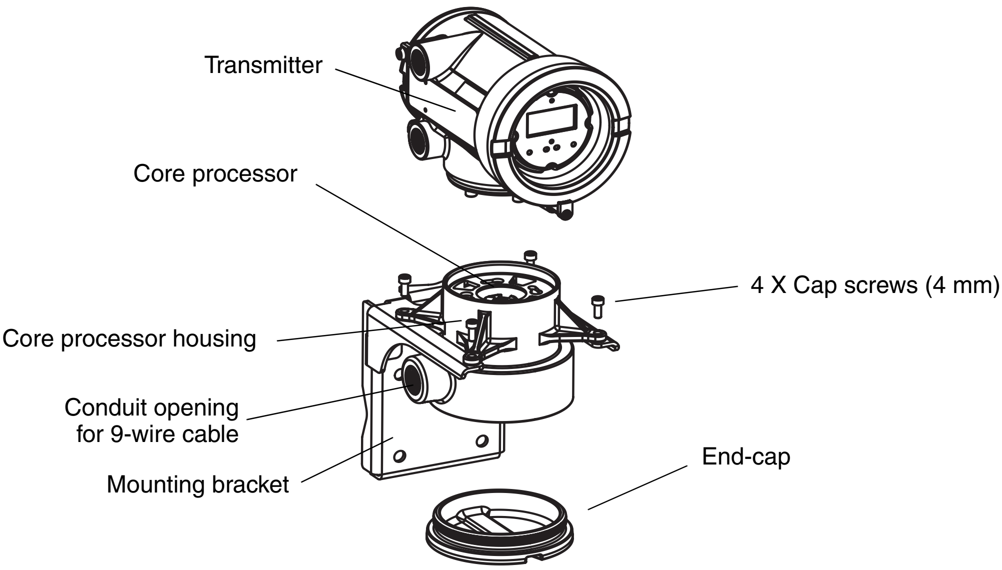


Figure B-12 **Remote core processor components**

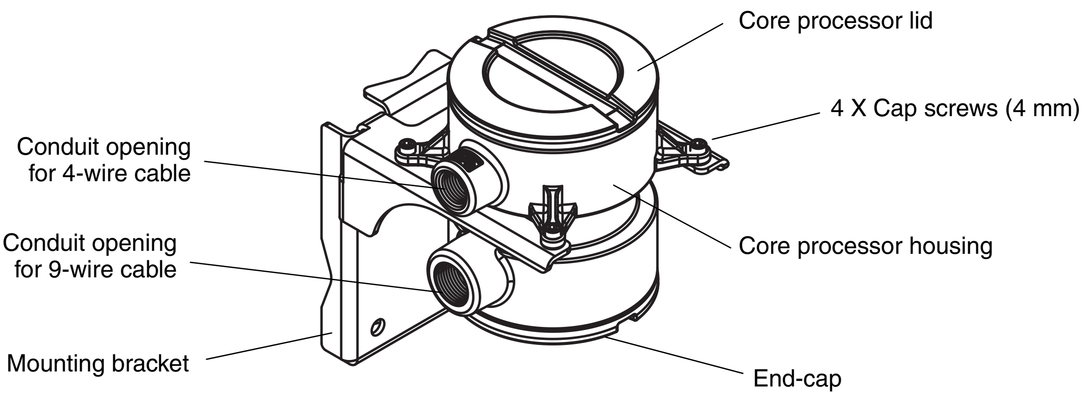


Figure B-13 **4-wire cable between Model 1700/2700 transmitter and standard core processor**

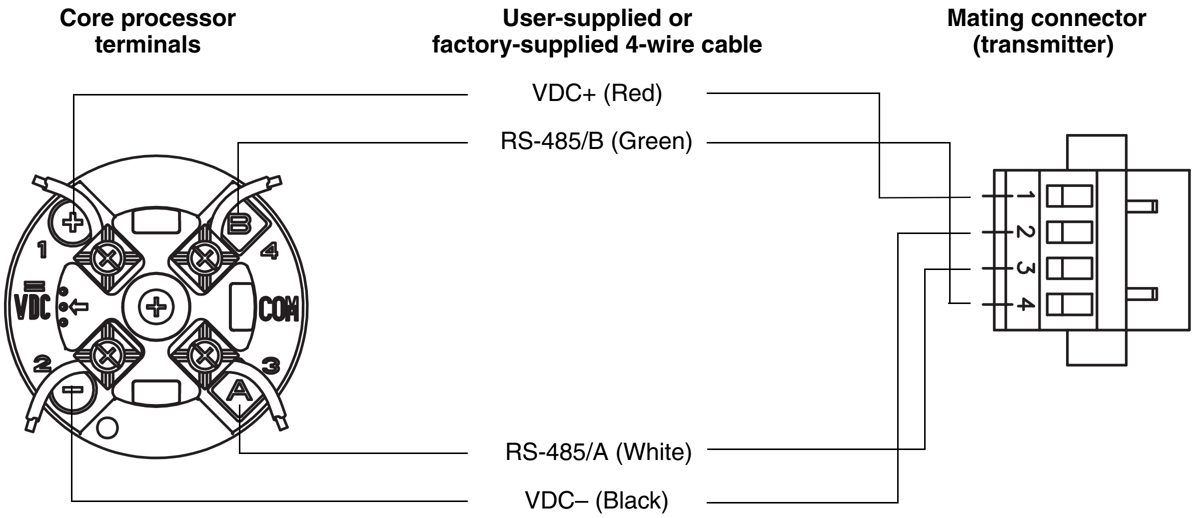


Figure B-14 **4-wire cable between Model 1700/2700 transmitter and enhanced core processor**

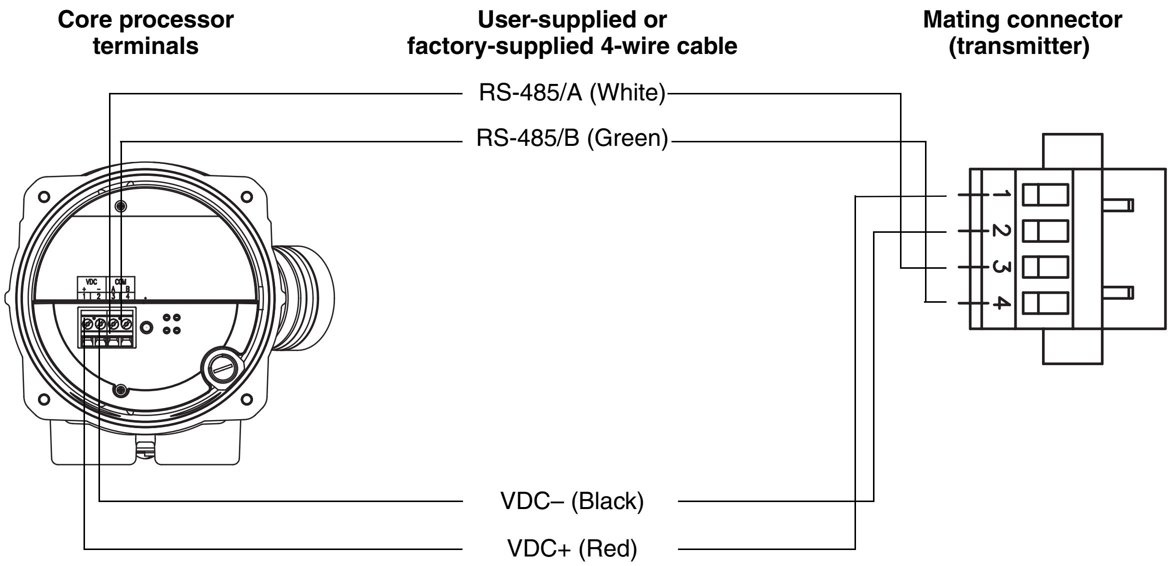


Figure B-15 9-wire cable between sensor junction box and core processor

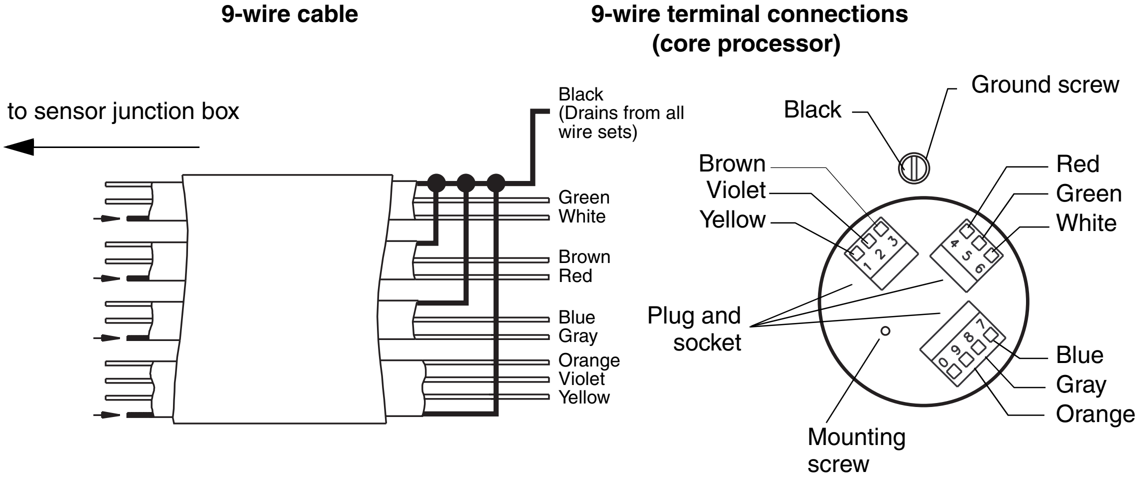
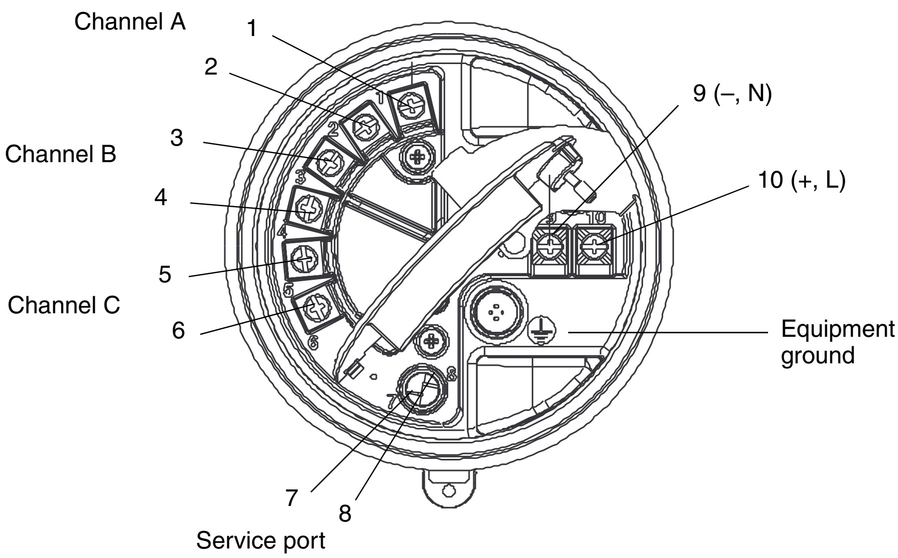


Figure B-16 Output and power supply terminals – Model 1700/2700 transmitter



Defaults

Diagrams

Model 1500 AN

Model 2500 CIO

Appendix C
Menu Flowcharts – Model 1500 AN Transmitters

C.1 Overview

This appendix provides the following menu flowcharts for the Model 1500 AN transmitter:

- ProLink II menus
  - Main menu – Figure C-1
  - Configuration menu – Figures C-2 through C-4
- Communicator 375 menus
  - Process variables menu – Figure C-5
  - Diagnostics/service menu – Figure C-6
  - Basic setup menu – Figure C-7
  - Detailed setup menu – Figures C-8 through C-10

C.2 Model 1500 output board

The Model 1500 transmitter is designed as an analog transmitter, i.e., a transmitter with the analog outputs option board. However, for technical reasons it is built on the CIO outputs option board. Accordingly, when you select a menu option that displays the outputs option board, the CIO board is shown. This is normal, and does not affect actual transmitter outputs or operation.

C.3 Version information

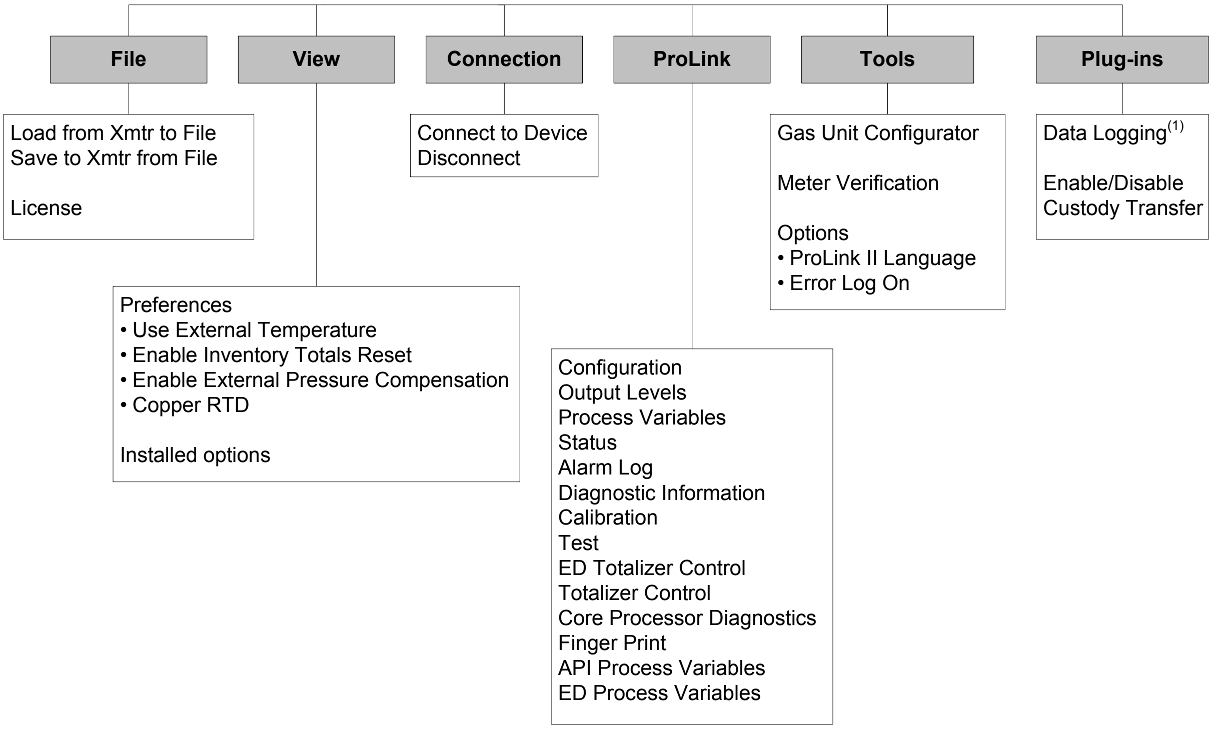
These menus flowcharts are based on:

- Transmitter software rev5.0
- Enhanced core processor software v3.2
- ProLink II v2.5
- 375 Field Communicator device rev 5, DD rev 1

Menus may vary slightly for different versions of these components.

C.4 ProLink II menus

Figure C-1 ProLink II main menu



(1) For information about using Data Logger, refer to the ProLink II manual.

Figure C-2 ProLink II configuration menu

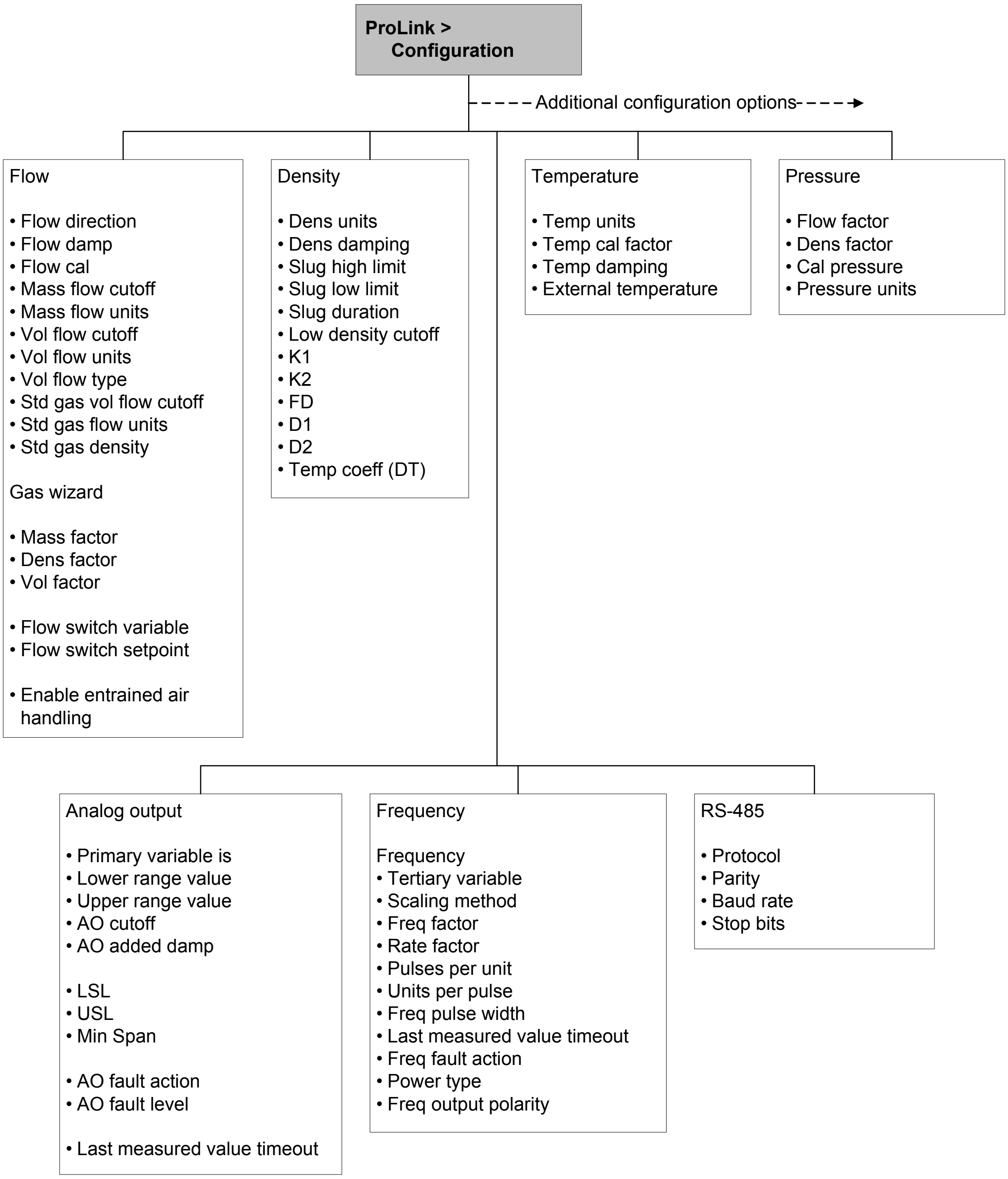


Figure C-3 ProLink II configuration menu *continued*

ProLink > Configuration

Additional configuration options

Device

- Tag
- Date
- Descriptor
- Message
- Sensor type
- Transmitter serial number
- Floating pt ordering
- Add comm resp delay

Digital comm settings
- Fault setting
- HART address
- Loop current mode
- HART device ID
- Modbus address
- Enable write protection

Update rate
- Update rate
- 100 Hz variable

Burst setup
- Enable burst
- Burst cmd
- Burst var 1...4

T Series

- FTG
- FFQ
- DTG
- DFQ1
- DFQ2
- K3
- D3
- D4
- K4

Special Units

- Base mass unit
- Base mass time
- Mass flow conv fact
- Mass flow text
- Mass total text

- Base vol unit
- Base vol time
- Vol flow conv fact
- Vol flow text
- Vol total text

Sensor simulation

- Enable/disable

Mass flow
- Wave form
- Fixed value
- Period
- Minimum
- Maximum

Density
- Wave form
- Fixed value
- Period
- Minimum
- Maximum

Temperature
- Wave form
- Fixed value
- Period
- Minimum
- Maximum

Alarm

- Alarm
- Severity

Events

- Event 1/2
- Variable
- Type
- Setpoint

Discrete events

- Event name
- Event type
- Process variable
- Low setpoint (A)
- High setpoint (B)

Discrete input

- Assignment
- Polarity

Polled variables

Polled variable 1/2
- Polling control
- External tag
- Variable type
- Current value

Figure C-4 ProLink II configuration menu *continued*

ProLink > Configuration

Variable mapping

- PV is
- SV is
- TV is
- QV is

System

- W & M approval
- Reset options

Sensor

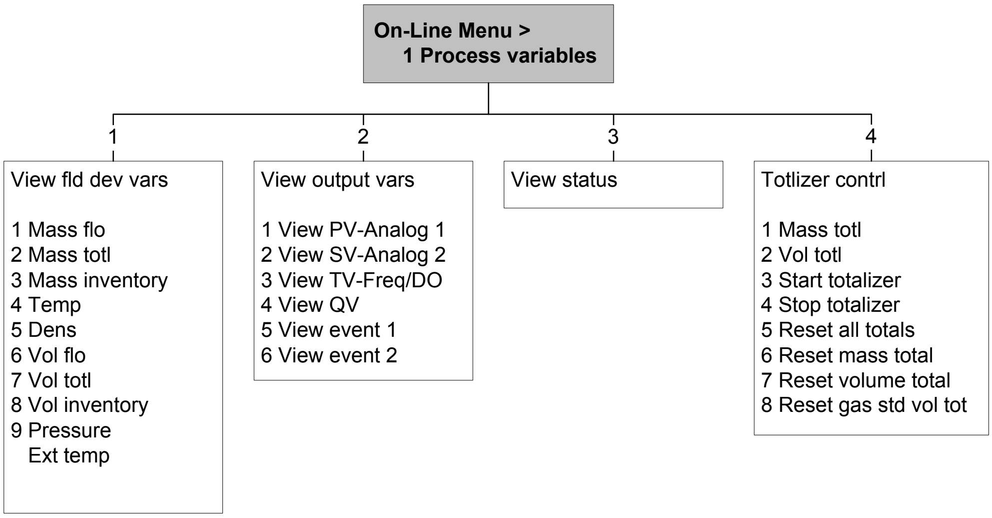
- Sensor s/n
- Sensor model
- Sensor matl
- Liner matl
- Flange

Transmitter options

- Volume flow
- Meter fingerprinting
- Meter verification

C.5 Communicator menus

Figure C-5 Communicator process variables menus



Defaults
Diagrams
Model 1500 AN
Model 2500 CIO

Figure C-6 Communicator diagnostics/service menu

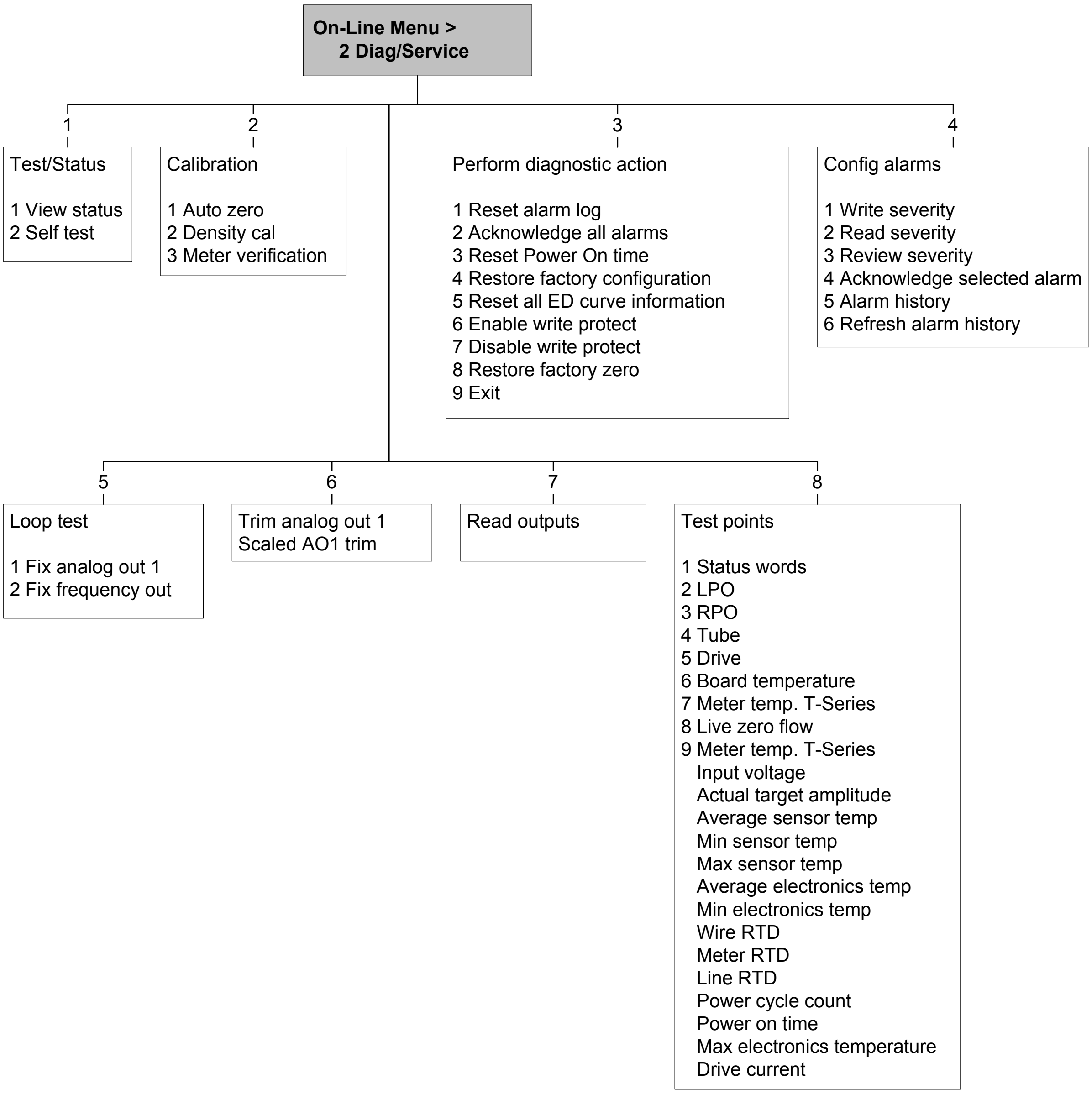


Figure C-7 Communicator basic setup menu

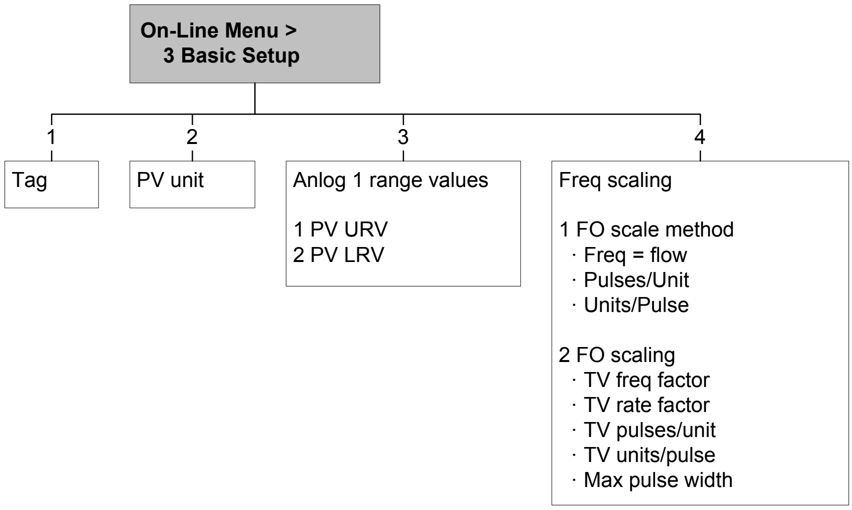


Figure C-8 Communicator detailed setup menu

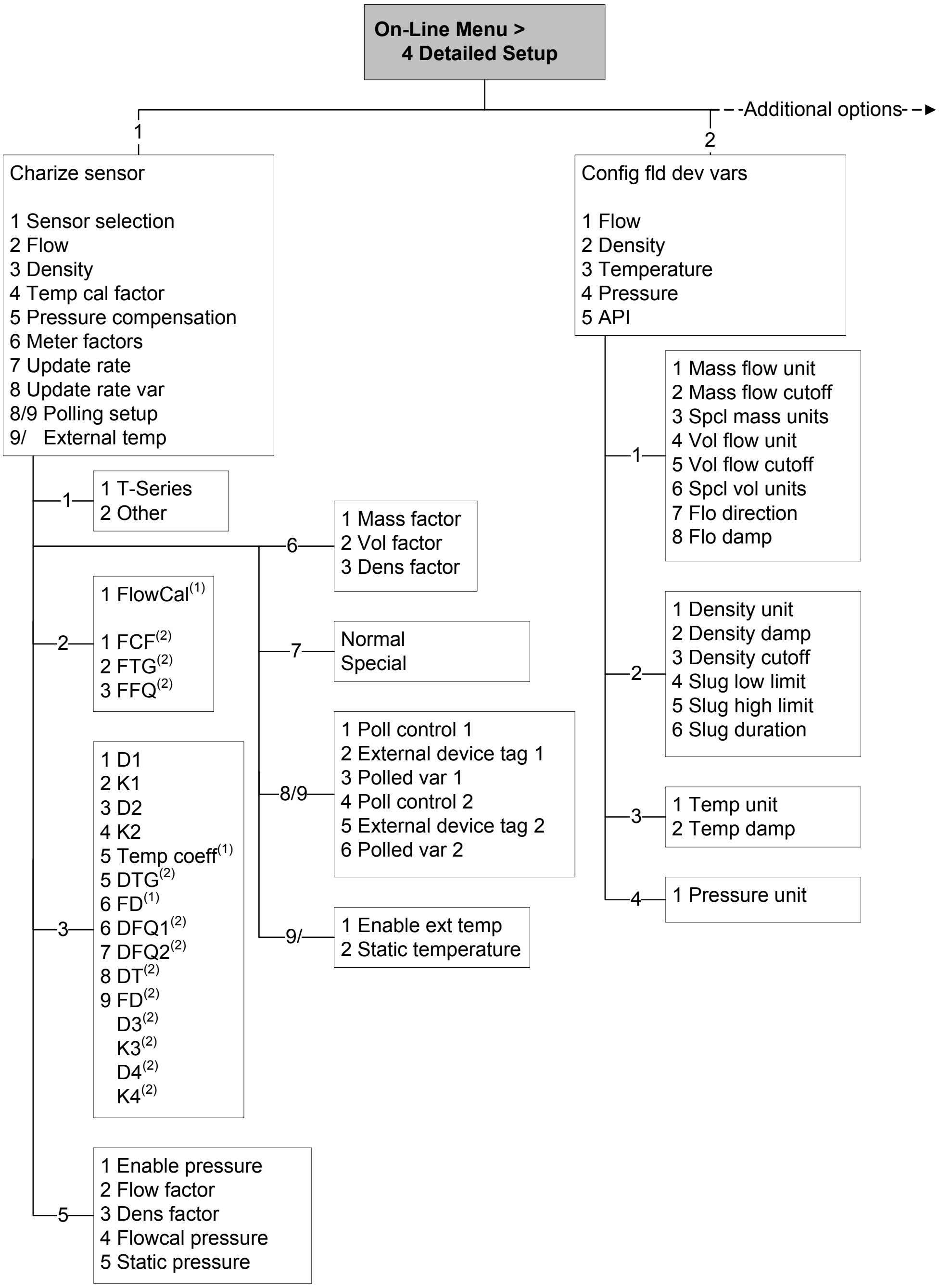


Figure C-9 Communicator detailed setup menu *continued*

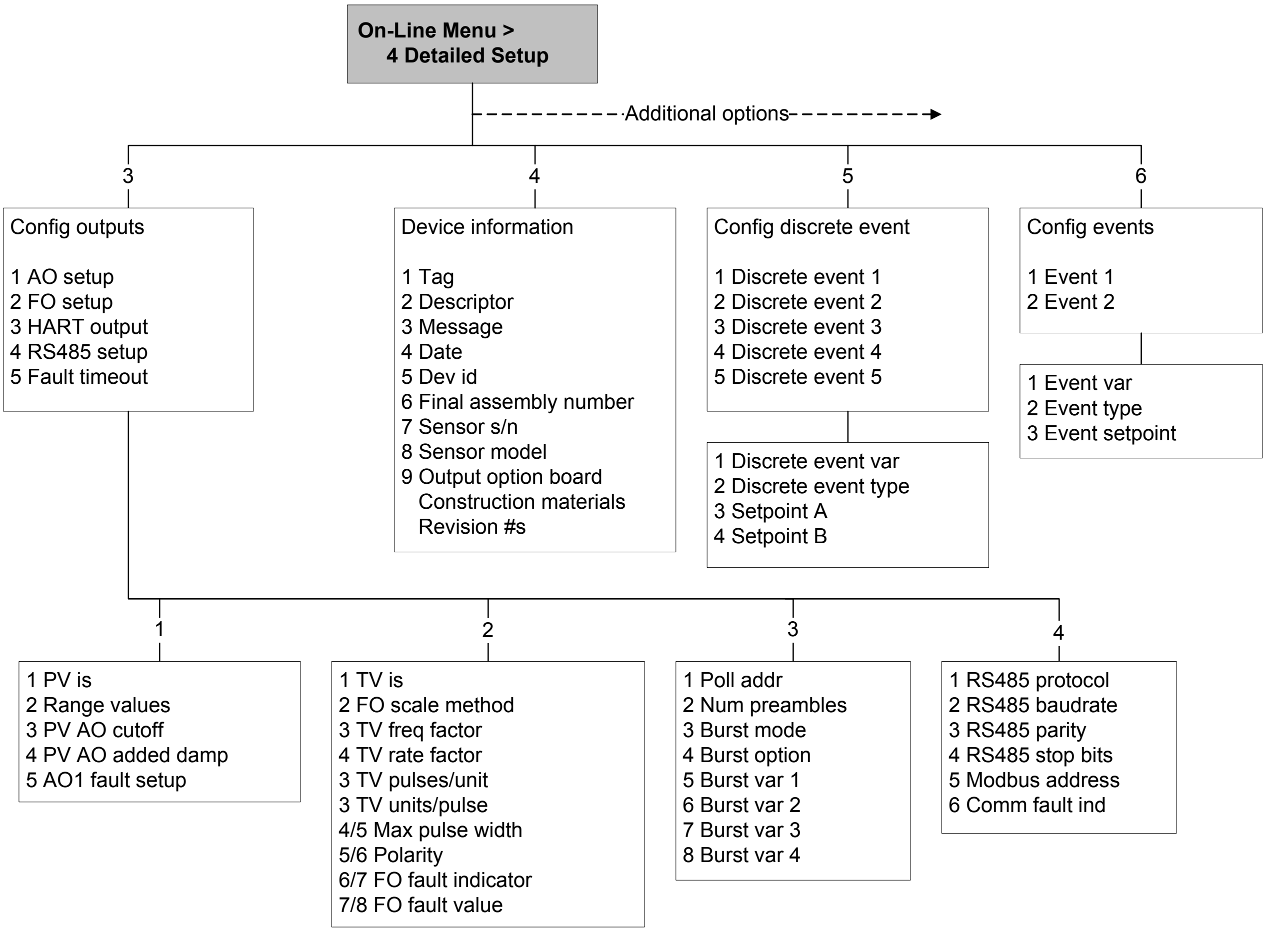
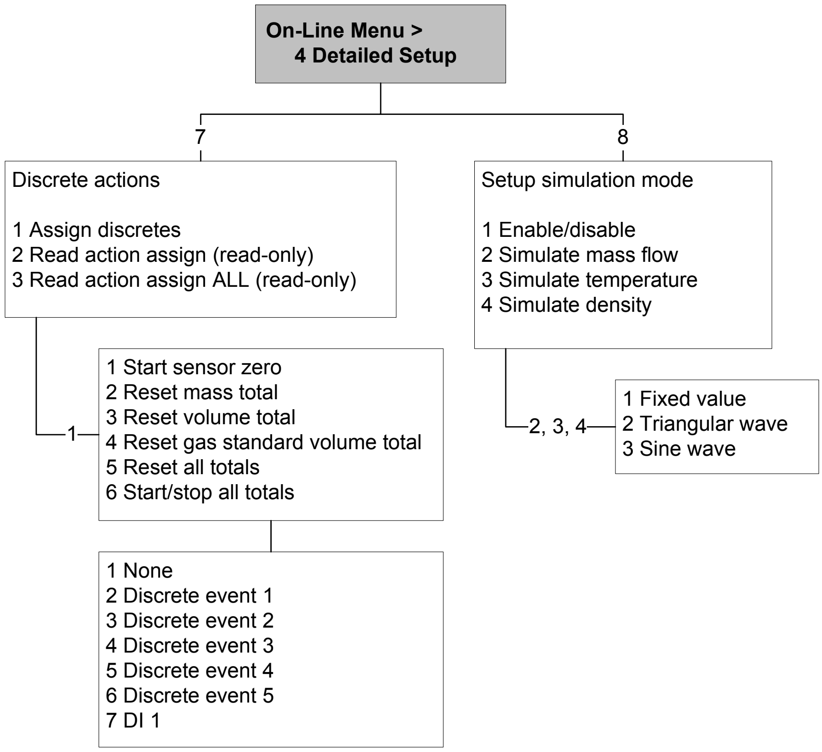


Figure C-10 Communicator detailed setup menu *continued*



Appendix D
Menu Flowcharts – Model 2500 CIO Transmitters

D.1 Overview

This appendix provides the following menu flowcharts for the Model 2500 CIO transmitter:

- ProLink II menus
  - Main menu – Figure D-1
  - Configuration menus – Figures D-2 through D-4
- Communicator 375 menus
  - Process variables menu – Figure D-5
  - Diagnostics/service menu – Figure D-6
  - Basic setup menu – Figure D-7
  - Detailed setup menu – Figures D-8 through D-10

D.2 Version information

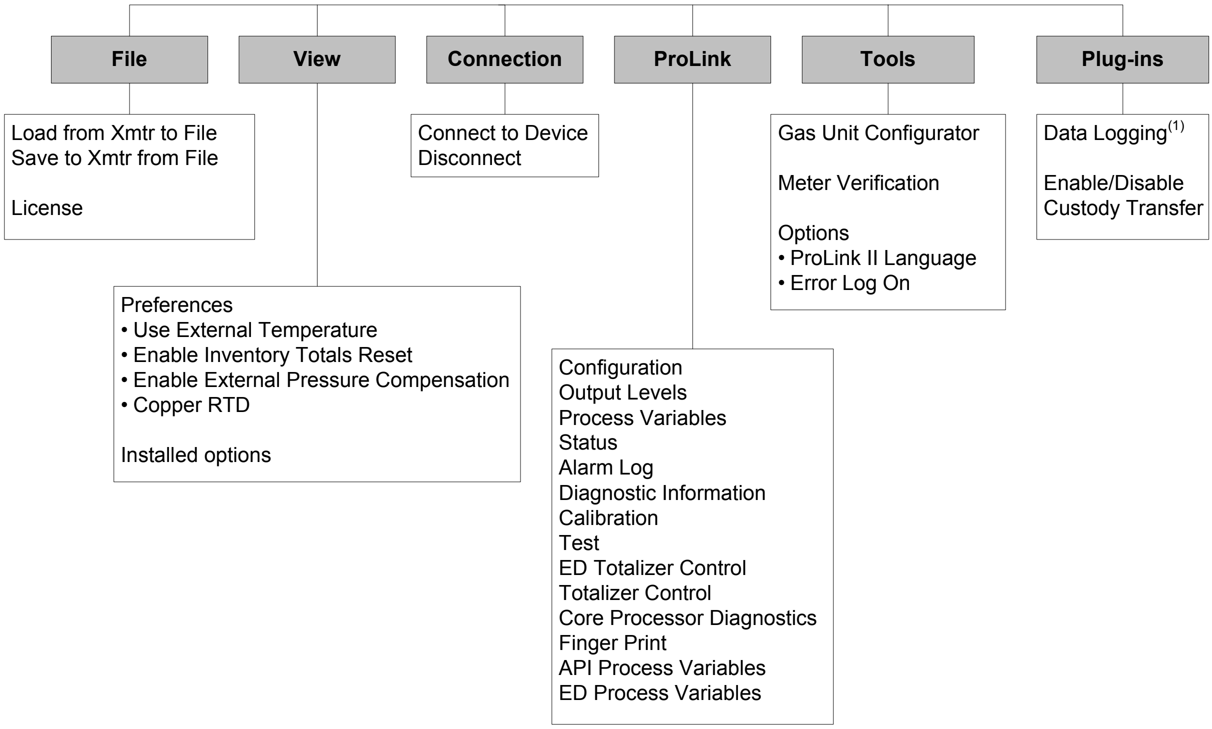
These menus flowcharts are based on:

- Transmitter software rev5.0
- Enhanced core processor software v3.2
- ProLink II v2.5
- 375 Field Communicator device rev 5, DD rev 1

Menus may vary slightly for different versions of these components.

D.3 ProLink II menus

Figure D-1 ProLink II main menu



(1) For information about using Data Logger, refer to the ProLink II manual.

Figure D-2 ProLink II configuration menu

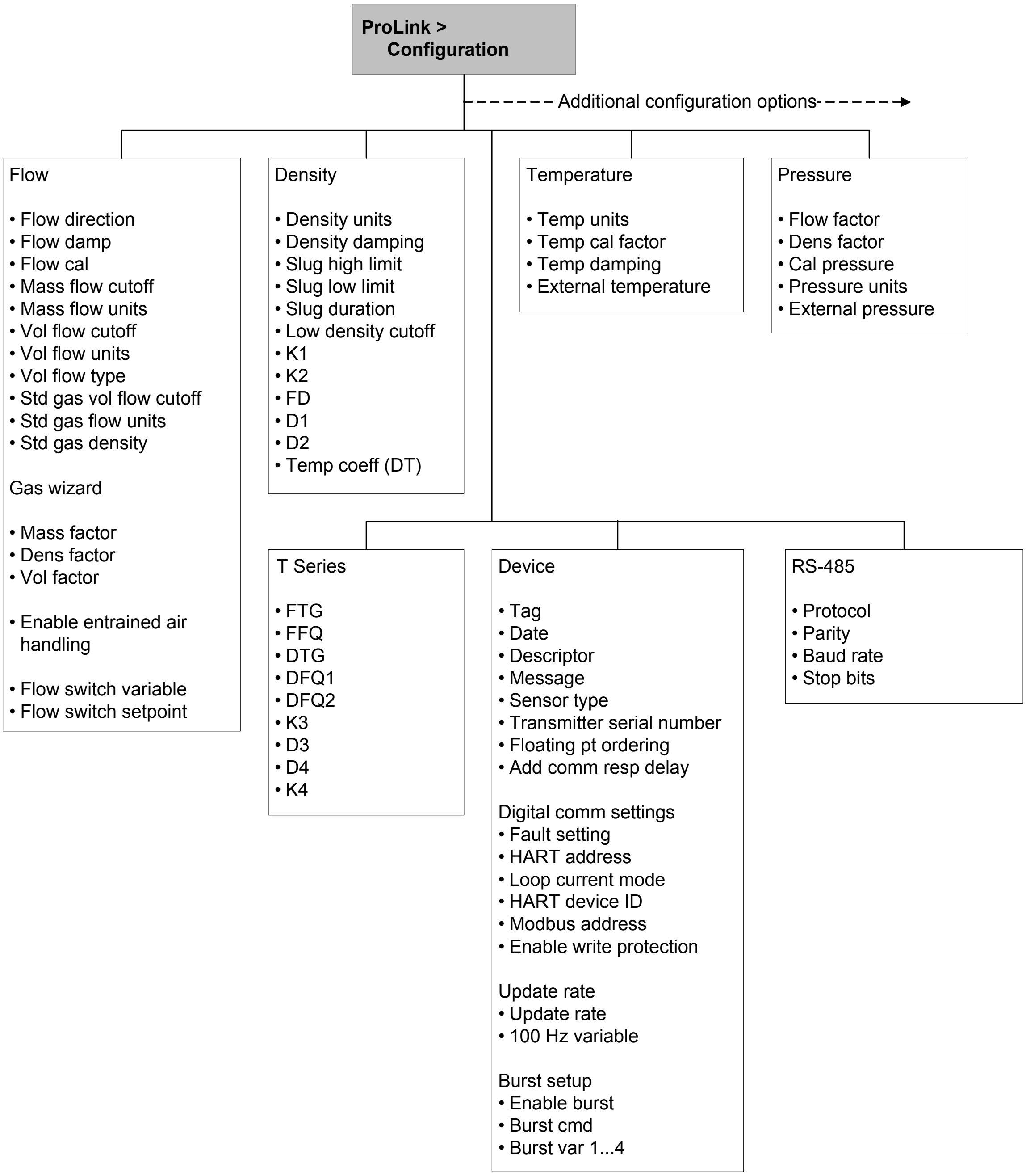


Figure D-3 ProLink II configuration menu *continued*

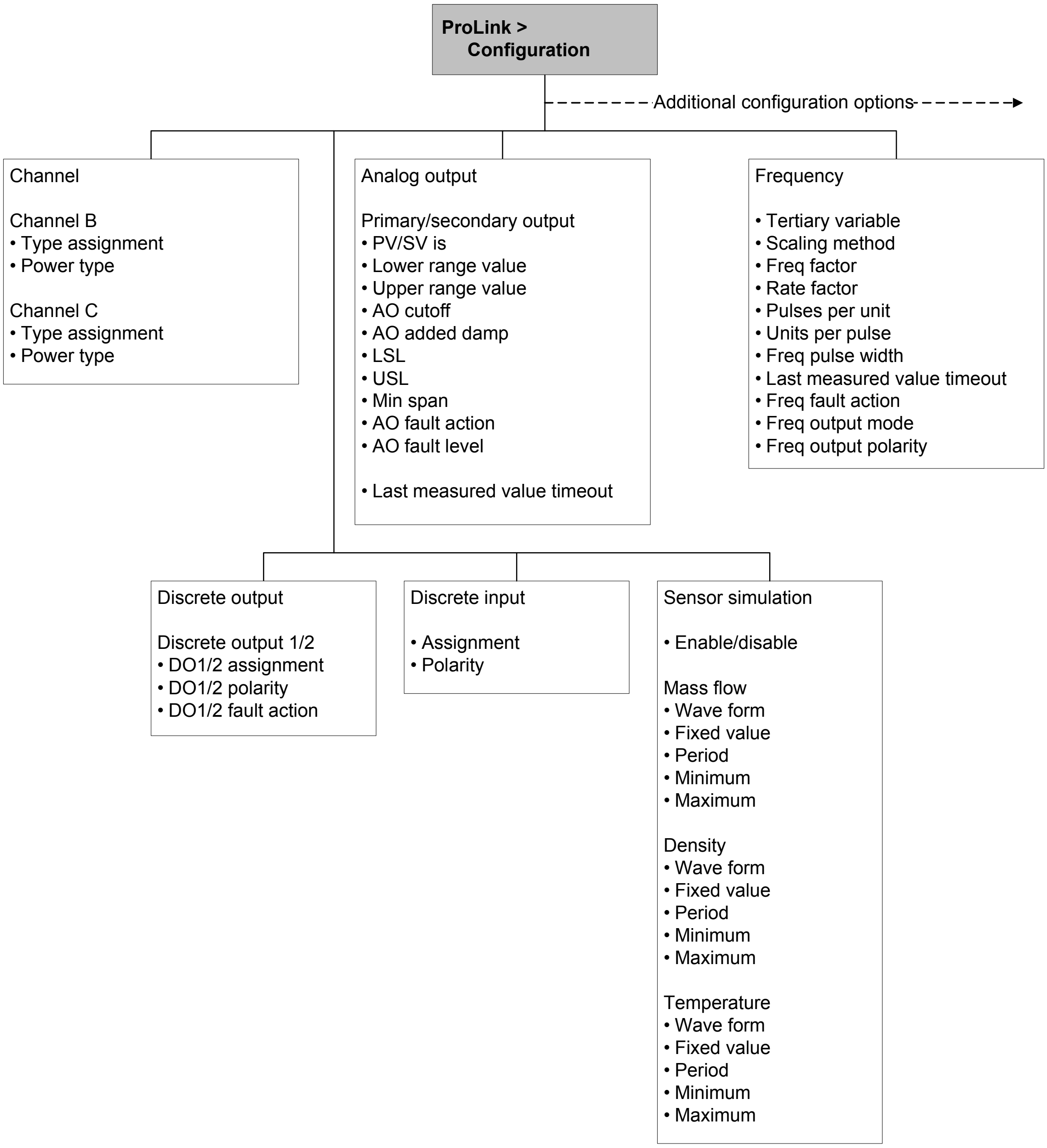
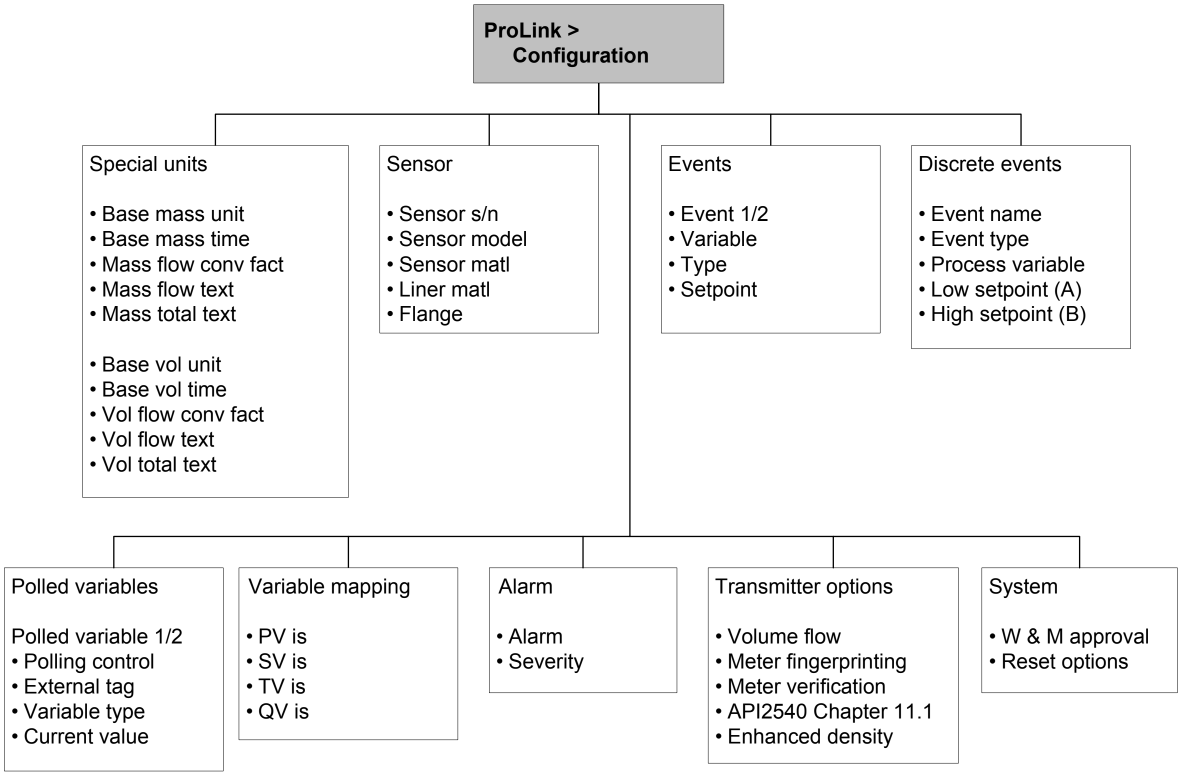
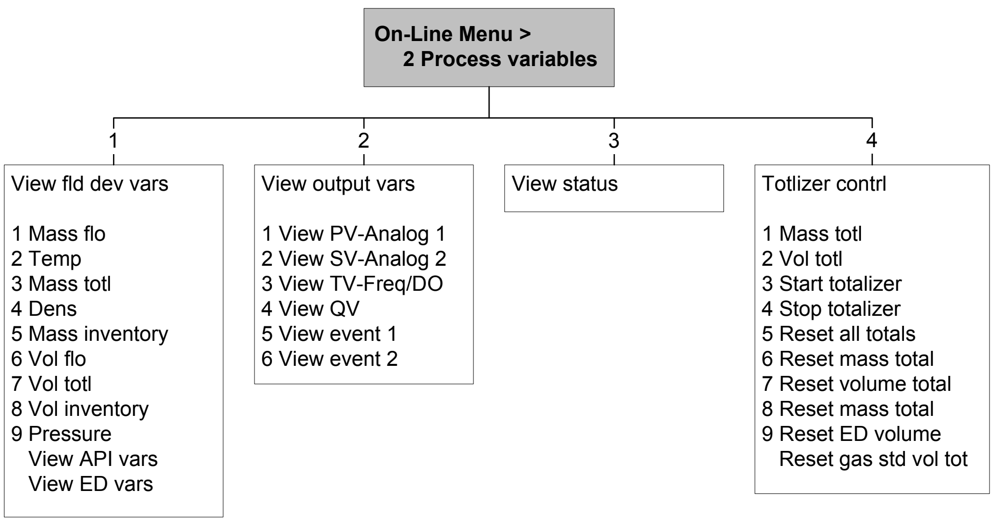


Figure D-4 ProLink II configuration menu *continued*



D.4 Communicator menus

Figure D-5 Communicator process variables menu



Defaults
Diagrams
Model 1500 AN
Model 2500 CIO

Figure D-6 Communicator diagnostics/service menu

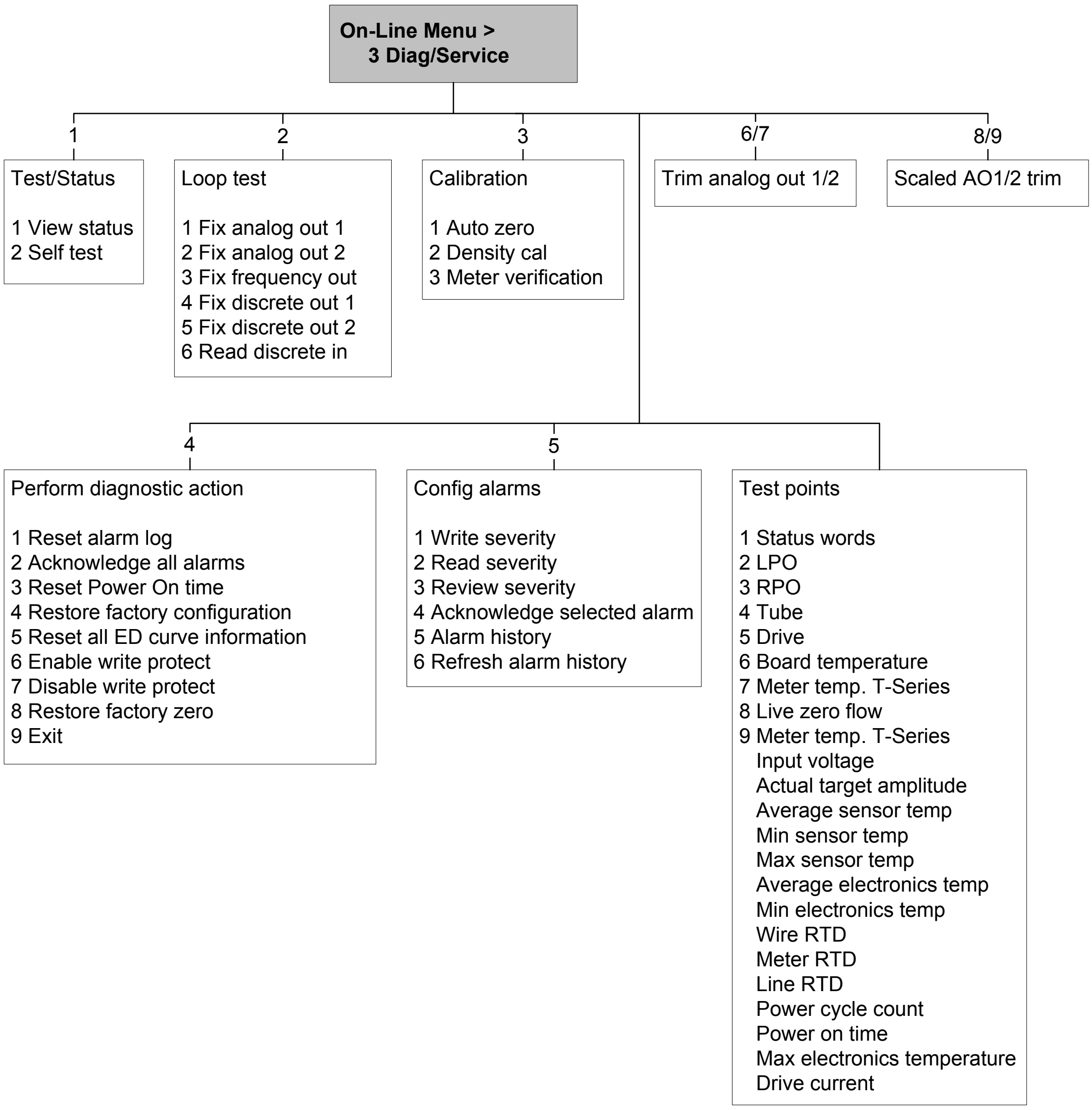


Figure D-7 **Communicator basic setup menu**

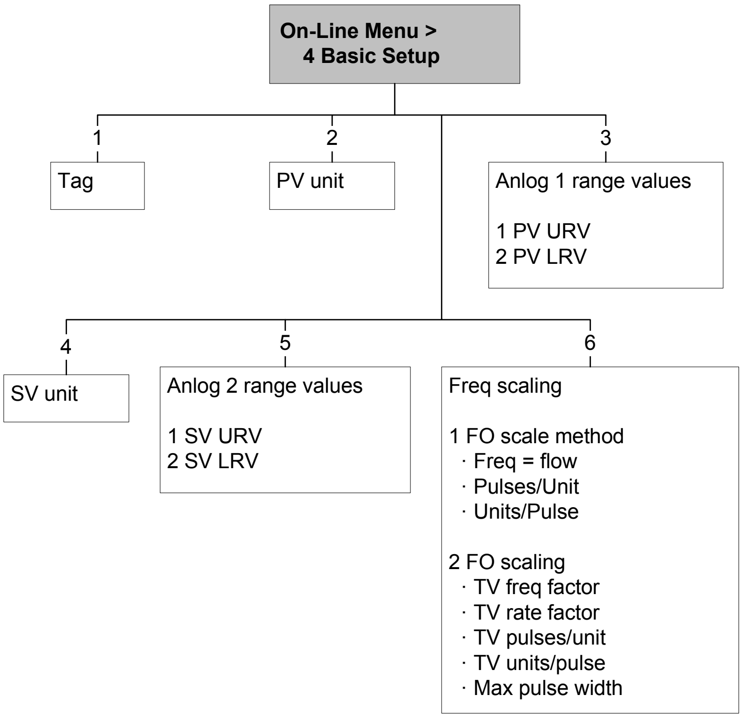


Figure D-8 Communicator detailed setup menu

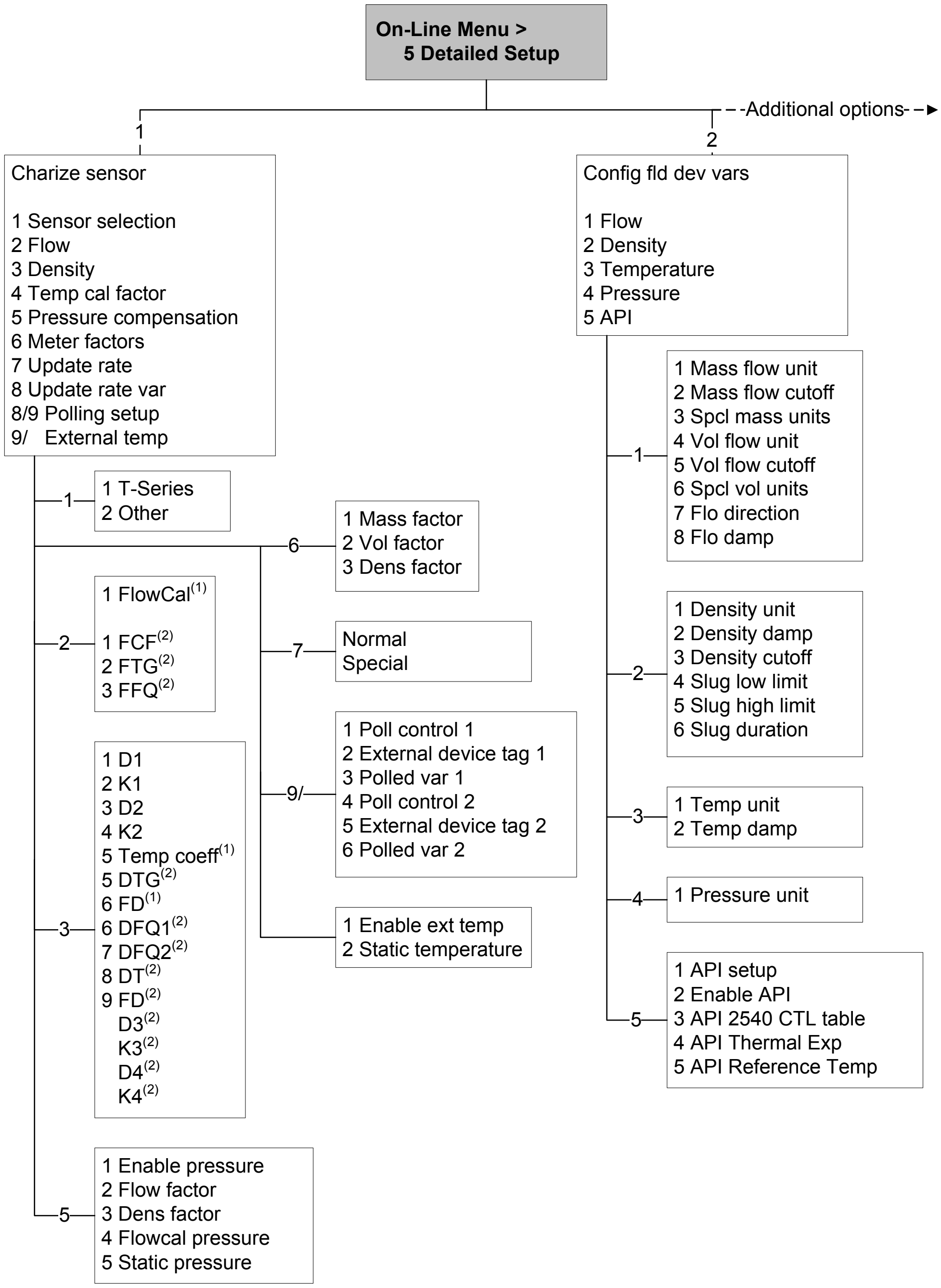


Figure D-9 Communicator detailed setup menu *continued*

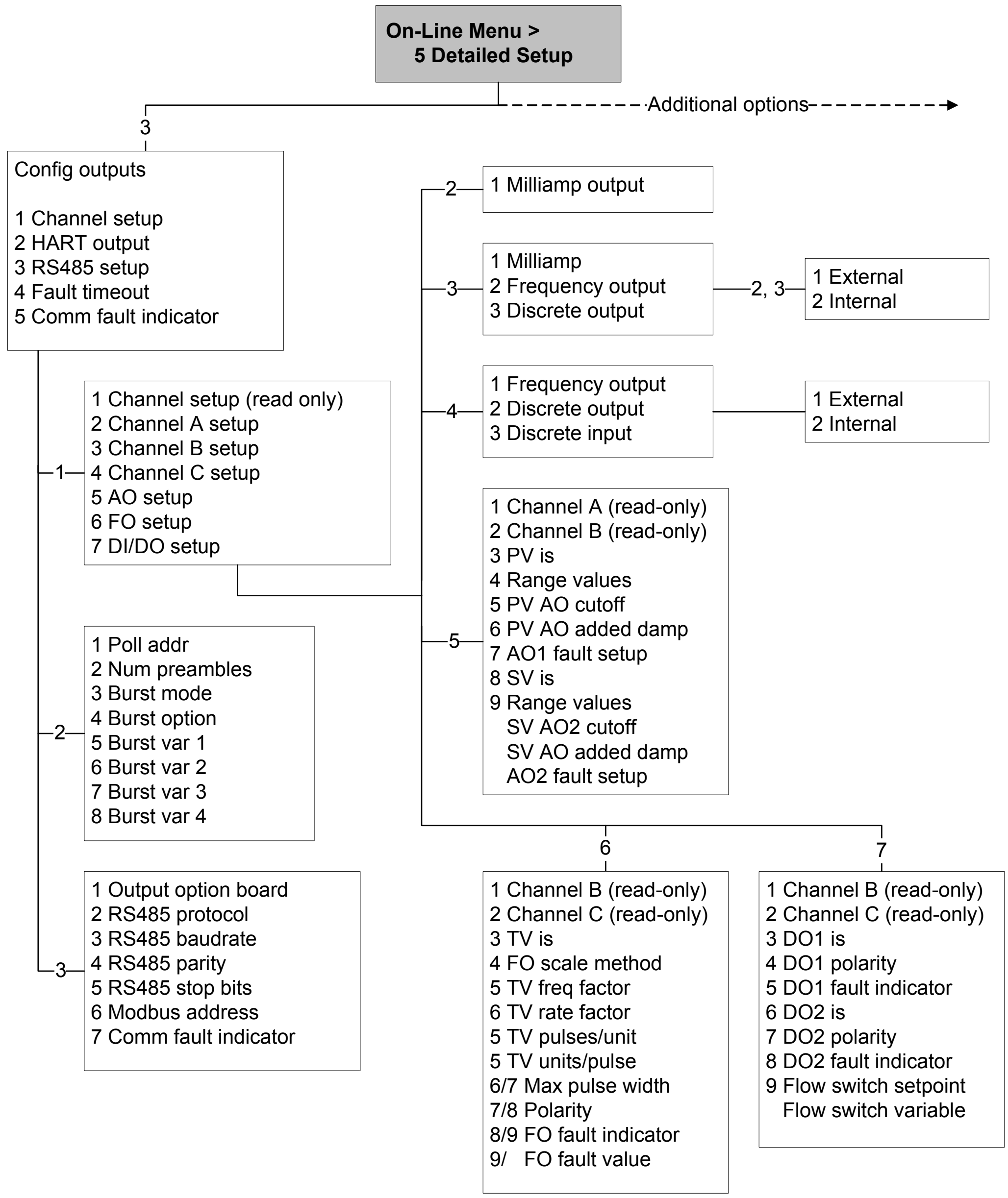
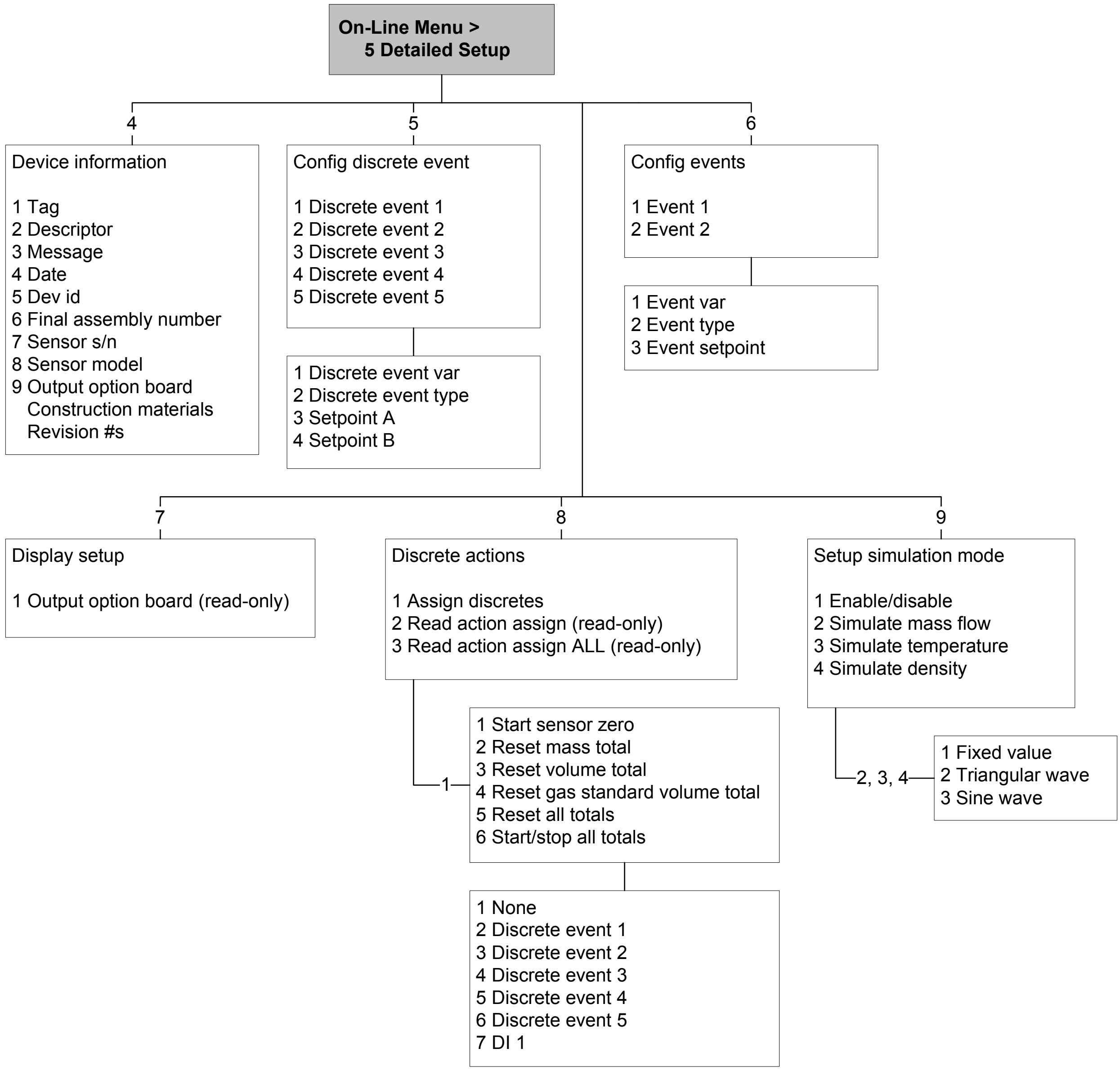


Figure D-10 Communicator detailed setup menu *continued*



Appendix E
Menu Flowcharts – Model 1700/2700 AN Transmitters

E.1 Overview

This appendix provides the following menu flowcharts for the Model 1700/2700 AN transmitter:

- ProLink II menus
  - Main menu – Figure E-1
  - Configuration menu – Figures E-2 through E-4
- Communicator menus
  - Process variables menu – Figure E-5
  - Diagnostics/service menu – Figure E-6
  - Basic setup menu – Figure E-7
  - Detailed setup menu – Figures E-8 through E-8
- Display menus
  - Managing totalizers and inventories – Figure E-11
  - Off-line menu, top level – Figure E-12
  - Off-line menu: Alarms – Figure E-13
  - Off-line maintenance menu: Version information – Figure E-14
  - Off-line maintenance menu: Configuration – Figures E-15 and E-16
  - Off-line maintenance menu: Simulation (loop testing) – Figure E-17
  - Off-line maintenance menu: Zero – Figure E-18
  - Off-line maintenance menu: Meter verification – Figure E-19

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

E.2 Version information

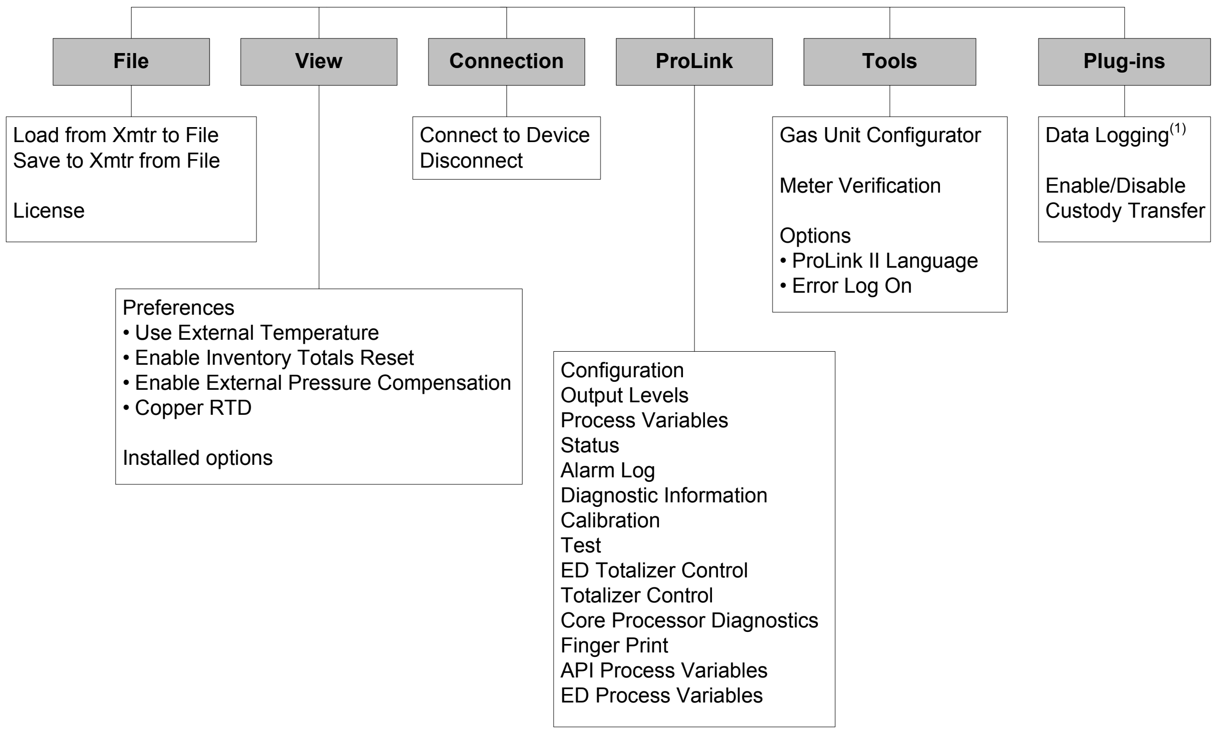
These menus flowcharts are based on:

- Transmitter software rev5.0
- Enhanced core processor software v3.2
- ProLink II v2.5
- 375 Field Communicator device rev 5, DD rev 1

Menus may vary slightly for different versions of these components. Some options (e.g., discrete output) may not apply to Model 1700 transmitters. Those options will be unavailable when using a Model 1700 transmitter.

E.3 ProLink II menus

Figure E-1 ProLink II main menu



(1) For information about using Data Logger, refer to the ProLink II manual.

Figure E-2 ProLink II configuration menu

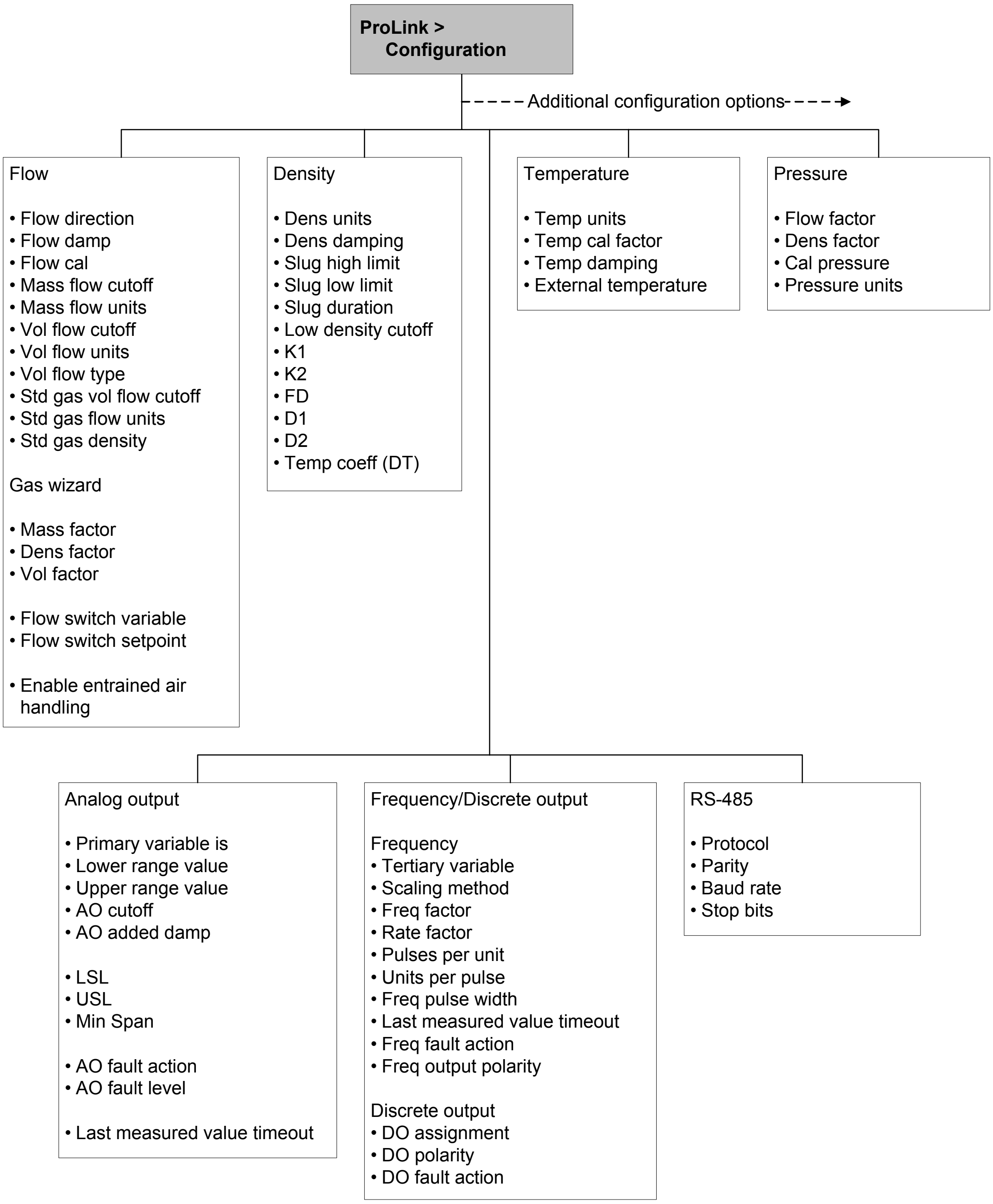


Figure E-3 ProLink II configuration menu *continued*

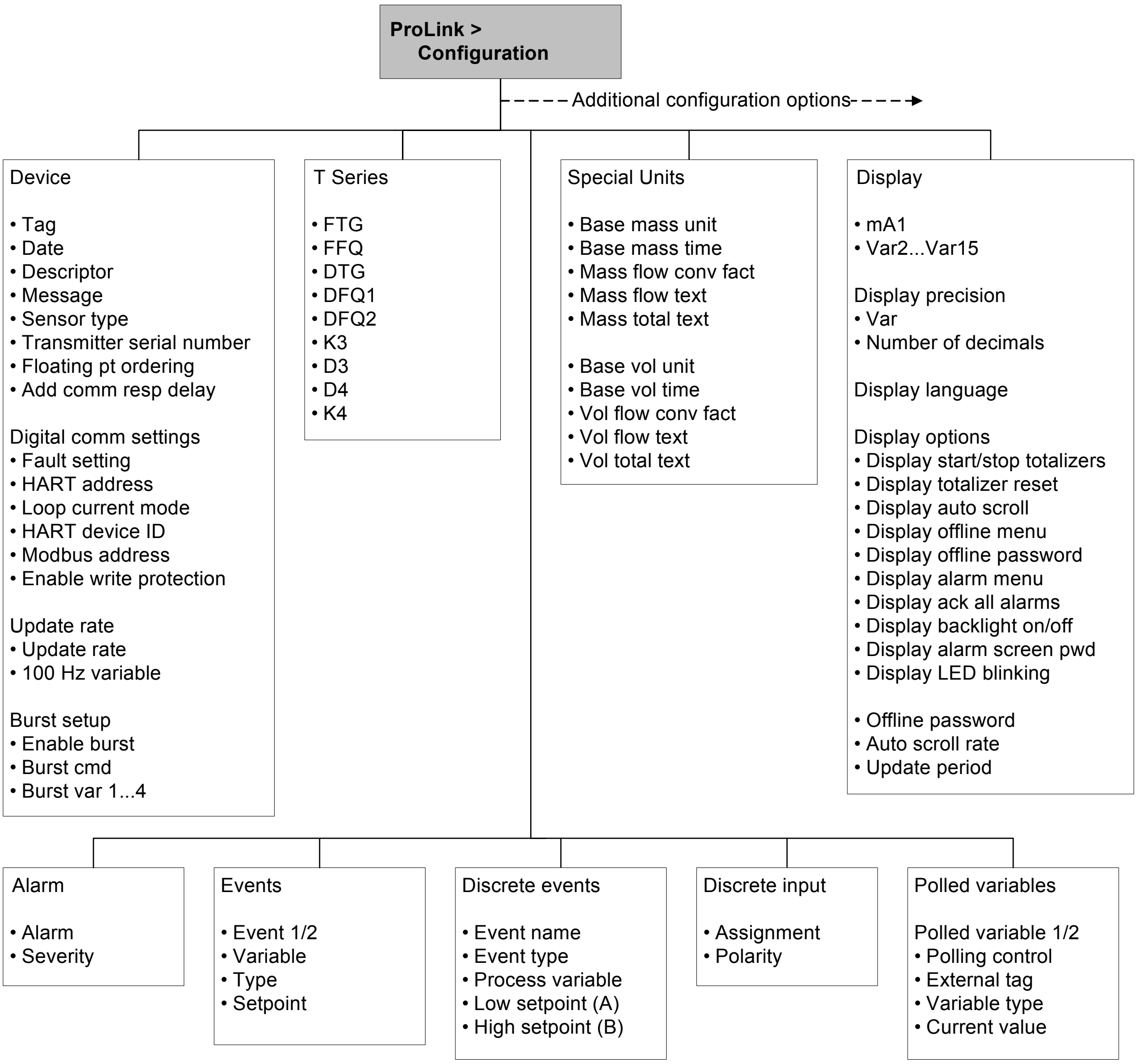
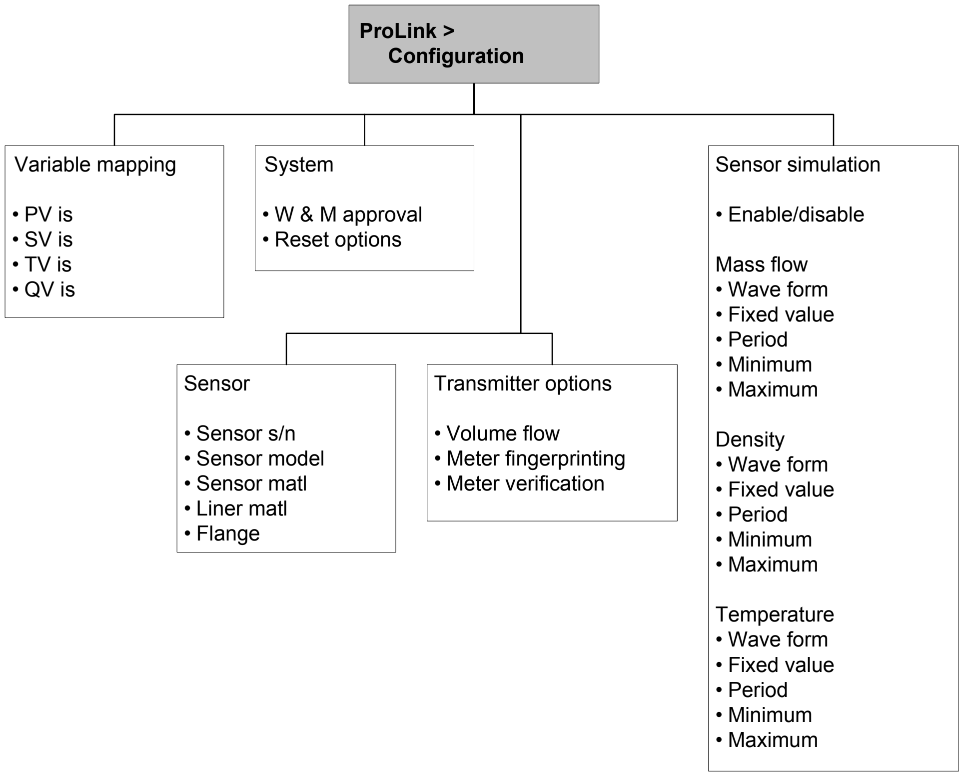


Figure E-4 ProLink II configuration menu *continued*



E.4 Communicator menus

Figure E-5 Communicator process variables menu

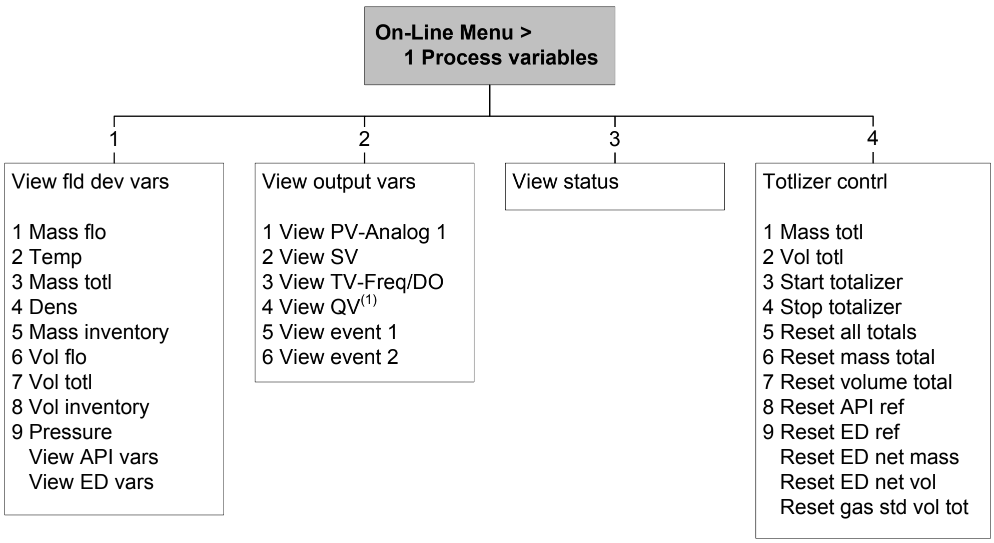


Figure E-6 Communicator diagnostics/service menu

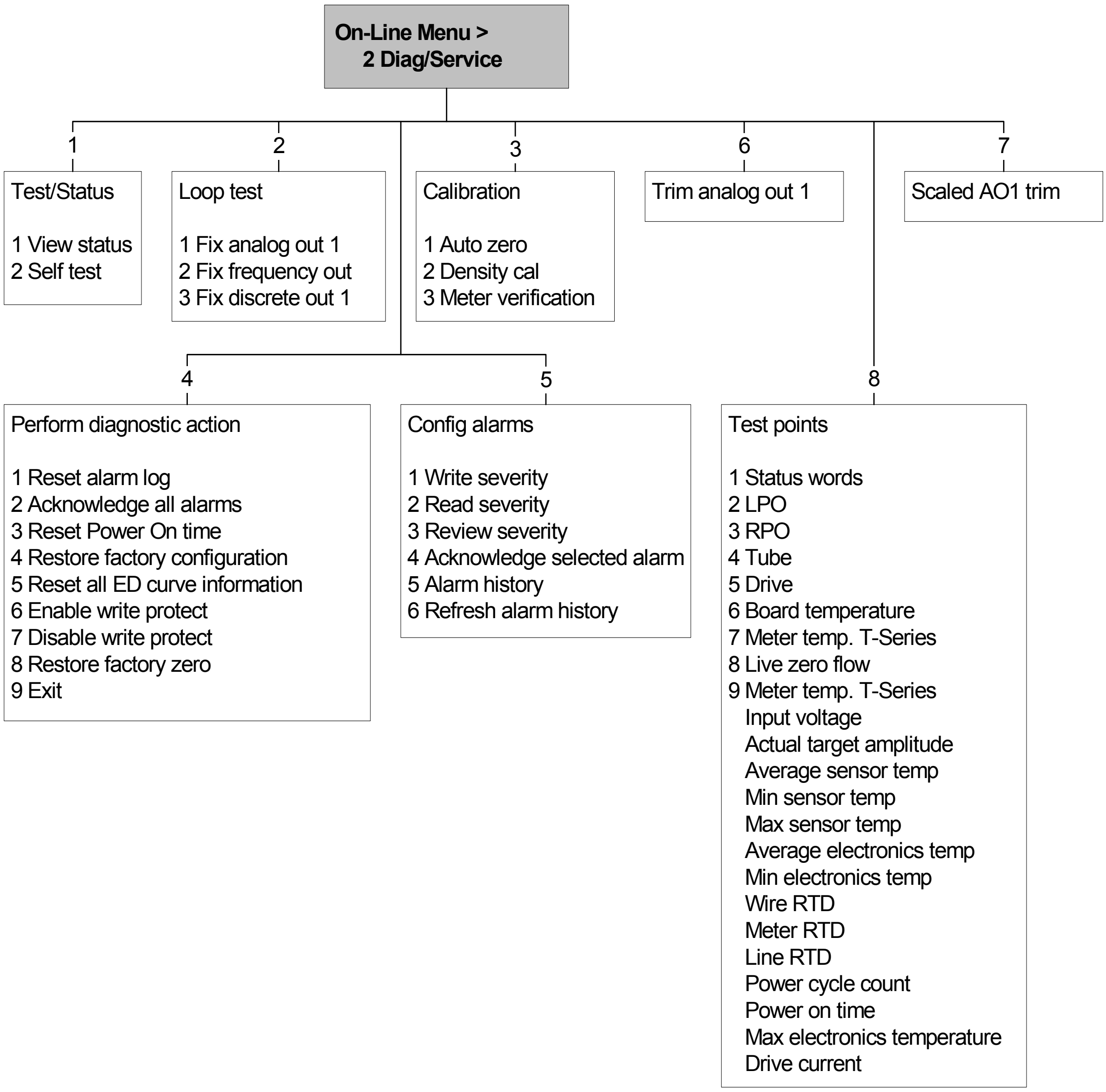


Figure E-7 Communicator basic setup menu

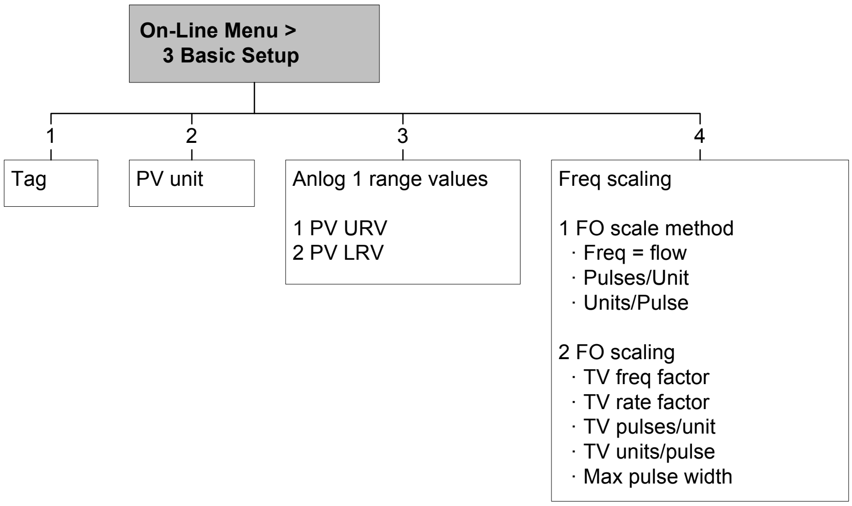
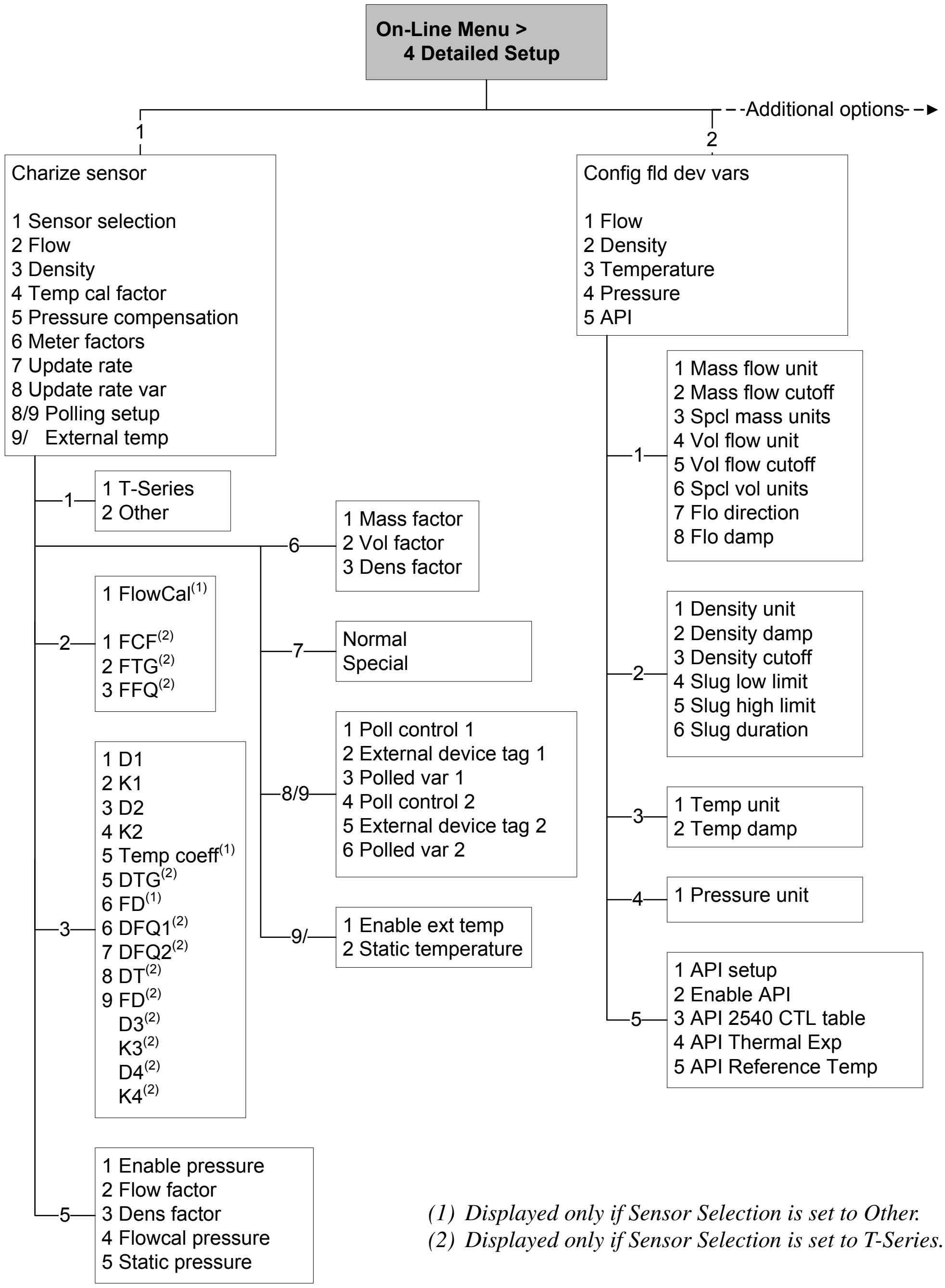


Figure E-8 Communicator detailed setup menu



(1) Displayed only if Sensor Selection is set to Other.
(2) Displayed only if Sensor Selection is set to T-Series.

Figure E-9 Communicator detailed setup menu *continued*

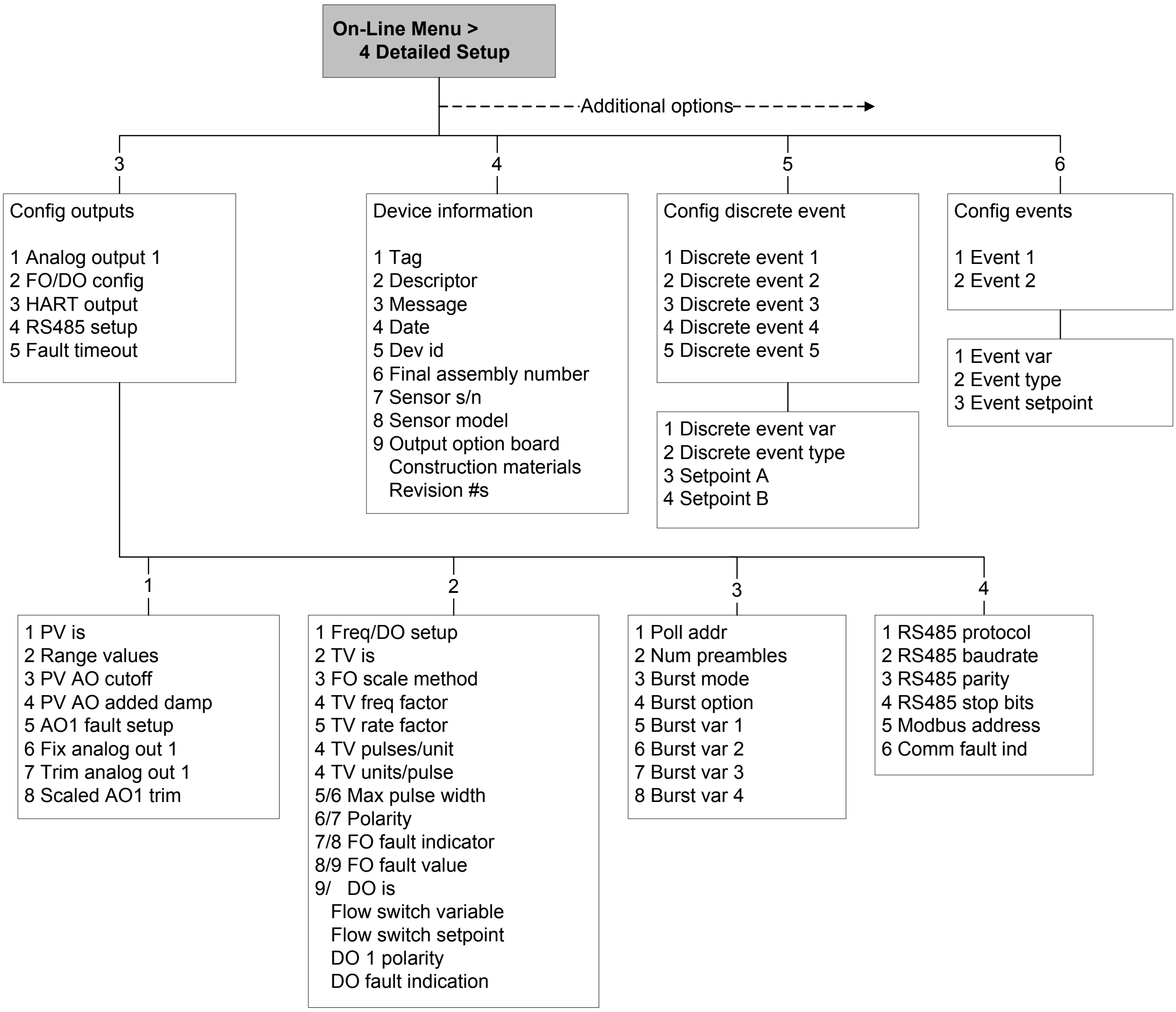
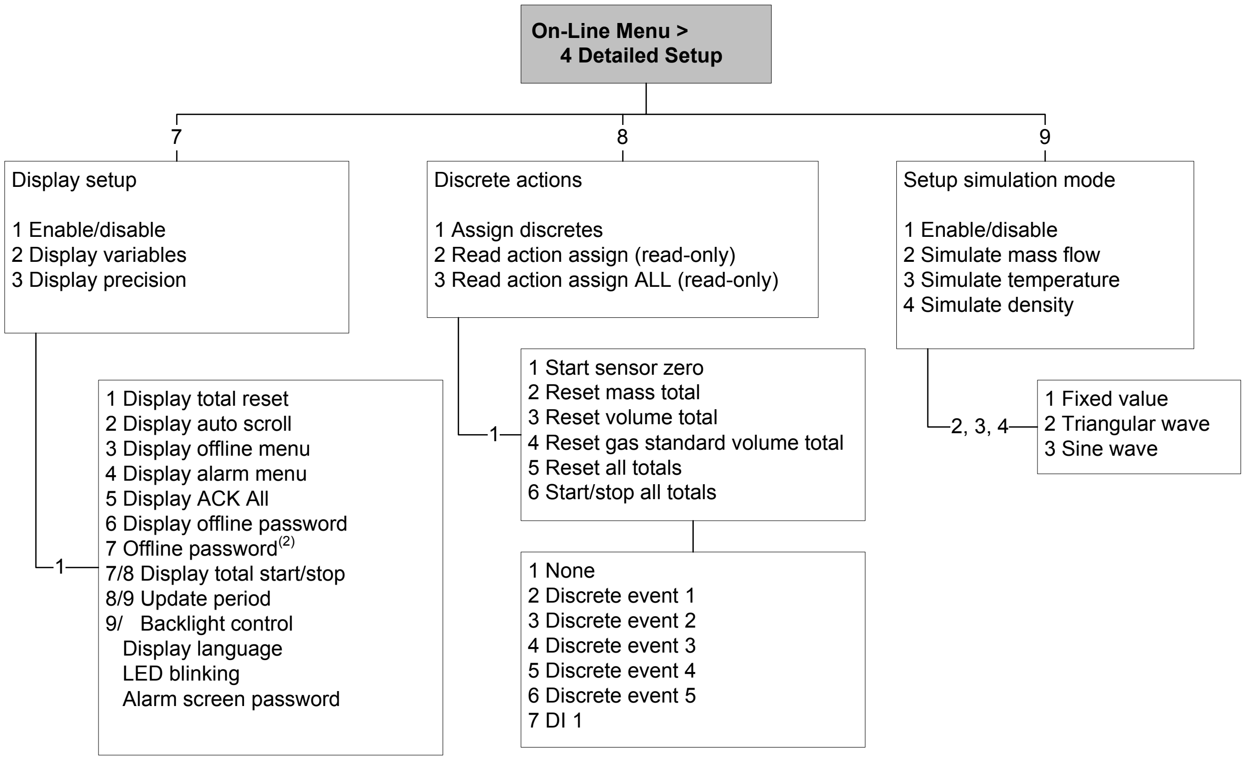
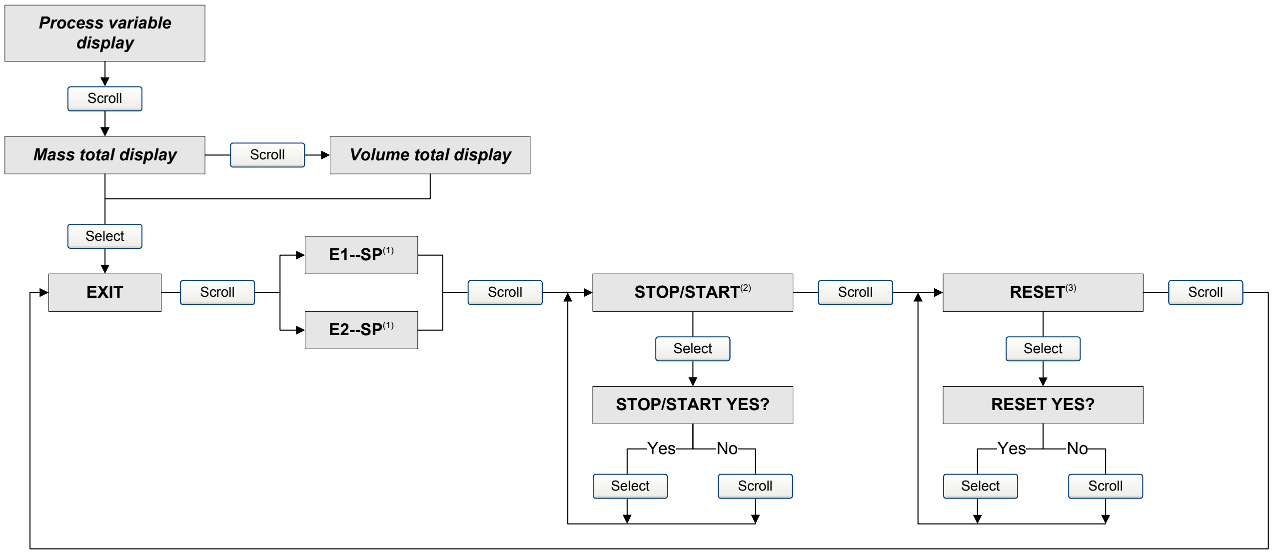


Figure E-10 Communicator detailed setup menu *continued*



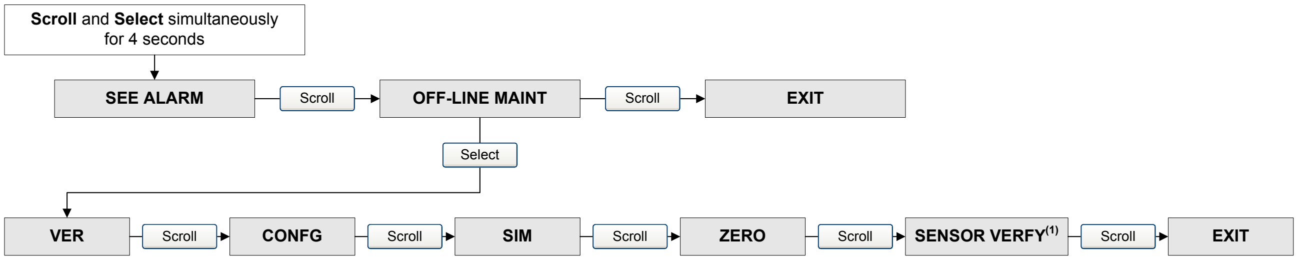
E.5 Display menus

Figure E-11 Display menu – Managing totalizers and inventories



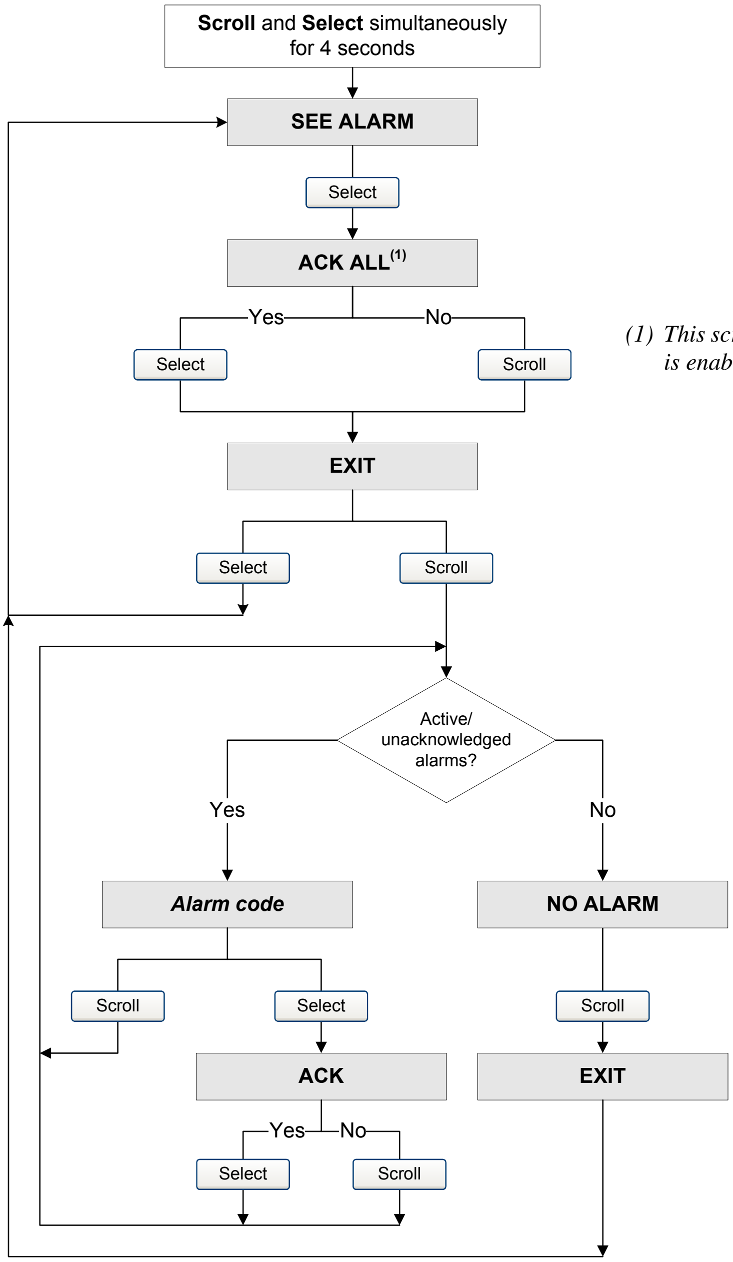
(1) *The Event Setpoint screens can be used to define or change the setpoint for Event 1 or Event 2 in the single-setpoint event model. These screens are displayed only if the event is defined on mass total or volume total. Note that this functionality does not apply to discrete events (the dual-setpoint event model). For more information, see Section 8.11.*
(2) *The transmitter must be configured to allow starting and stopping totalizers from the display.*
(3) *The transmitter must be configured to allow resetting totalizers from the display.*

Figure E-12 Display menu – Off-line menu, top level



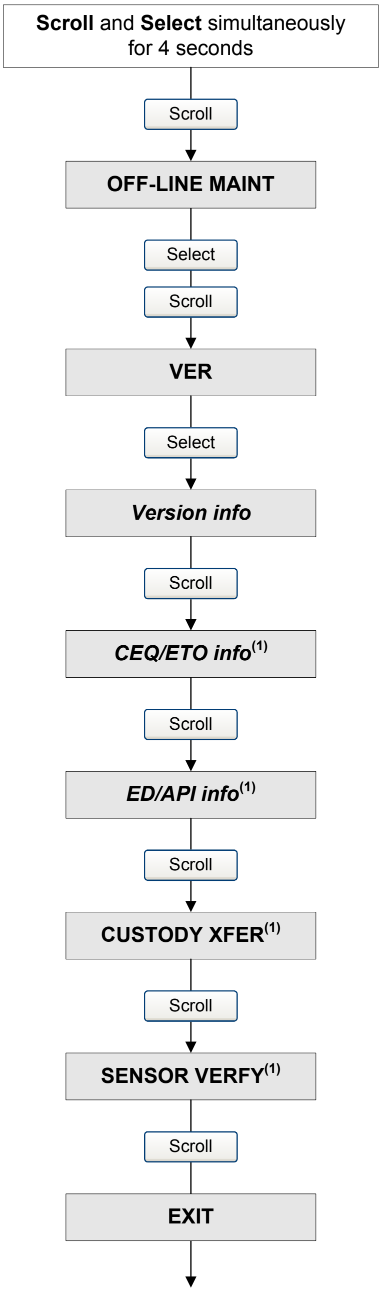
(1) *This option is displayed only if the transmitter is connected to an enhanced core processor and the meter verification software is installed on the transmitter.*

Figure E-13 Display – Alarms



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

Figure E-14 Display menu – Off-line maintenance: Version information



(1) The option is displayed only if the corresponding CEQ/ETO or application is installed on the transmitter.

Figure E-15 Display menu – Off-line maintenance: – Configuration

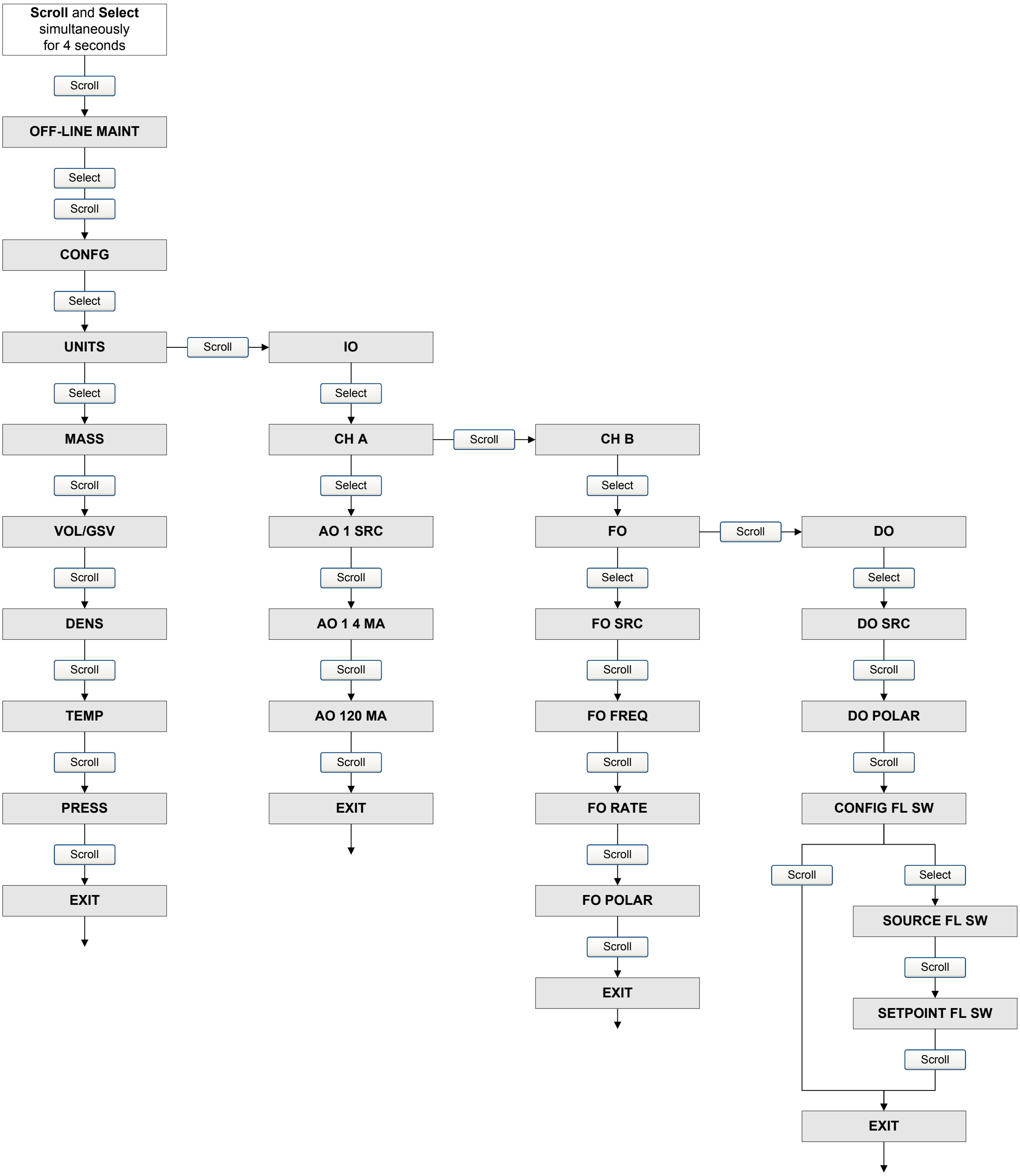
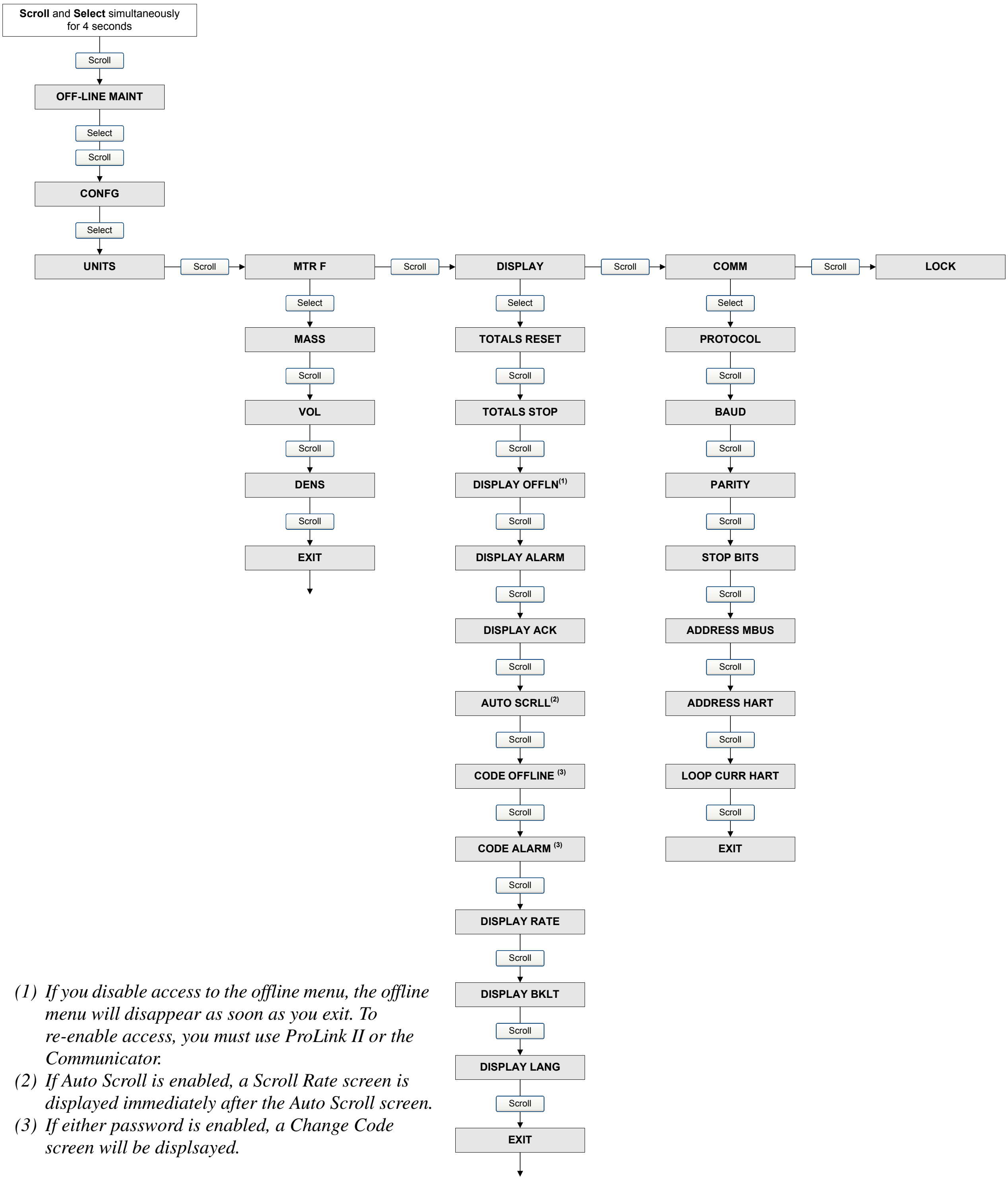


Figure E-16 Display menu – Off-line maintenance: Configuration *continued*

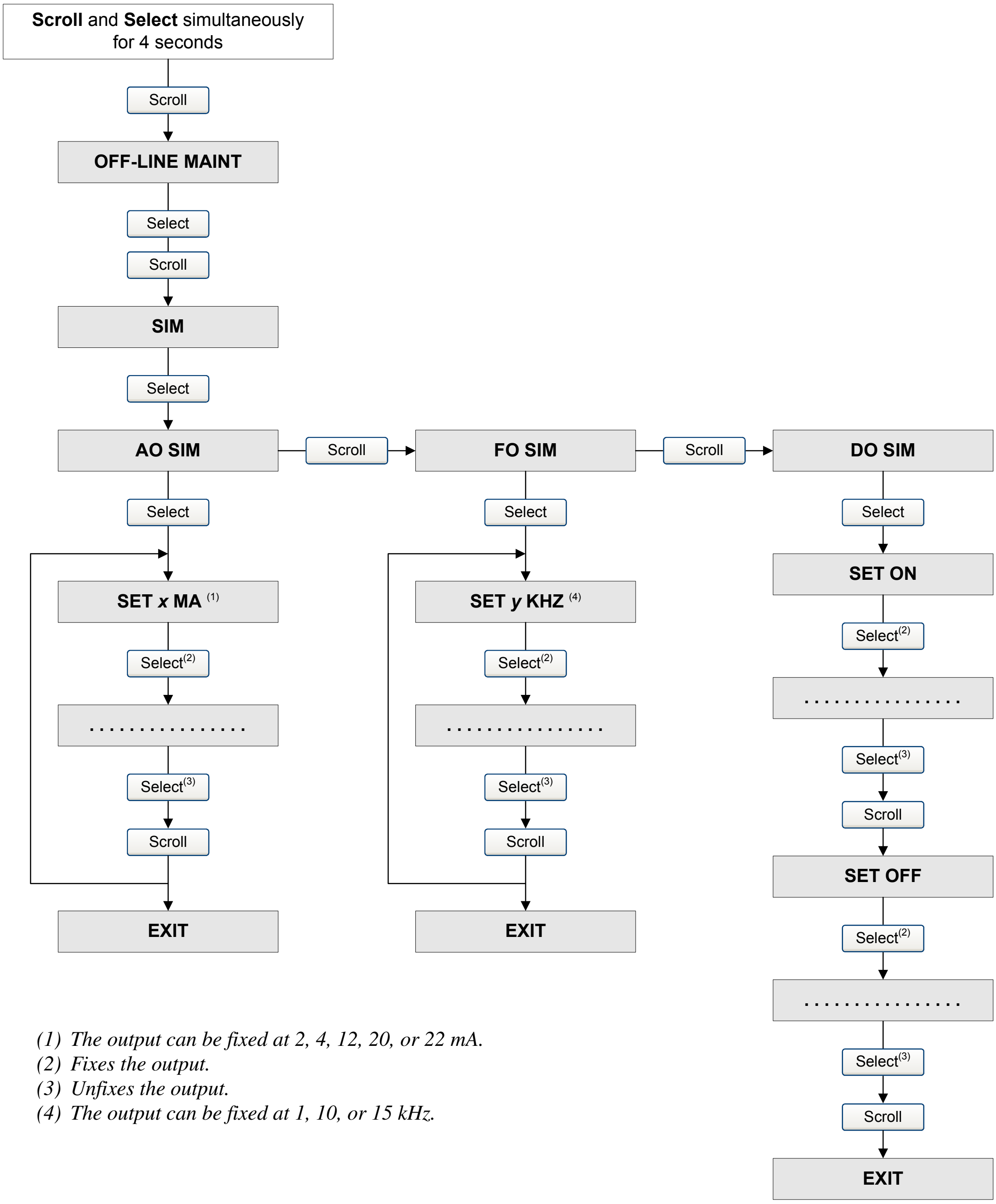


(1) If you disable access to the offline menu, the offline menu will disappear as soon as you exit. To re-enable access, you must use ProLink II or the Communicator.

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

(3) If either password is enabled, a Change Code screen will be displsayed.

Figure E-17 **Display menu – Off-line maintenance: Simulation (loop testing)**



(1) The output can be fixed at 2, 4, 12, 20, or 22 mA.
(2) Fixes the output.
(3) Unfixes the output.
(4) The output can be fixed at 1, 10, or 15 kHz.

Figure E-18 Display menu – Off-line maintenance: Zero

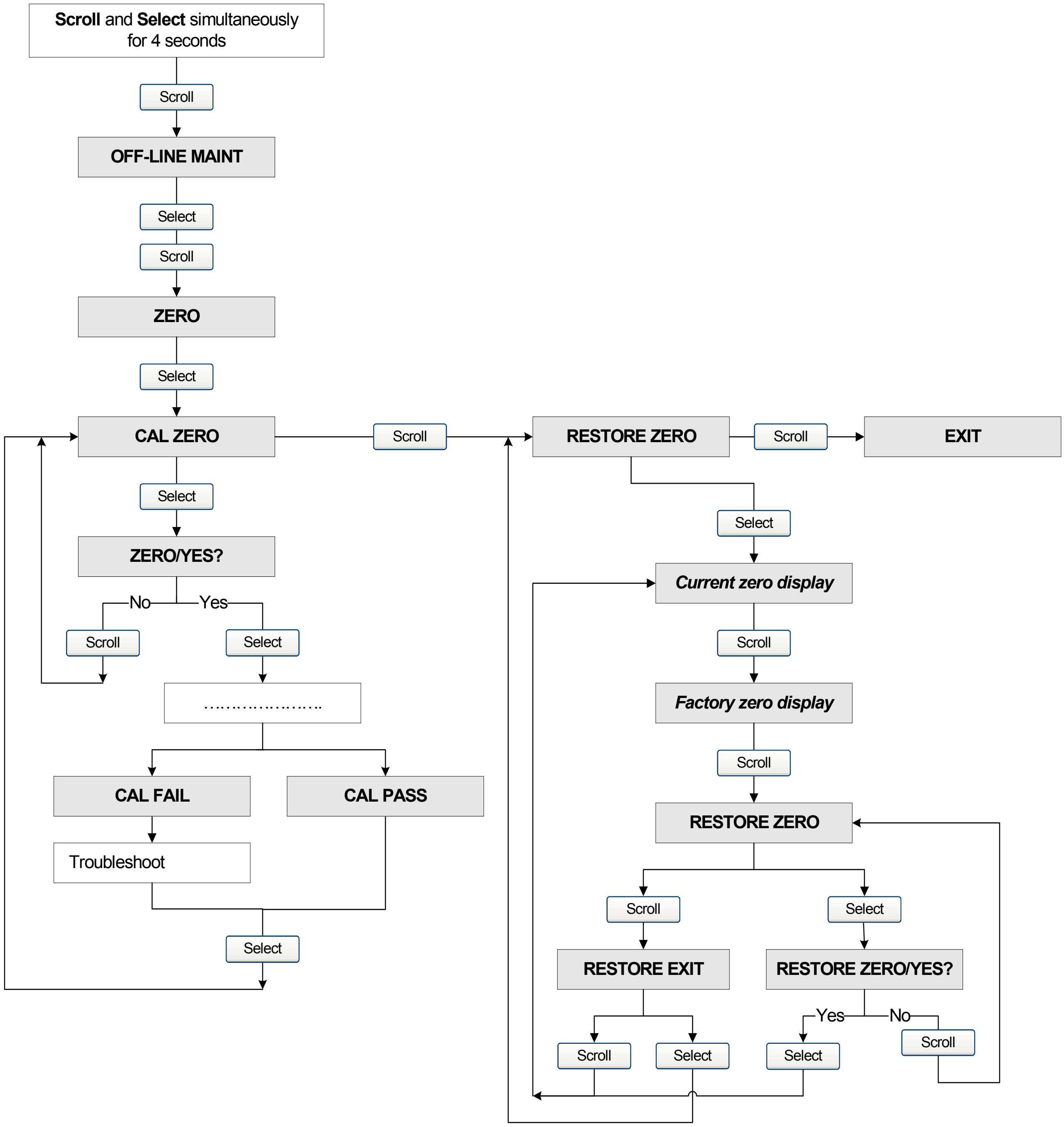
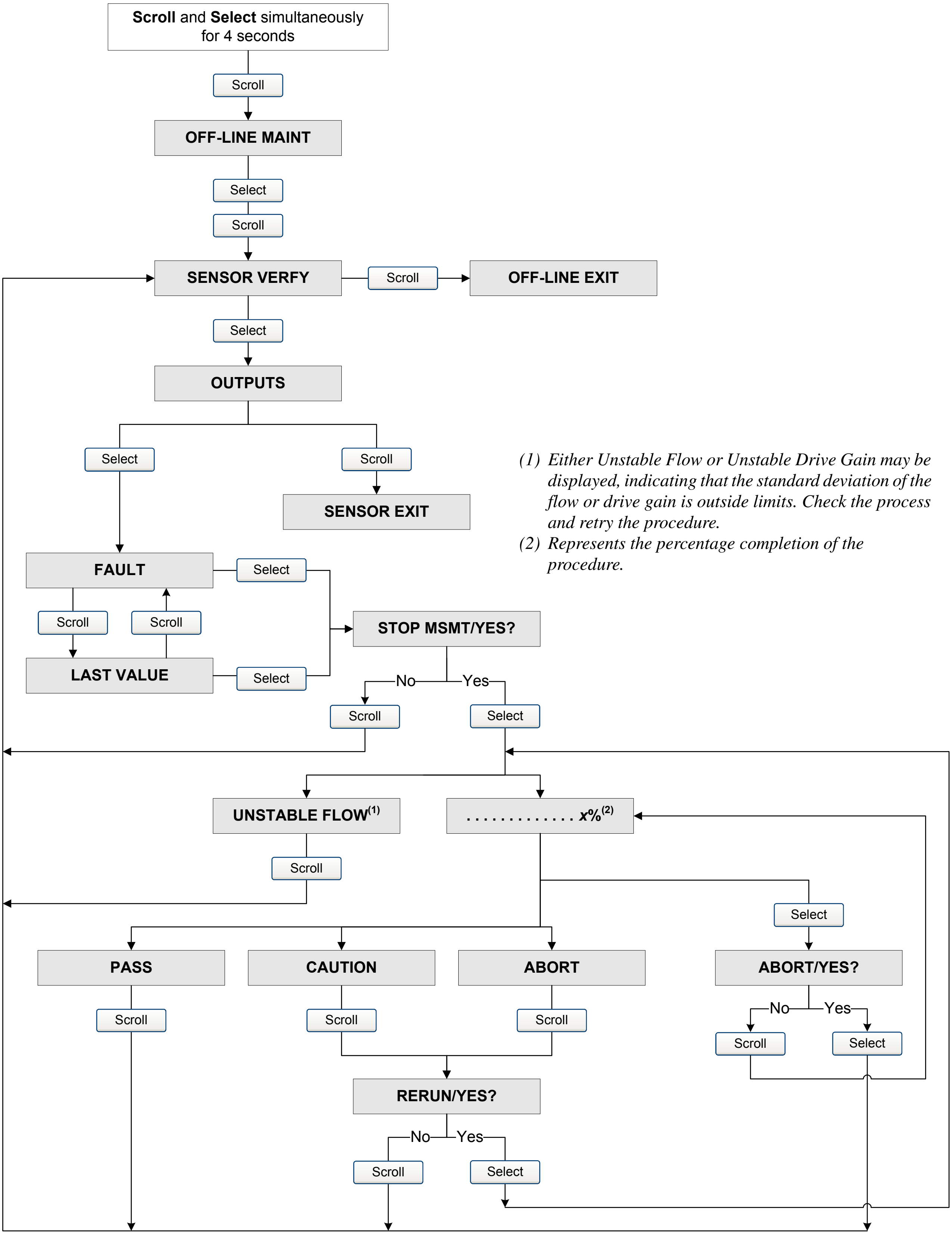


Figure E-19 **Display menu – Off-line maintenance: Meter verification**



(1) *Either Unstable Flow or Unstable Drive Gain may be displayed, indicating that the standard deviation of the flow or drive gain is outside limits. Check the process and retry the procedure.*

(2) *Represents the percentage completion of the procedure.*

Appendix F
Menu Flowcharts – Model 1700/2700 IS Transmitters

F.1 Overview

This appendix provides the following menu flowcharts for the Model 1700/2700 IS transmitter:

- ProLink II menus
  - Main menu – Figure F-1
  - Configuration menu – Figures F-2 through F-4
- Communicator menus
  - Process variables menu – Figure F-5
  - Diagnostics/service menu – Figure F-6
  - Basic setup menu – Figure F-7
  - Detailed setup menu – Figures F-8 through F-10
- Display menus
  - Managing totalizers and inventories – Figure F-11
  - Off-line menu, top level – Figure F-12
  - Off-line menu: Alarms – Figure F-13
  - Off-line maintenance menu: Version information – Figure F-14
  - Off-line maintenance menu: Configuration – Figures F-15 and F-16
  - Off-line maintenance menu: Simulation (loop testing) – Figure F-17
  - Off-line maintenance menu: Zero – Figure F-18
  - Off-line maintenance menu: Meter verification – see Figure F-19

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

F.2 Version information

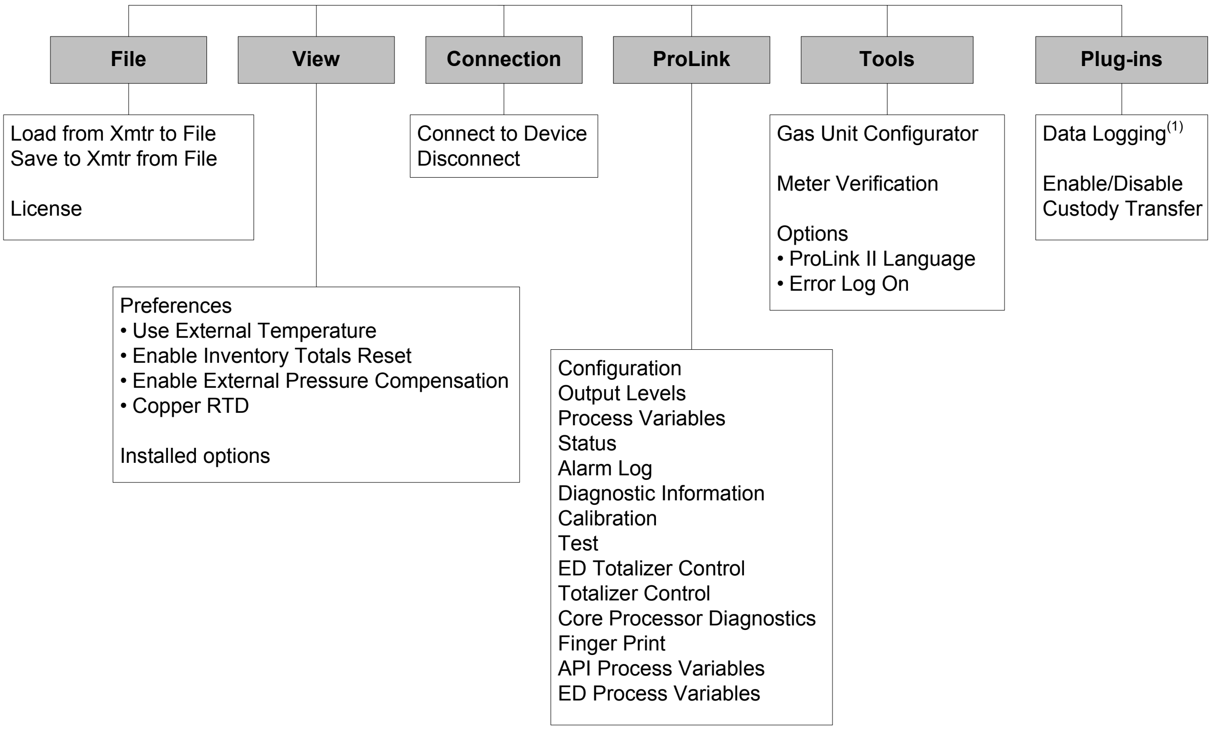
These menus flowcharts are based on:

- Transmitter software rev5.0
- Enhanced core processor software v3.2
- ProLink II v2.5
- 375 Field Communicator device rev 5, DD rev 1

Menus may vary slightly for different versions of these components. Some options (e.g., discrete output) may not apply to Model 1700 transmitters. Those options will be unavailable when using a Model 1700 transmitter.

F.3 ProLink II menus

Figure F-1 ProLink II main menu



(1) For information about using Data Logger, refer to the ProLink II manual.

Figure F-2 ProLink II configuration menu

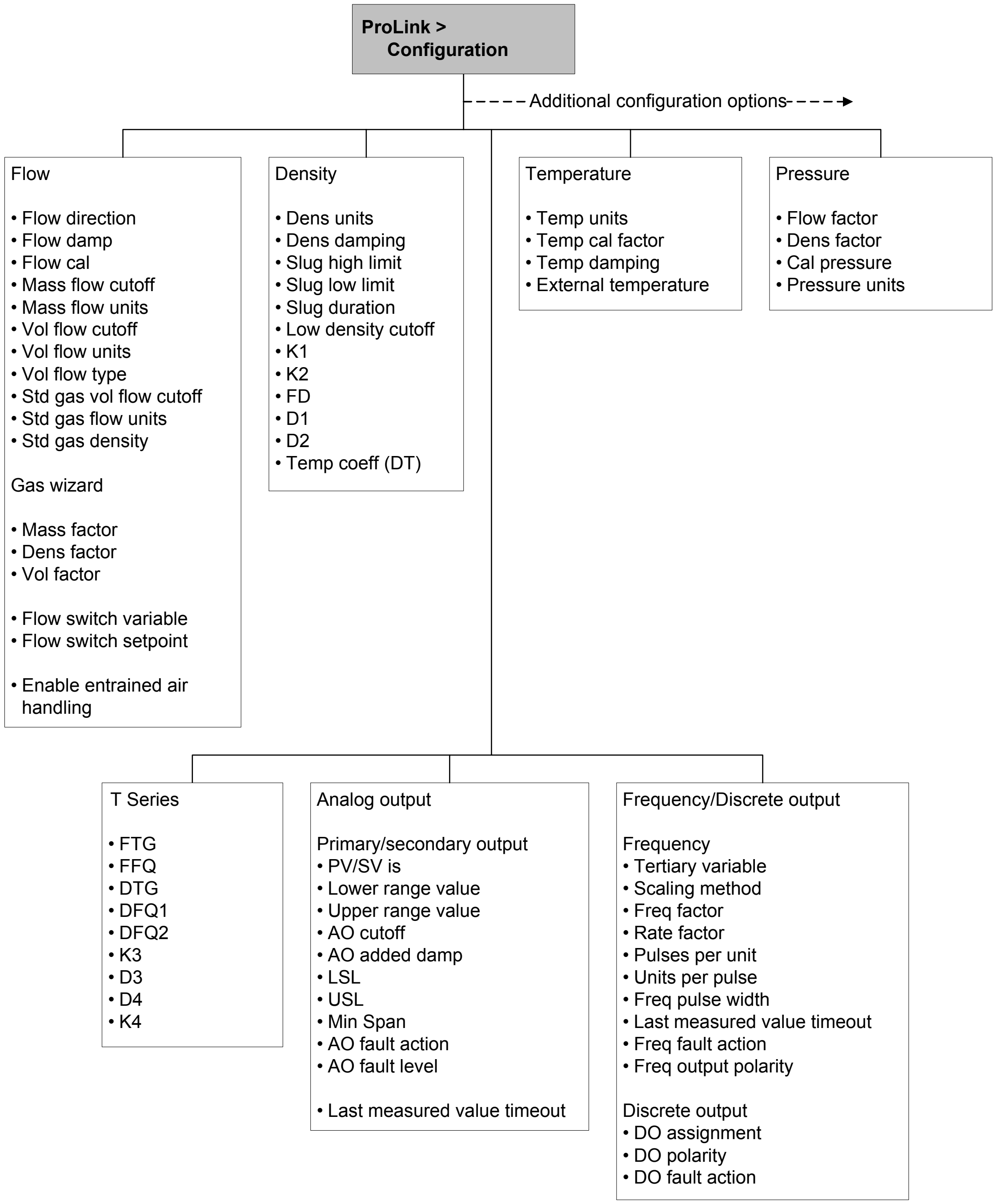


Figure F-3 ProLink II configuration menu *continued*

ProLink > Configuration

Additional configuration options

Device

- Tag
- Date
- Descriptor
- Message
- Sensor type
- Floating pt ordering
- Add comm resp delay
- Transmitter serial number

Digital comm settings
- Fault setting
- HART address
- Loop current mode
- HART device ID
- Modbus address
- Enable write protect

Update rate
- Update rate
- 100 Hz variable

Burst setup
- Enable burst
- Burst cmd
- Burst var 1...4

Special Units

- Base mass unit
- Base mass time
- Mass flow conv fact
- Mass flow text
- Mass total text

- Base vol unit
- Base vol time
- Vol flow conv fact
- Vol flow text
- Vol total text

- Gas unit configurator

Display

- mA1
- Var2...Var15

Display precision
- Var
- Number of decimals

- Display language

Display options
- Display start/stop totalizers
- Display totalizer reset
- Display auto scroll
- Display offline menu
- Display offline password
- Display alarm menu
- Display ack all alarms
- Display backlight on/off
- Display alarm screen pwd
- Display LED blinking

- Offline password
- Auto scroll rate
- Update period

Sensor simulation

- Enable/disable

Mass flow
- Wave form
- Fixed value
- Period
- Minimum
- Maximum

Density
- Wave form
- Fixed value
- Period
- Minimum
- Maximum

Temperature
- Wave form
- Fixed value
- Period
- Minimum
- Maximum

Figure F-4 ProLink II configuration menu *continued*

ProLink > Configuration

Variable mapping

- PV is
- SV is
- TV is
- QV is

System

- W & M approval
- Reset options

Transmitter options

- Volume flow
- Meter fingerprinting
- Meter verification

Alarm

- Alarm
- Severity

Sensor

- Sensor s/n
- Sensor model
- Sensor matl
- Liner matl
- Flange

Events

- Event 1/2
- Variable
- Type
- Setpoint

Discrete events

- Event name
- Event type
- Process variable
- Low setpoint (A)
- High setpoint (B)

Discrete input

- Assignment
- Polarity

Polled variables

Polled variable 1/2
- Polling control
- External tag
- Variable type
- Current value

F.4 Communicator menus

Figure F-5 Communicator process variables menu

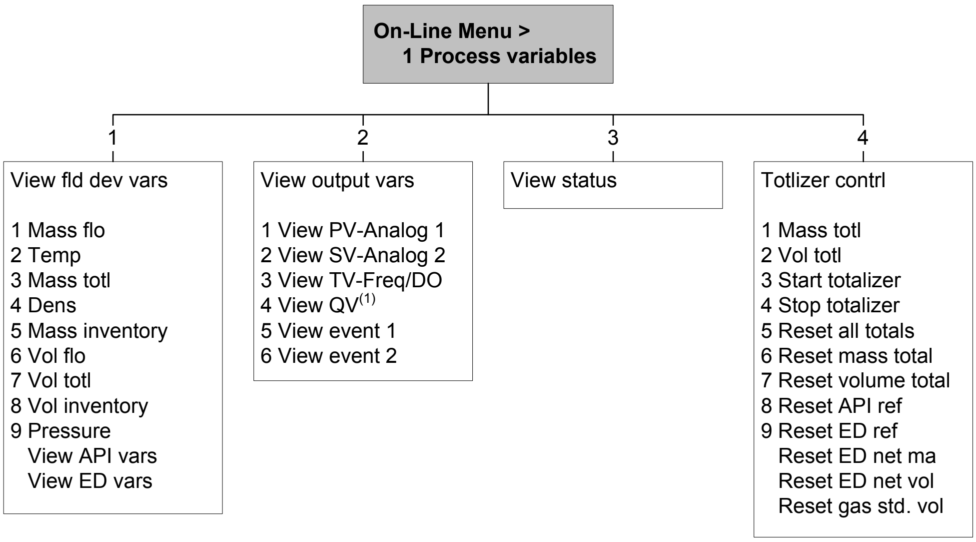


Figure F-6 Communicator diagnostics/service menu

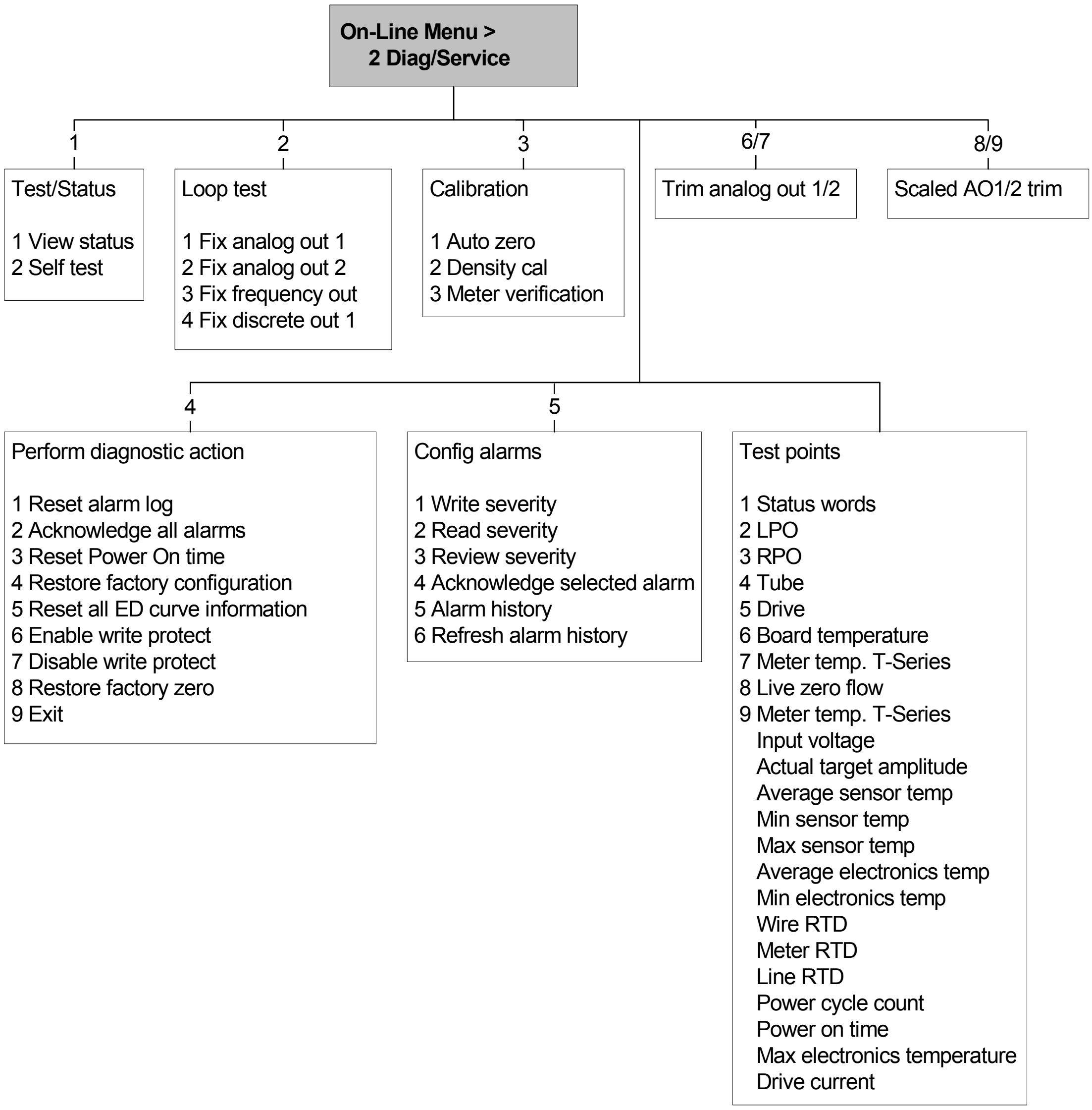


Figure F-7 Communicator basic setup menu

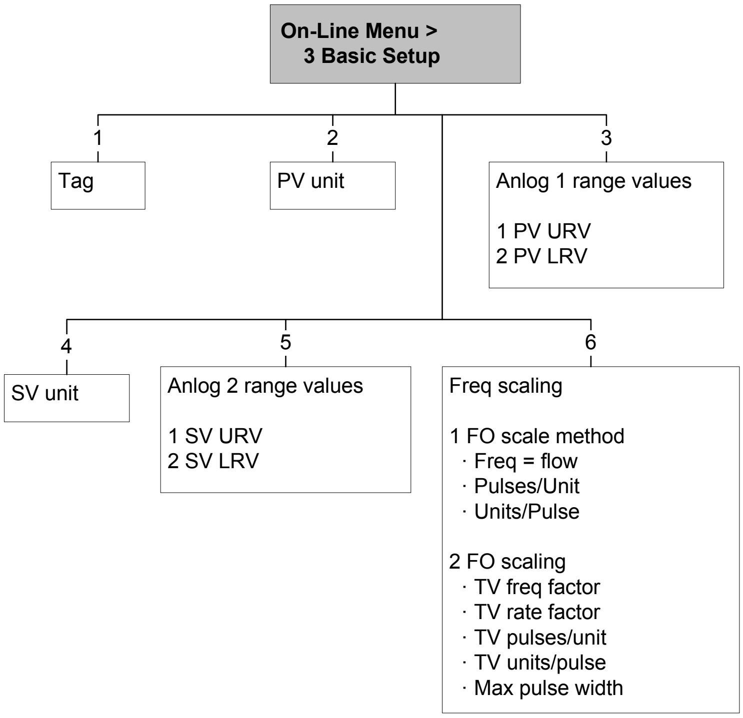
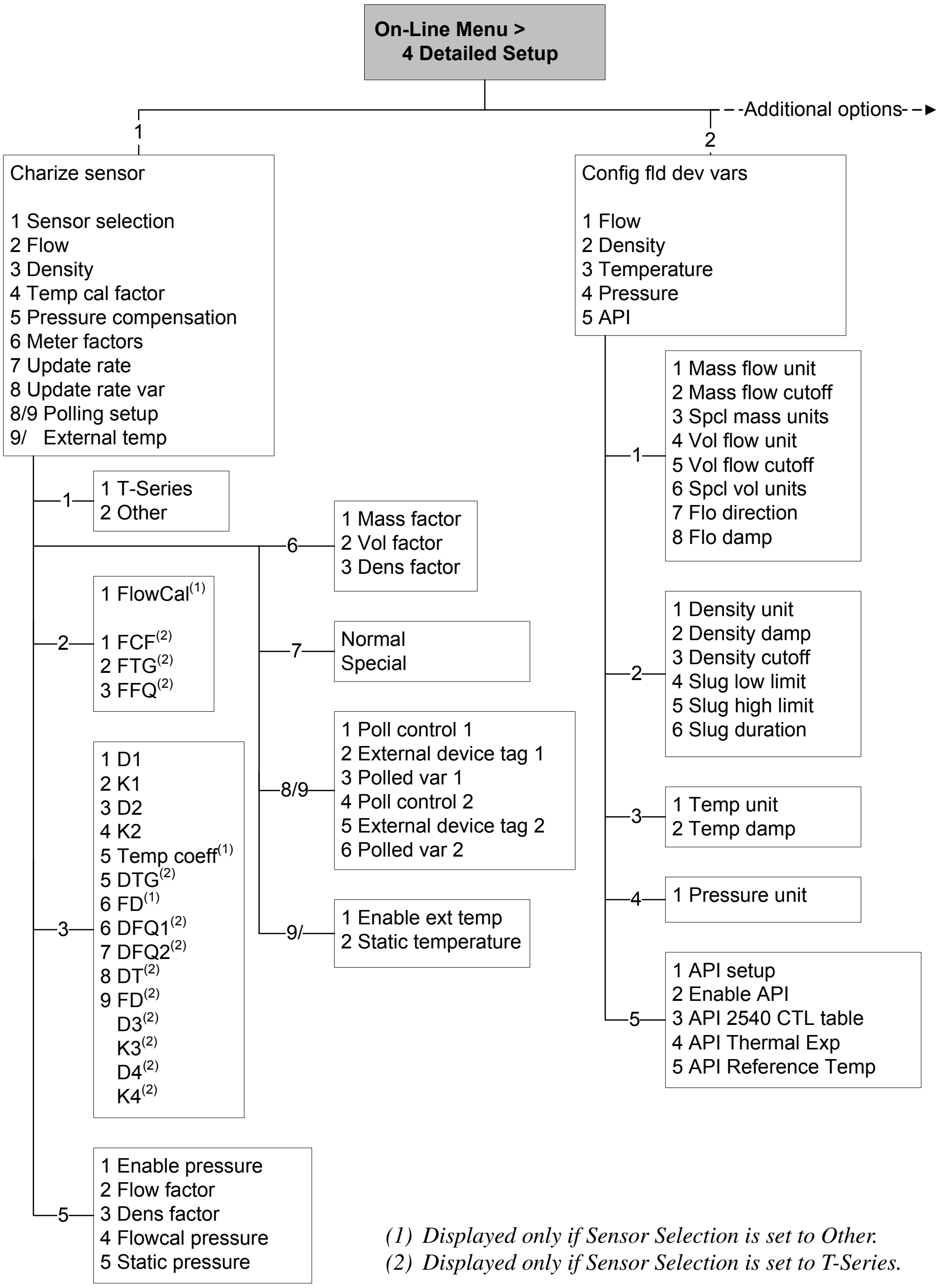


Figure F-8 Communicator detailed setup menu



(1) Displayed only if Sensor Selection is set to Other.
(2) Displayed only if Sensor Selection is set to T-Series.

Figure F-9 Communicator detailed setup menu *continued*

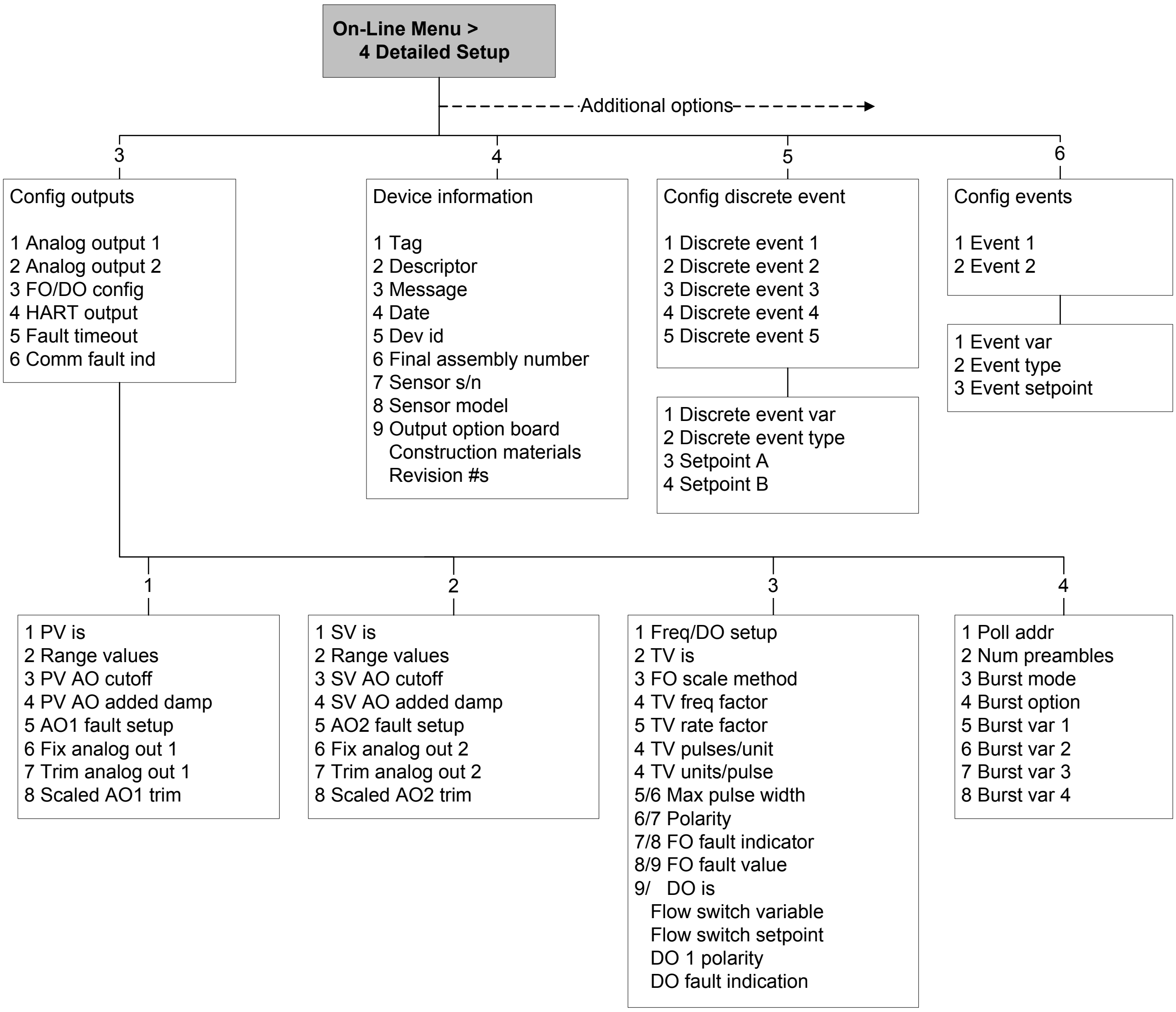
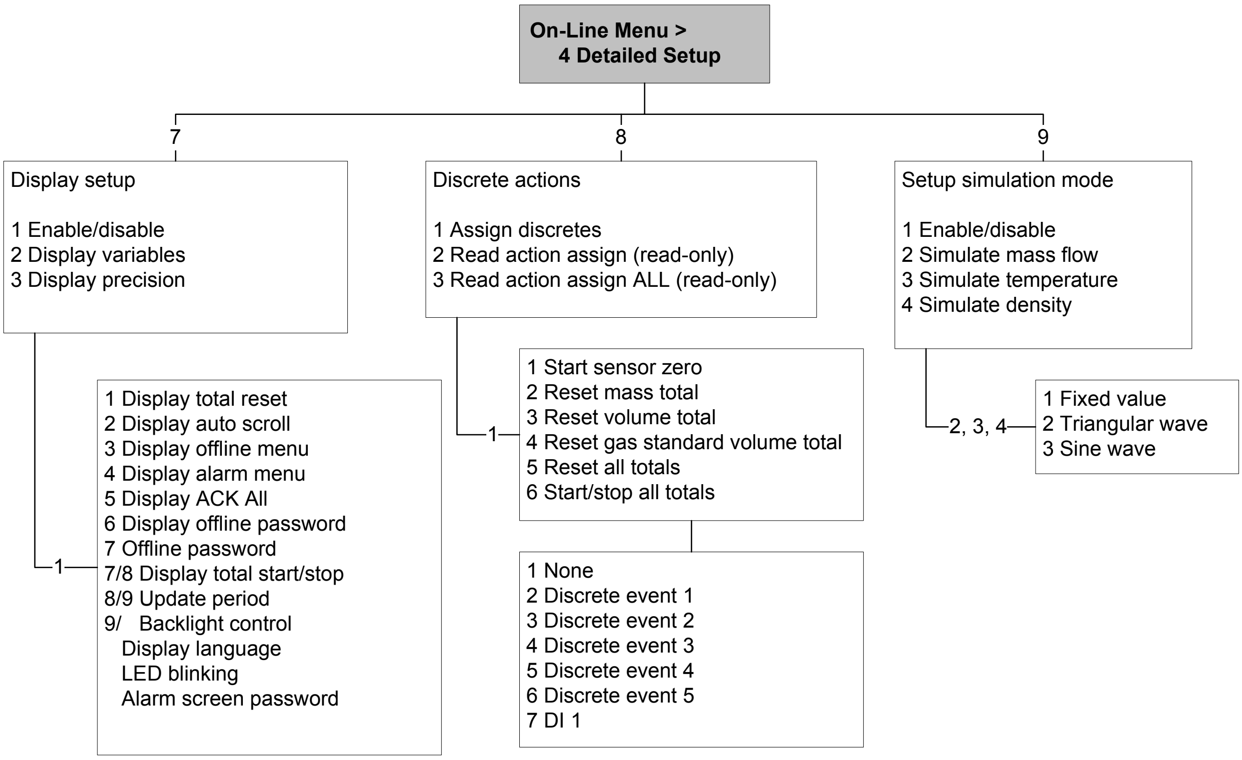
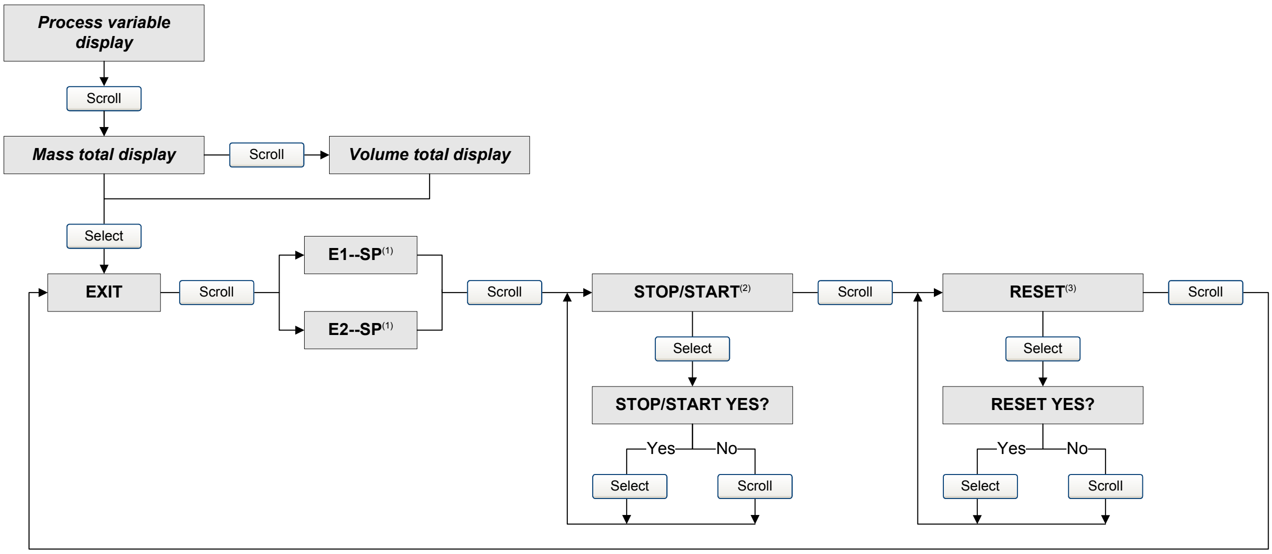


Figure F-10 Communicator detailed setup menu *continued*



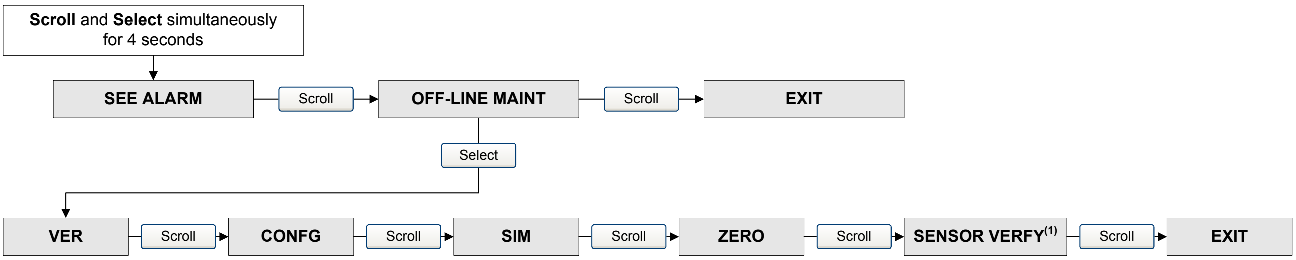
F.5 Display menus

Figure F-11 Display menu – Managing totalizers and inventories



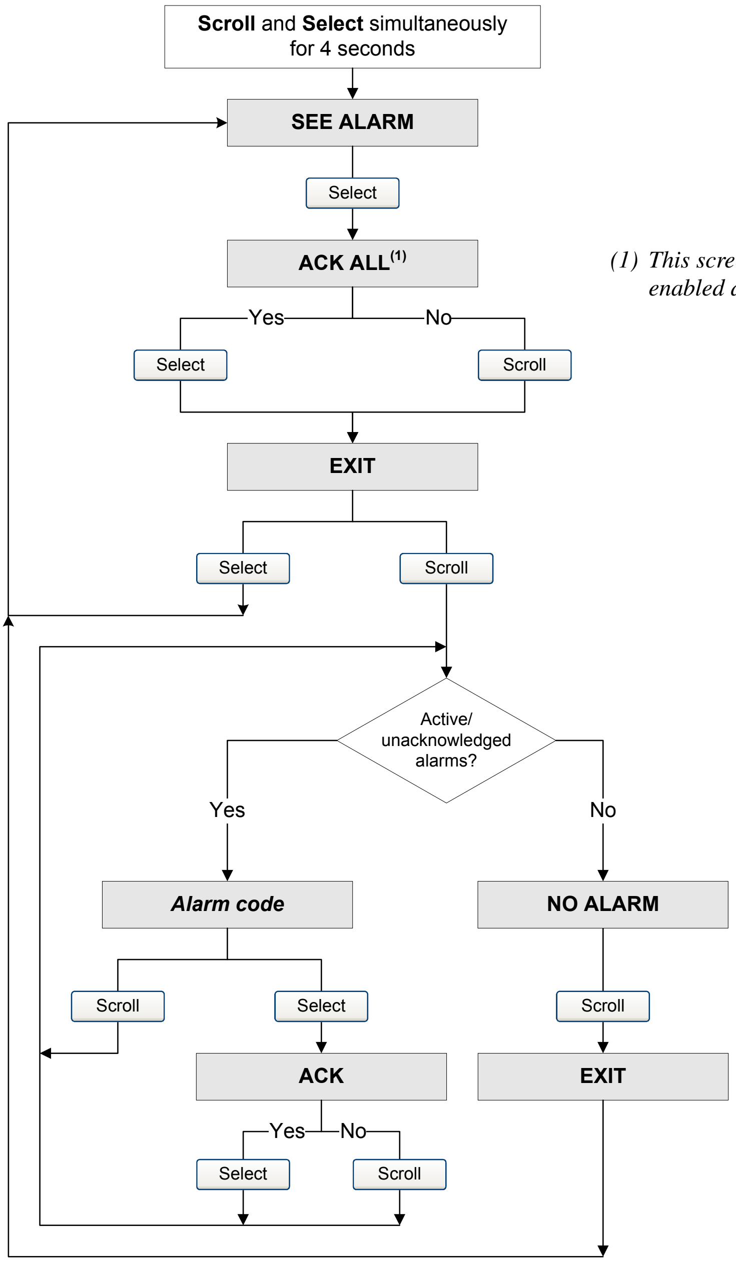
(1) *The Event Setpoint screens can be used to define or change the setpoint for Event 1 or Event 2 in the single-setpoint event model. These screens are displayed only if the event is defined on mass total or volume total. Note that this functionality does not apply to discrete events (the dual-setpoint event model). For more information, see Section 8.11.*
(2) *The transmitter must be configured to allow starting and stopping totalizers from the display.*
(3) *The transmitter must be configured to allow resetting totalizers from the display.*

Figure F-12 Display menu – Off-line menu, top level



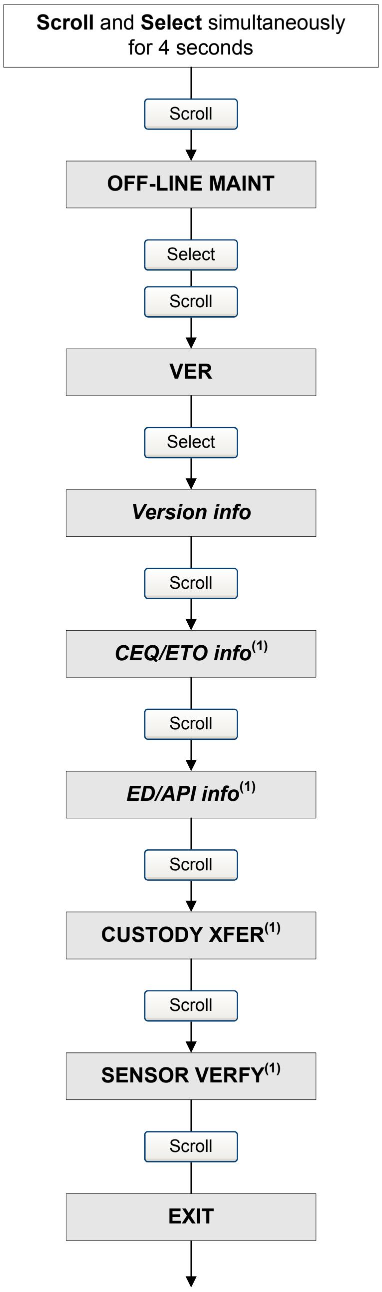
(1) *This option is displayed only if the transmitter is connected to an enhanced core processor and the meter verification software is installed on the transmitter.*

Figure F-13 Display menu – Alarms



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

Figure F-14 **Display menu – Maintenance: Version information**



(1) *The option is displayed only if the corresponding CEQ/ETO or application is installed on the transmitter.*

Figure F-15 Display menu – Off-line maintenance: Configuration

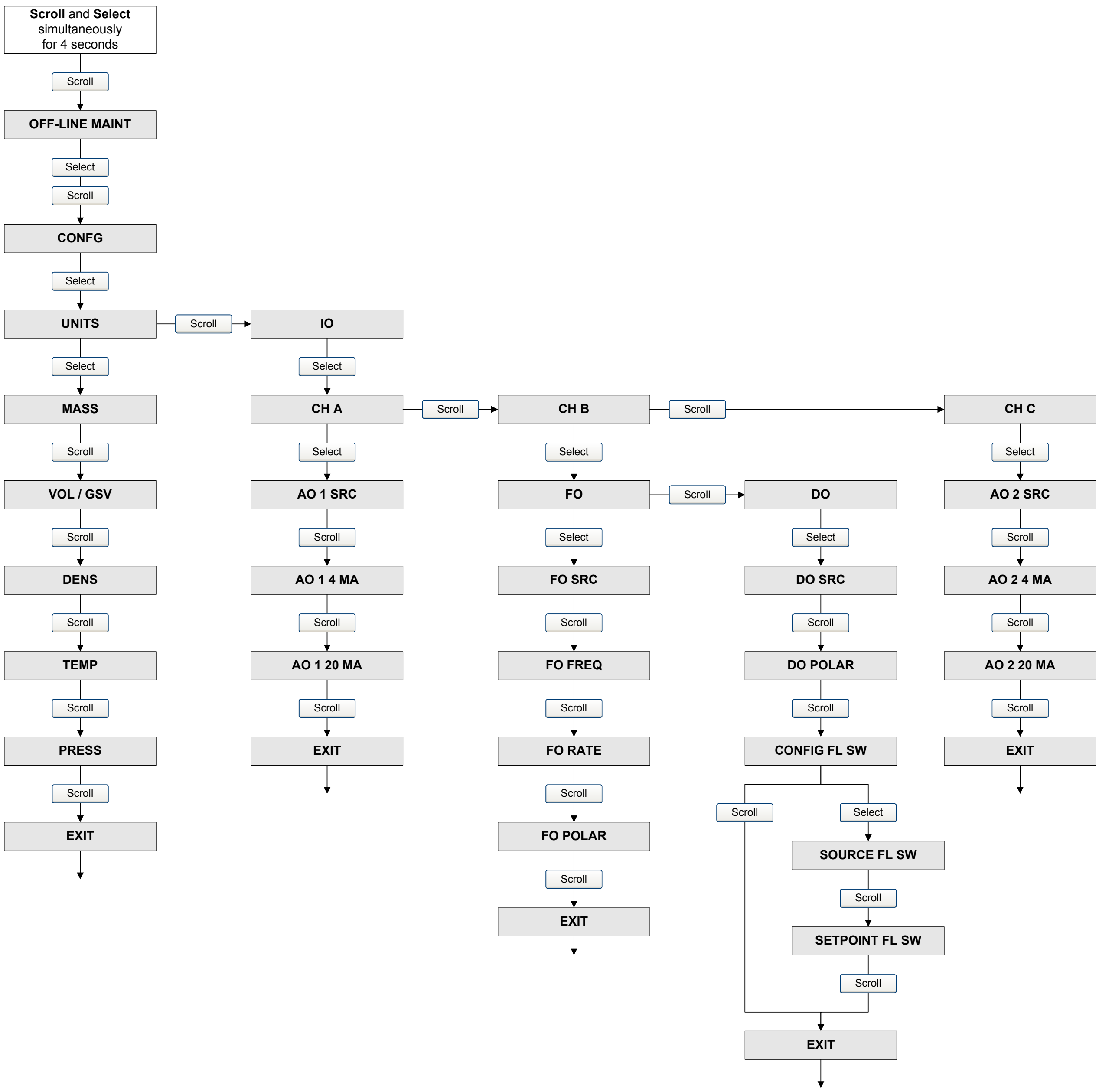
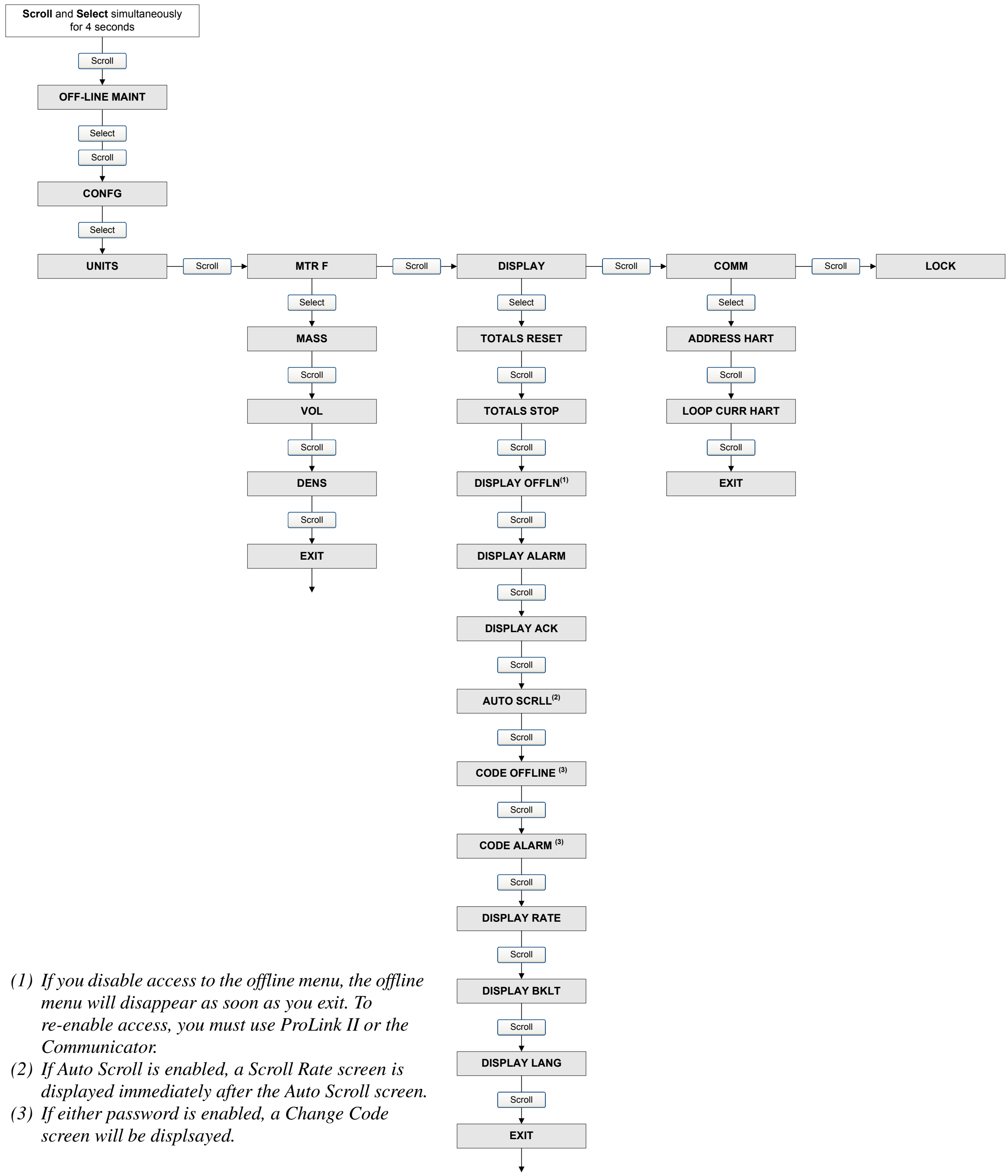


Figure F-16 Display menu – Off-line maintenance: Configuration

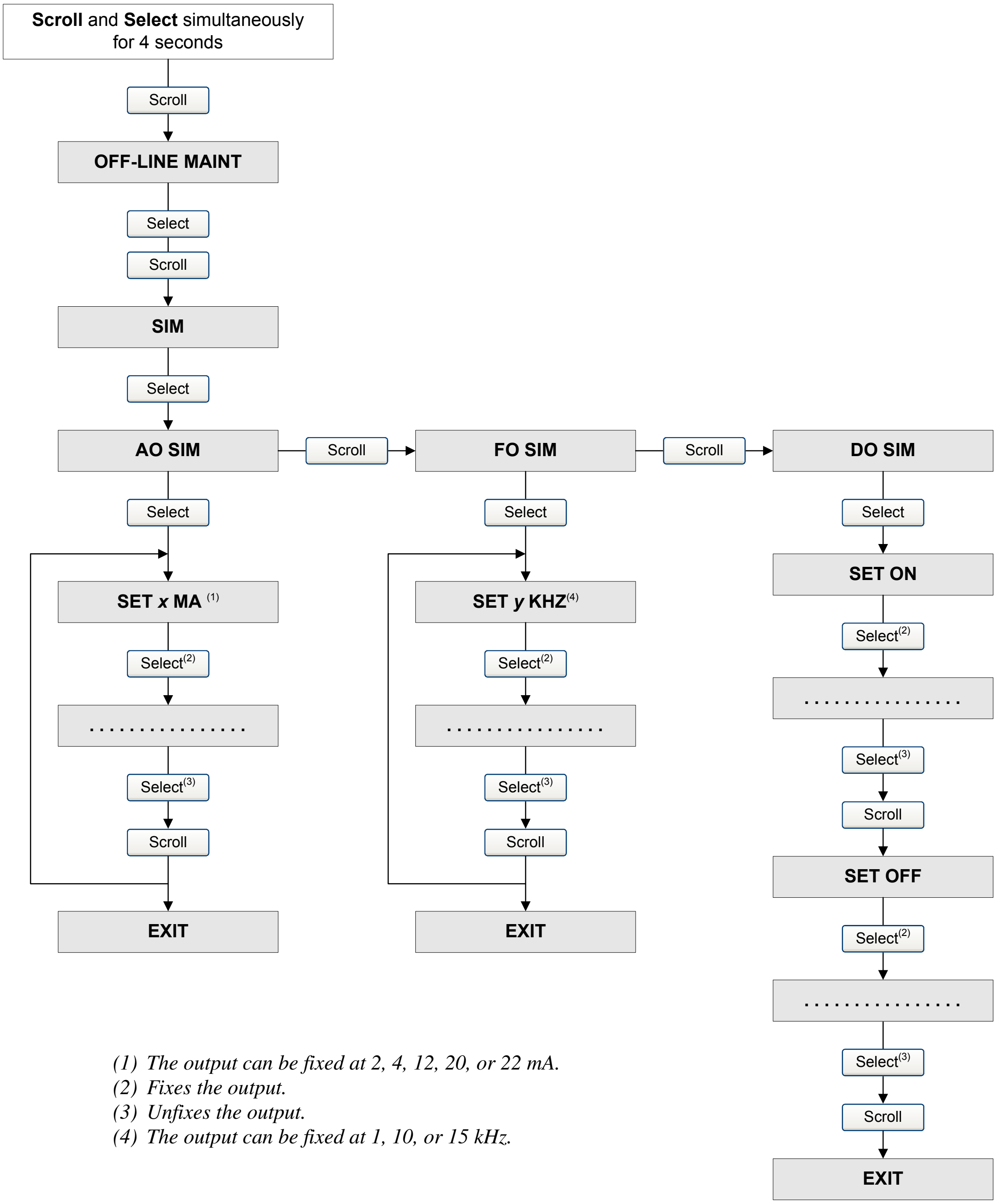


(1) If you disable access to the offline menu, the offline menu will disappear as soon as you exit. To re-enable access, you must use ProLink II or the Communicator.

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

(3) If either password is enabled, a Change Code screen will be displsayed.

Figure F-17 **Display menu – Off-line maintenance: Simulation (loop testing)**



(1) The output can be fixed at 2, 4, 12, 20, or 22 mA.
(2) Fixes the output.
(3) Unfixes the output.
(4) The output can be fixed at 1, 10, or 15 kHz.

Figure F-18 **Display menu – Off-line maintenance: Zero**

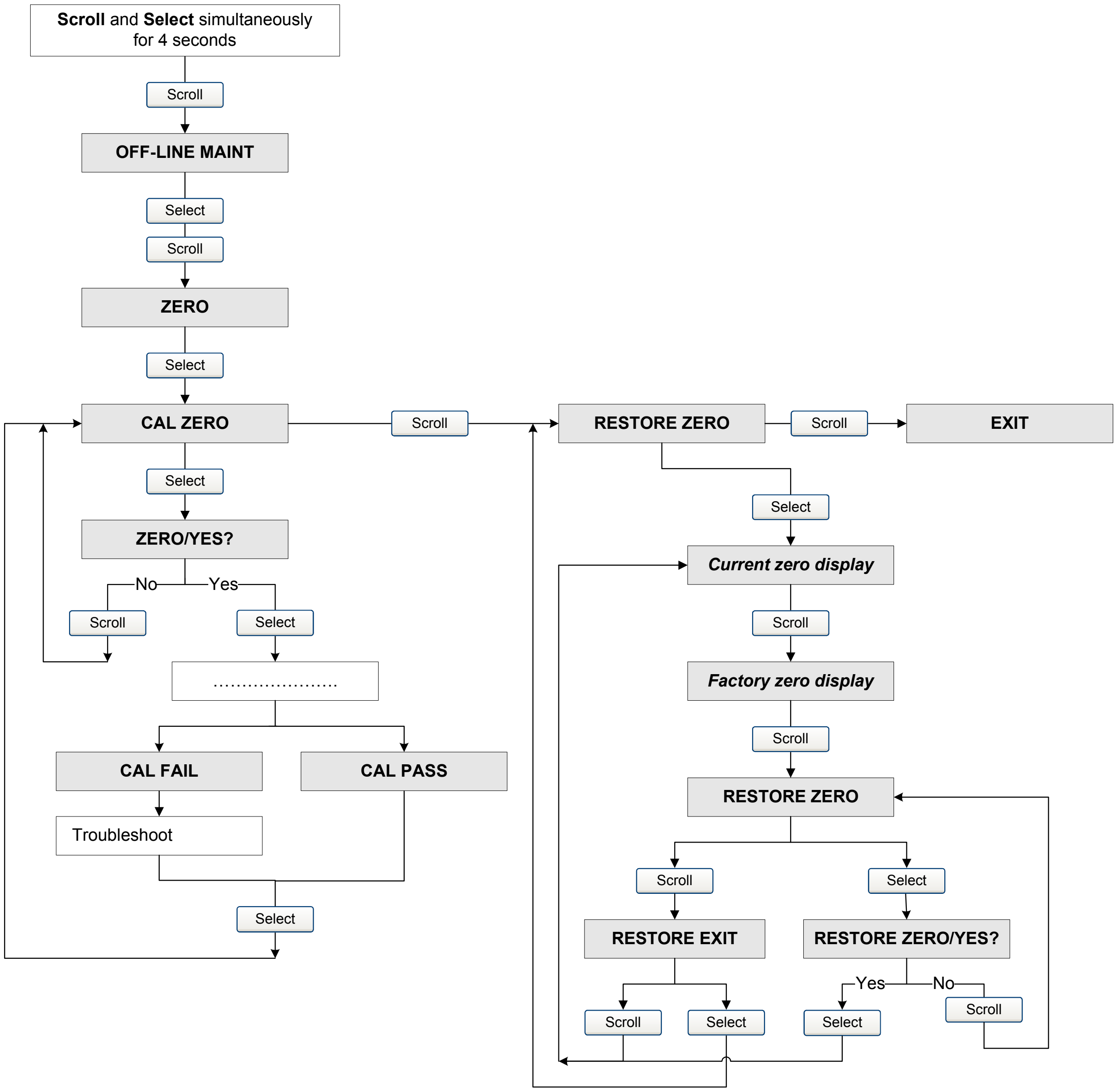
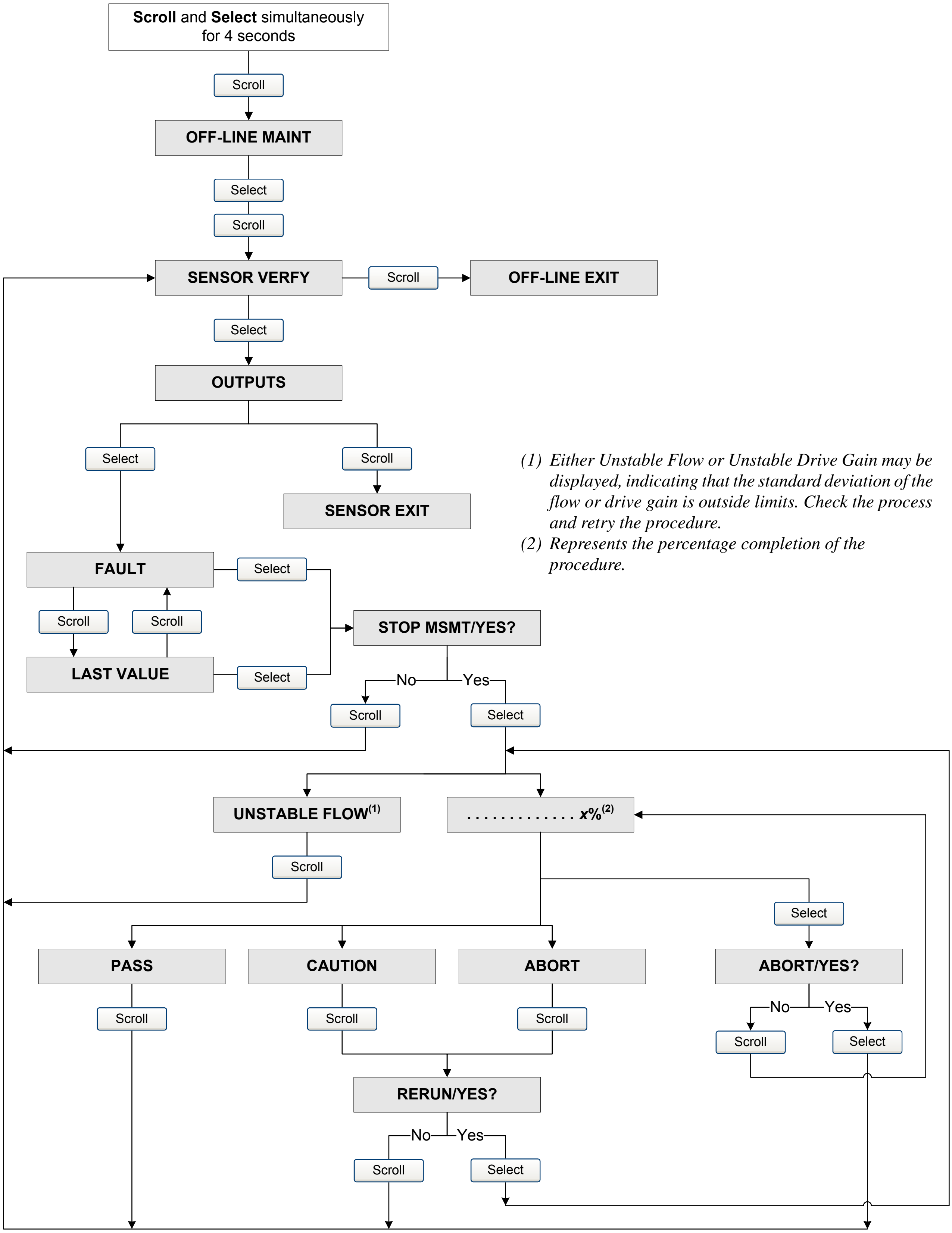


Figure F-19 Display menu – Off-line maintenance: Meter verification



(1) *Either Unstable Flow or Unstable Drive Gain may be displayed, indicating that the standard deviation of the flow or drive gain is outside limits. Check the process and retry the procedure.*
(2) *Represents the percentage completion of the procedure.*

Appendix G
Menu Flowcharts – Model 2700 CIO Transmitters

G.1 Overview

This appendix provides the following menu flowcharts for the Model 2700 CIO transmitter:

- ProLink II menus
  - Main menu – Figure G-1
  - Configuration menu – Figures G-2 through G-4
- Communicator menus
  - Process variables menu – Figure G-5
  - Diagnostics/service menu – Figure G-6
  - Basic setup menu – Figure G-7
  - Detailed setup menu – Figures G-8 through G-10
- Display menus
  - Managing totalizers and inventories – Figure G-11
  - Off-line menu: top level – Figure G-12
  - Off-line menu: Alarms – Figure G-13
  - Off-line maintenance menu: Version information – Figure G-14
  - Off-line maintenance menu: Configuration – Figures G-15 through G-18
  - Off-line maintenance menu: Simulation (loop testing) – Figure G-19
  - Off-line maintenance menu: Zero – see Figure G-20
  - Off-line maintenance menu: Meter verification – see Figure G-21

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

G.2 Version information

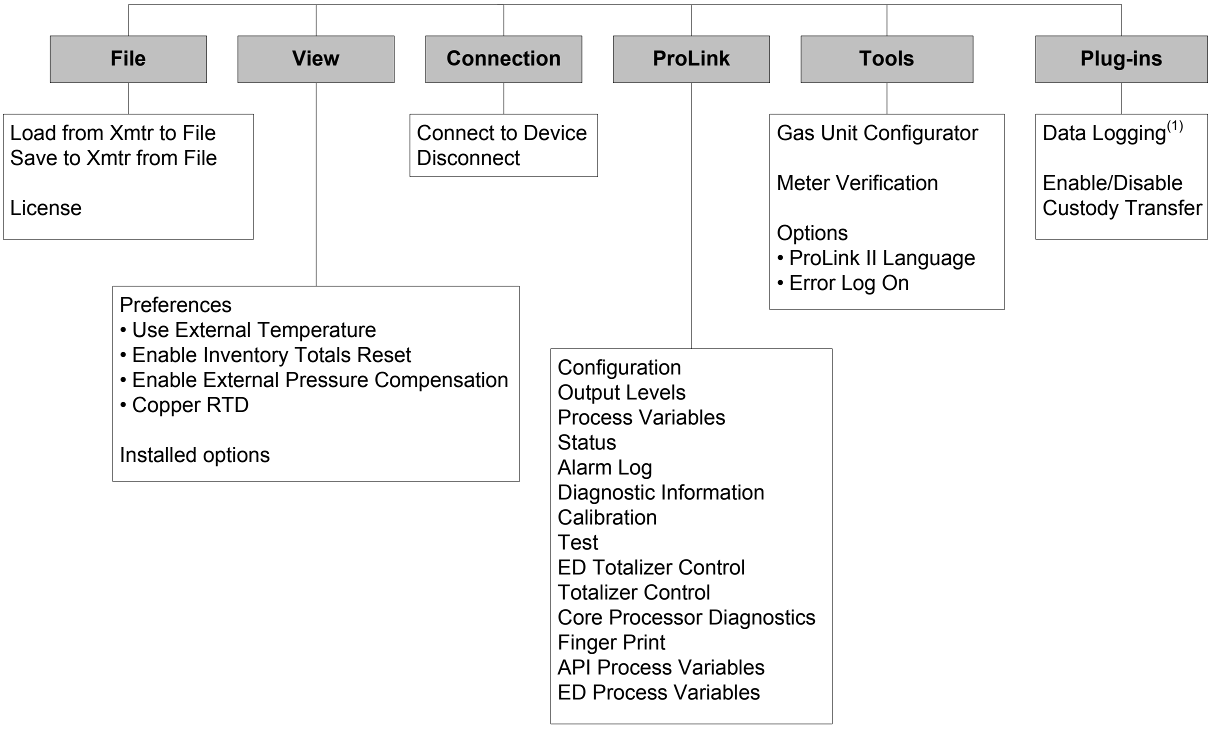
These menus flowcharts are based on:

- Transmitter software rev5.0
- Enhanced core processor software v3.2
- ProLink II v2.5
- 375 Field Communicator device rev 5, DD rev 1

Menus may vary slightly for different versions of these components.

G.3 ProLink II menus

Figure G-1 ProLink II main menu



(1) For information about using Data Logger, refer to the ProLink II manual.

Figure G-2 ProLink II configuration menu

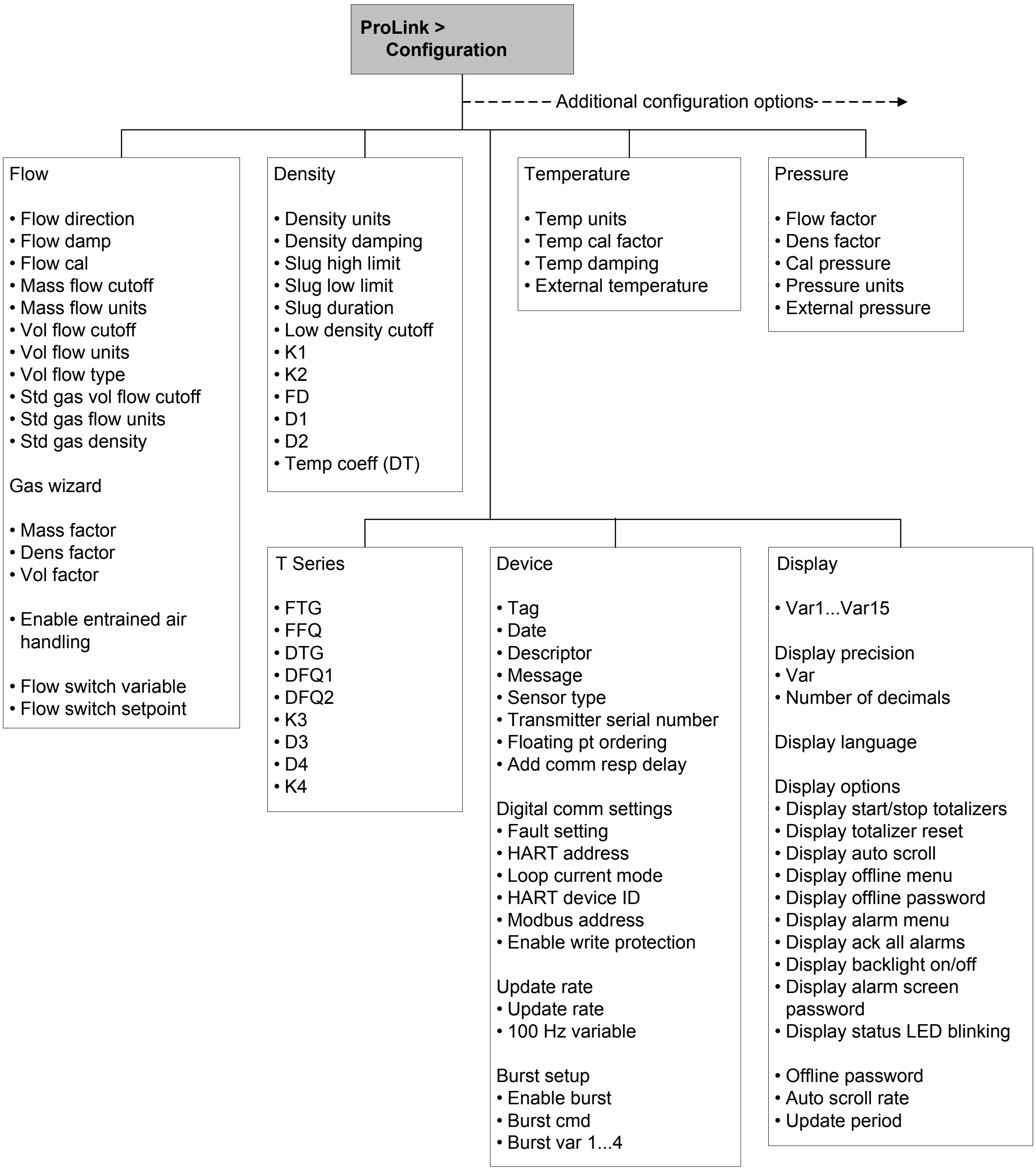


Figure G-3 ProLink II configuration menu *continued*

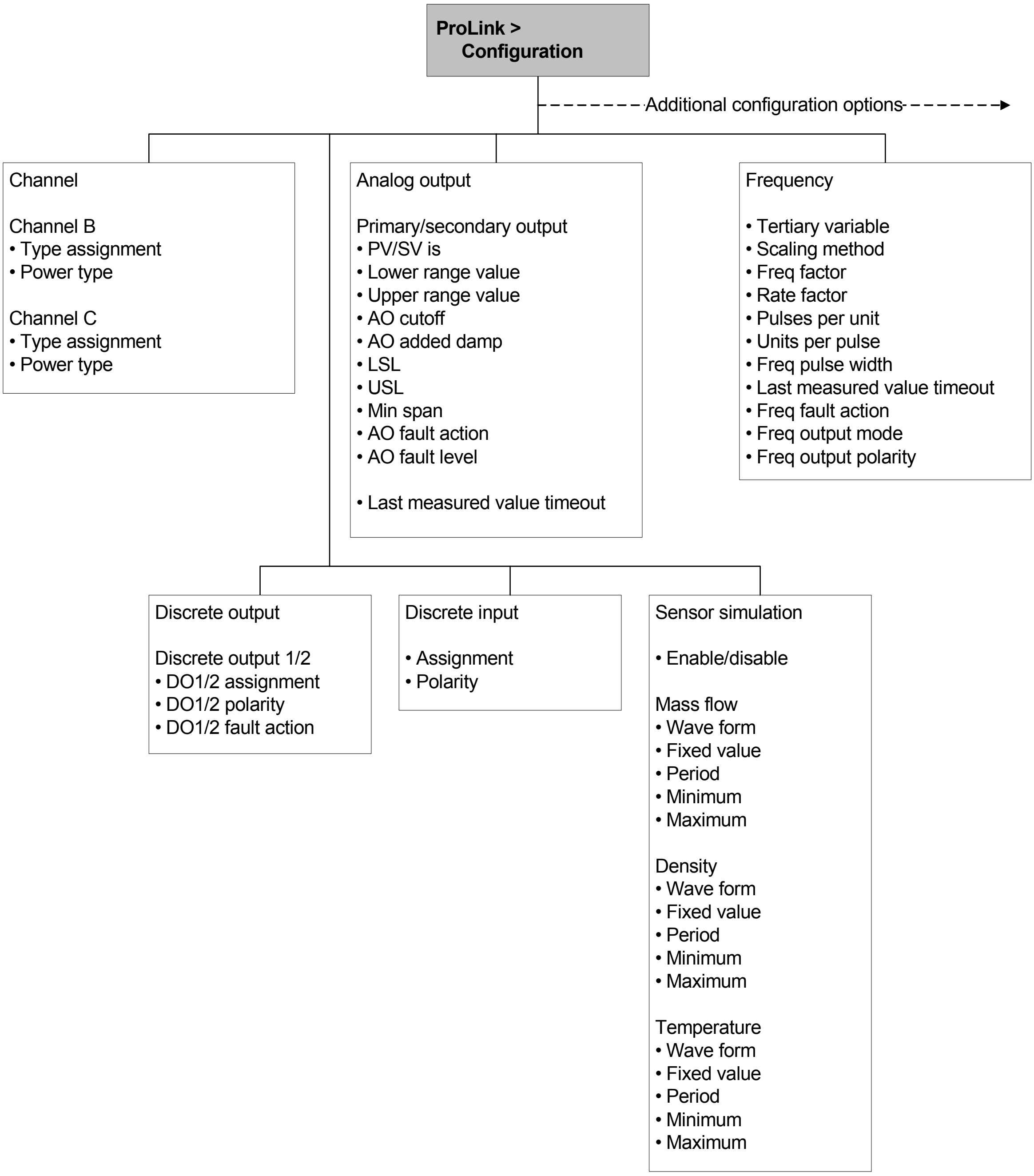
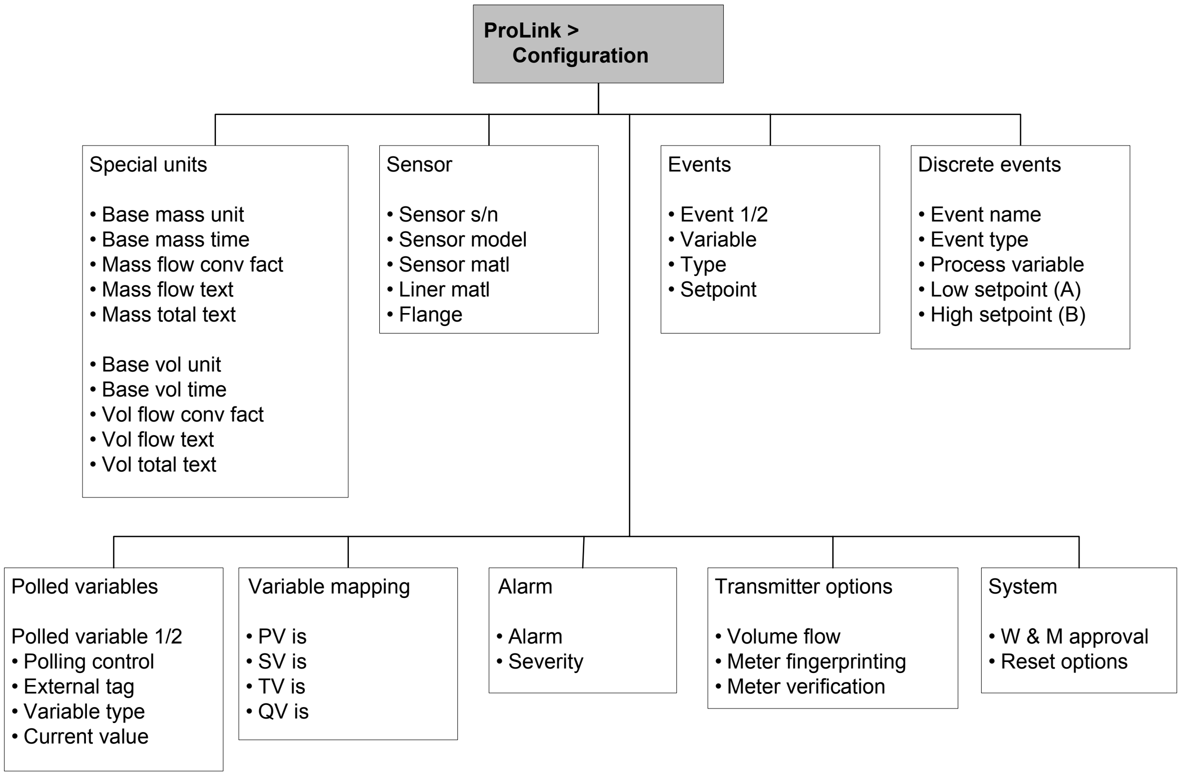


Figure G-4 **ProLink II configuration menu *continued***



G.4 Communicator menus

Figure G-5 **Communicator process variables menu**

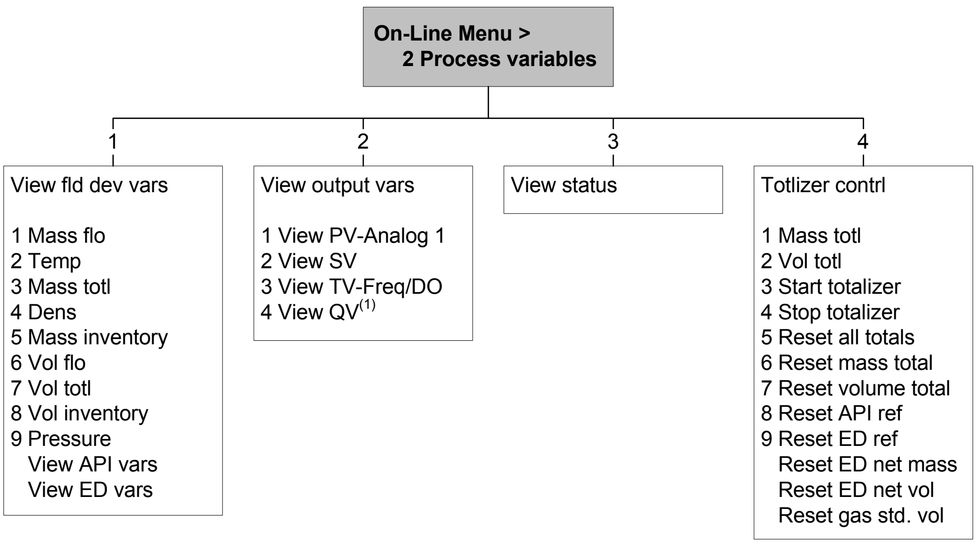


Figure G-6 Communicator diagnostics/service menu

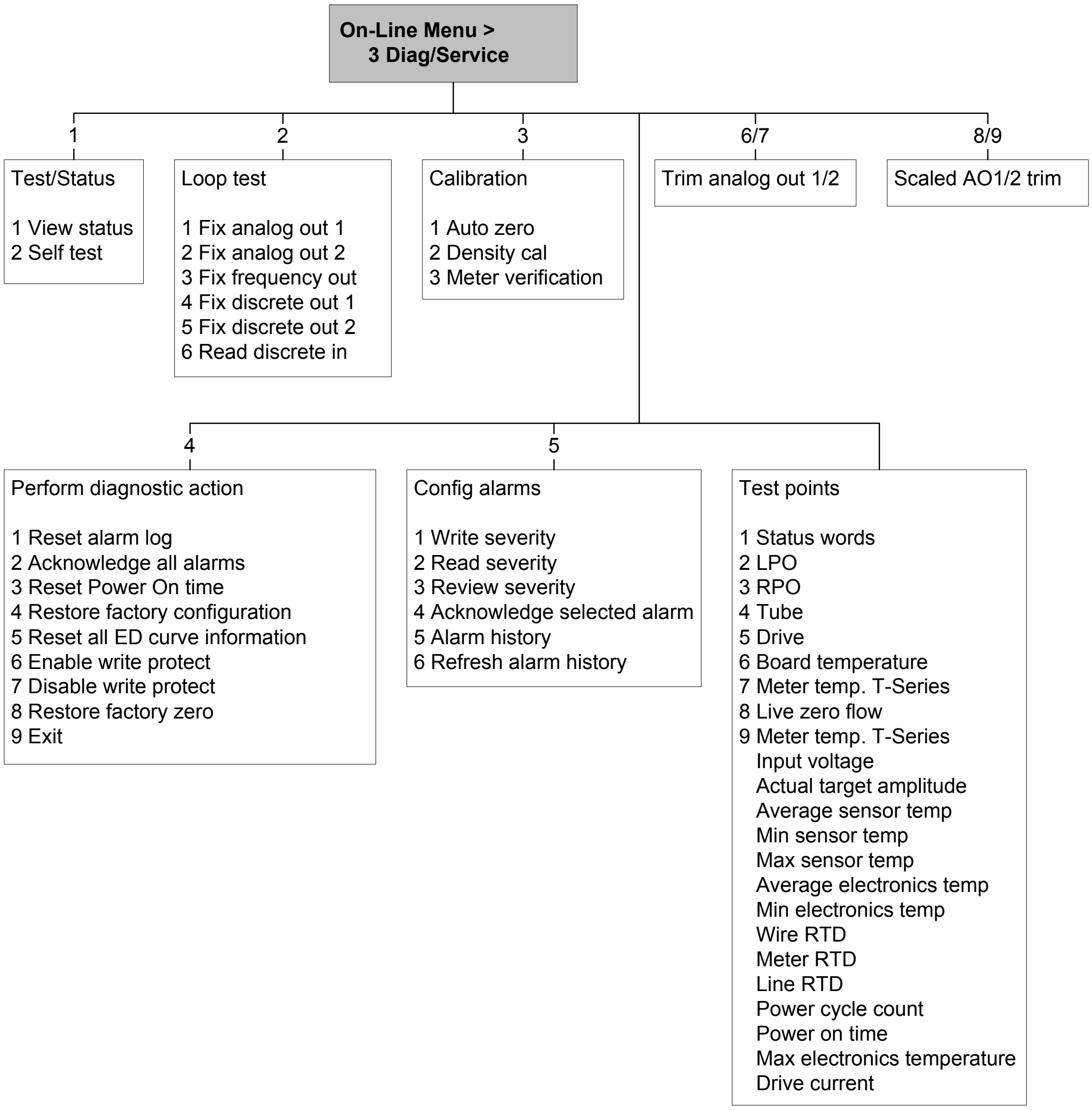


Figure G-7 Communicator basic setup menu

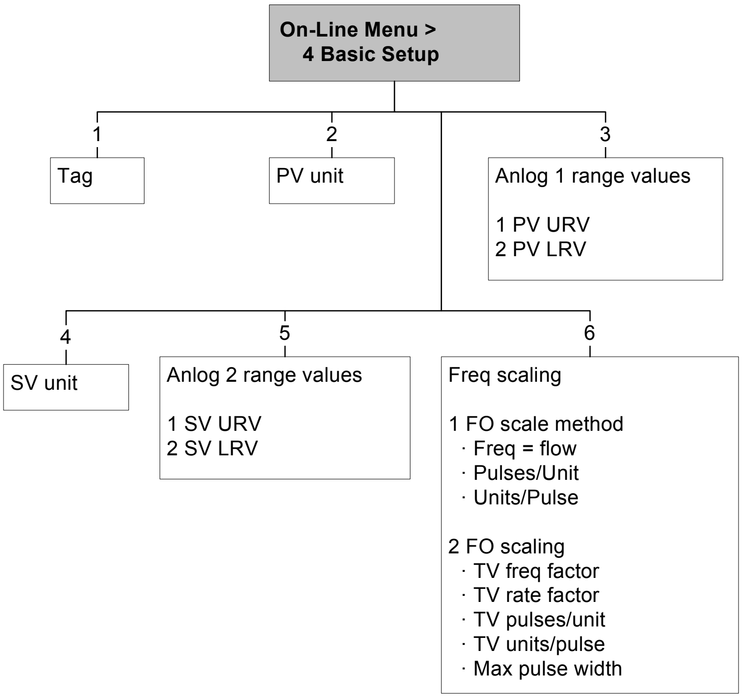
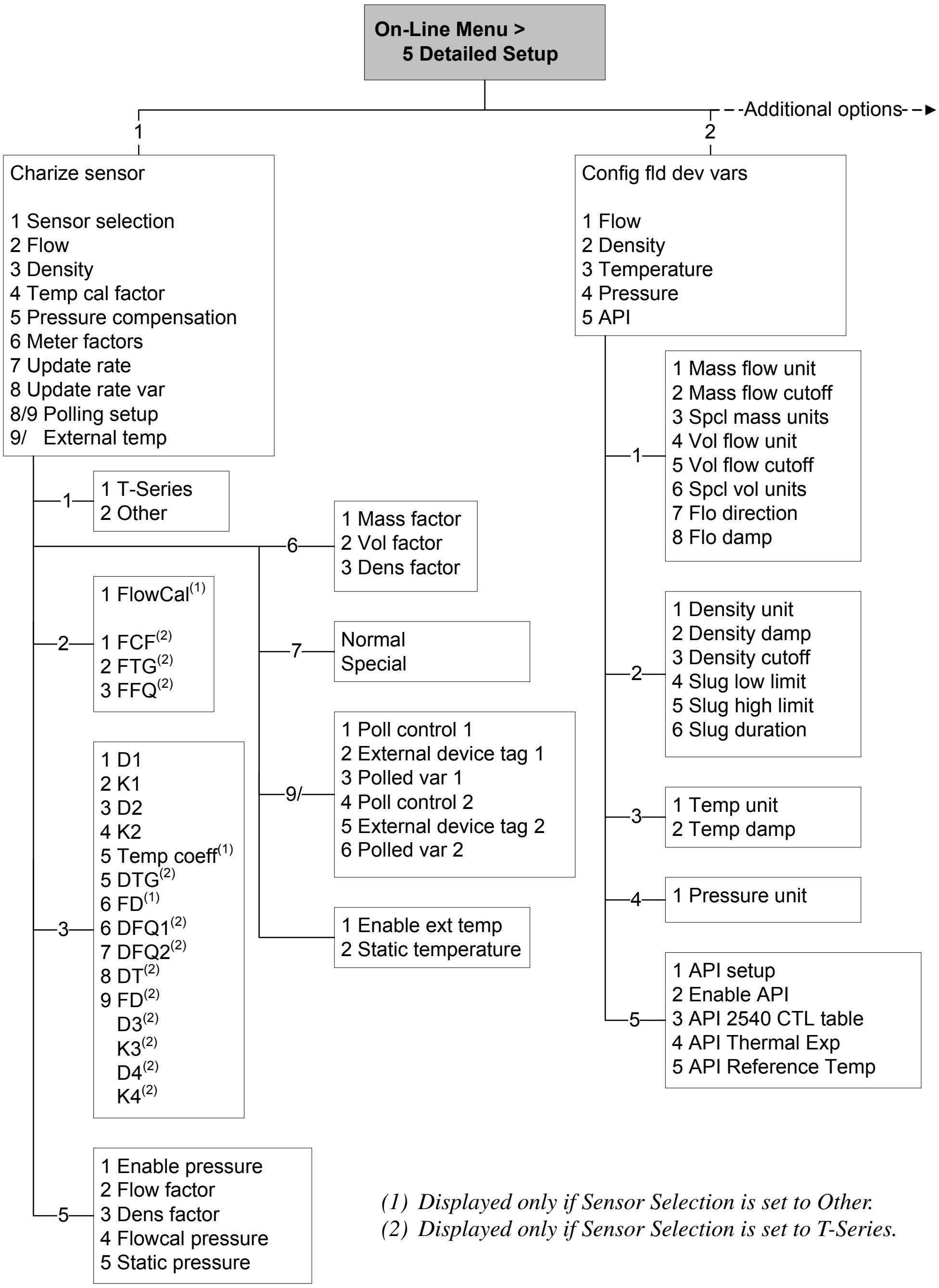
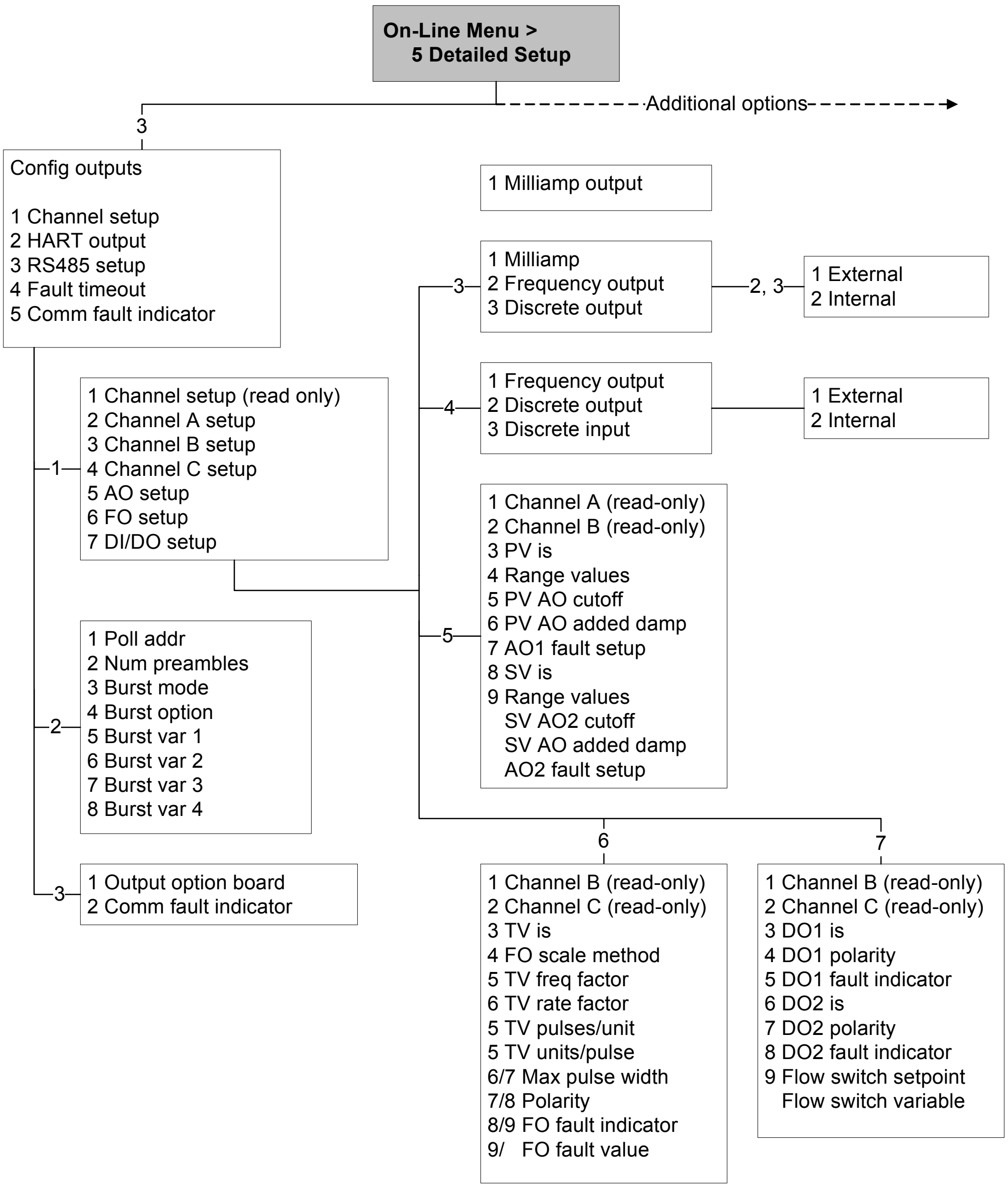


Figure G-8 Communicator detailed setup menu



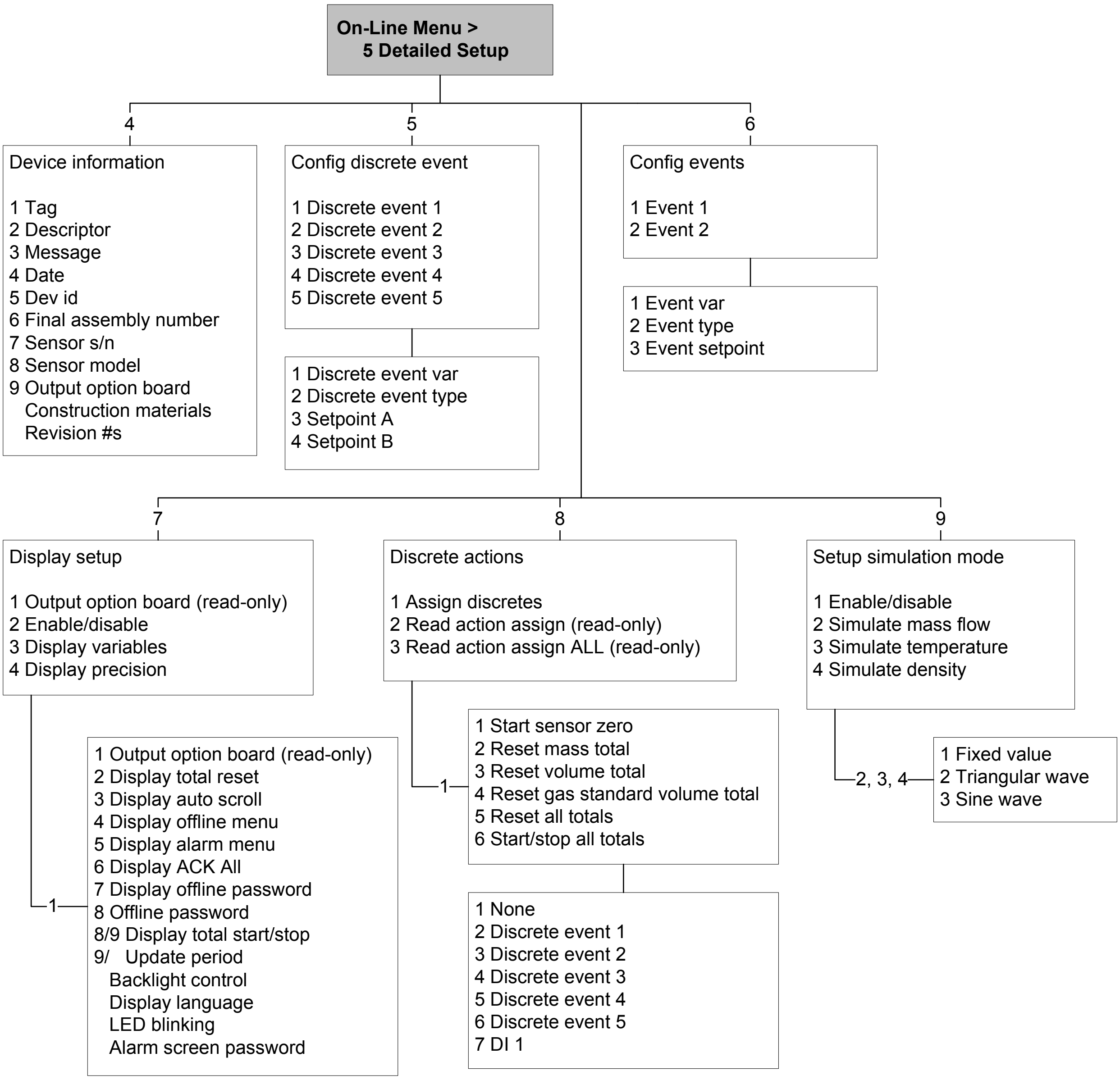
(1) Displayed only if Sensor Selection is set to Other.
(2) Displayed only if Sensor Selection is set to T-Series.

Figure G-9 Communicator detailed setup menu *continued*



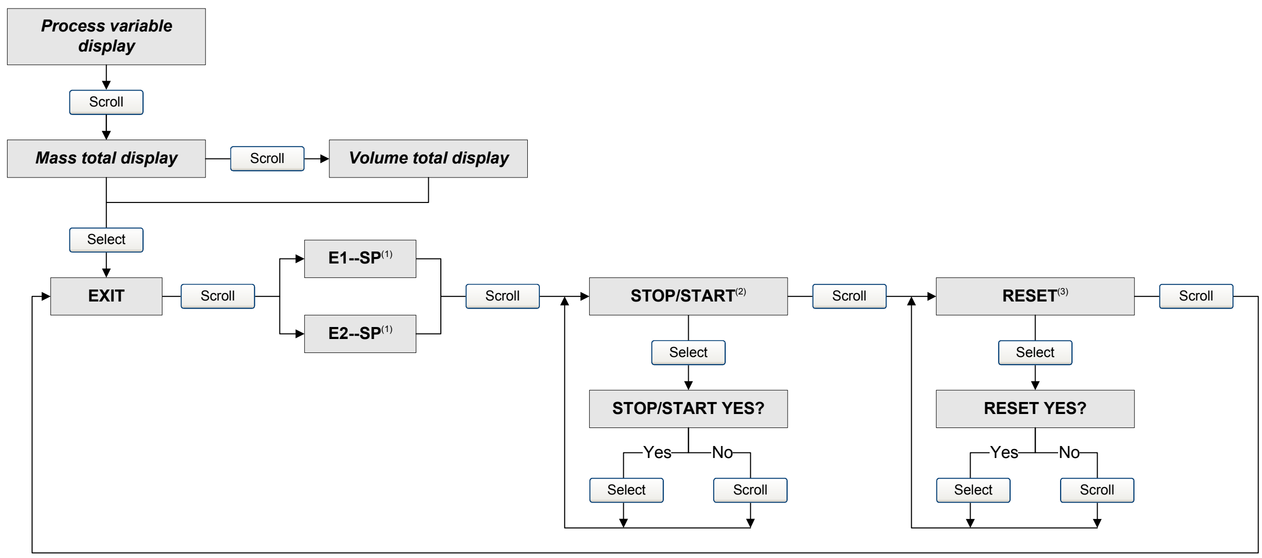
Model 1700/2700 AN
Model 1700/2700 IS
Model 2700 CIO
Display Codes

Figure G-10 Communicator detailed setup menu *continued*



G.5 Display menus

Figure G-11 Display menu – Managing totalizers and inventories

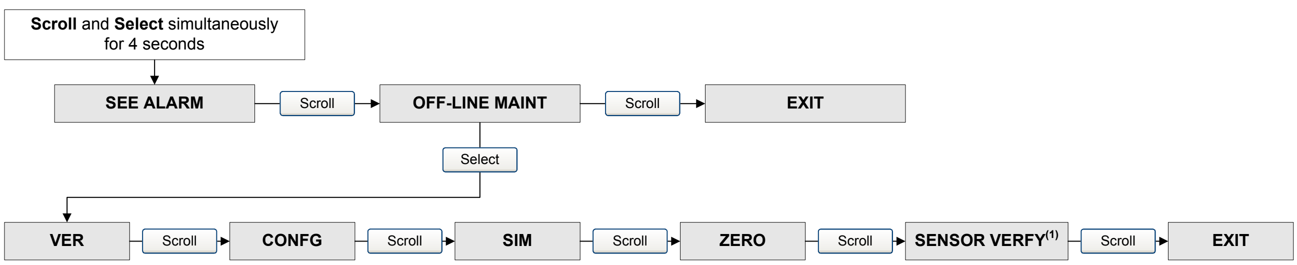


(1) *The Event Setpoint screens can be used to define or change the setpoint for Event 1 or Event 2 in the single-setpoint event model. These screens are displayed only if the event is defined on mass total or volume total. Note that this functionality does not apply to discrete events (the dual-setpoint event model). For more information, see Section 8.11.*

(2) *The transmitter must be configured to allow starting and stopping totalizers from the display.*

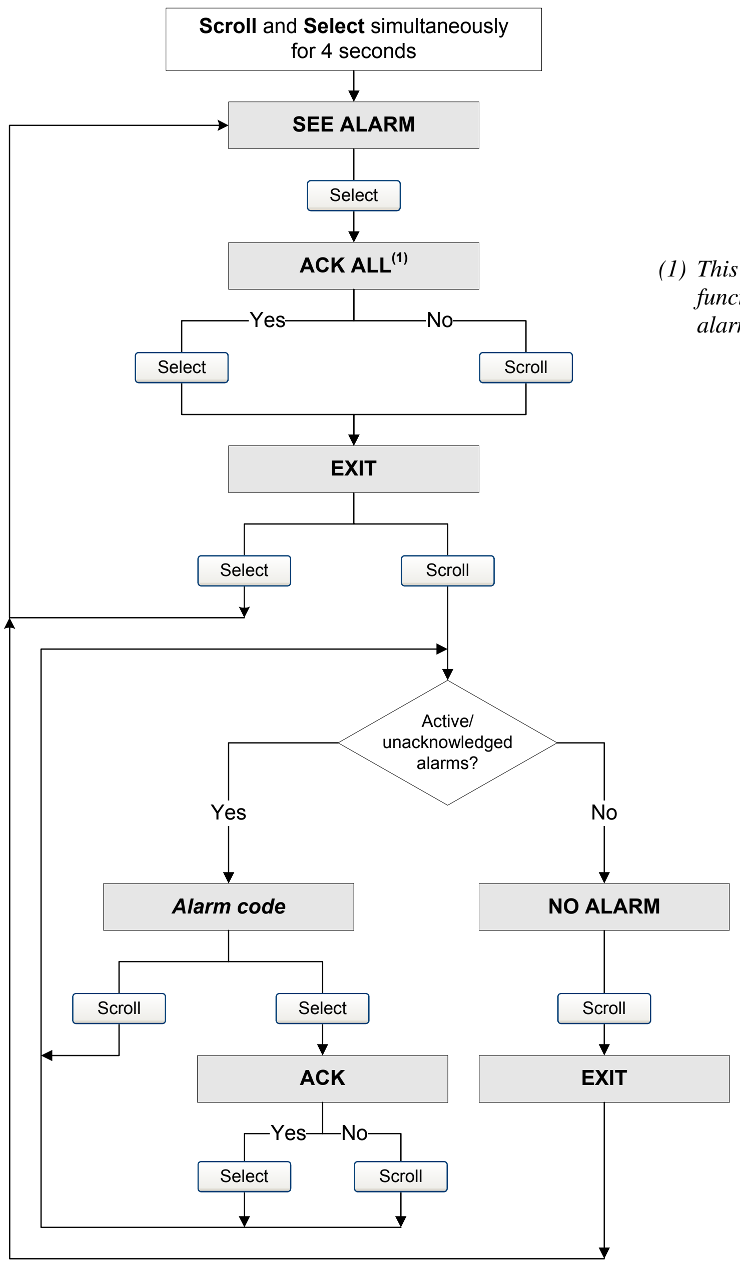
(3) *The transmitter must be configured to allow resetting totalizers from the display.*

Figure G-12 Display menu – Off-line menu, top level



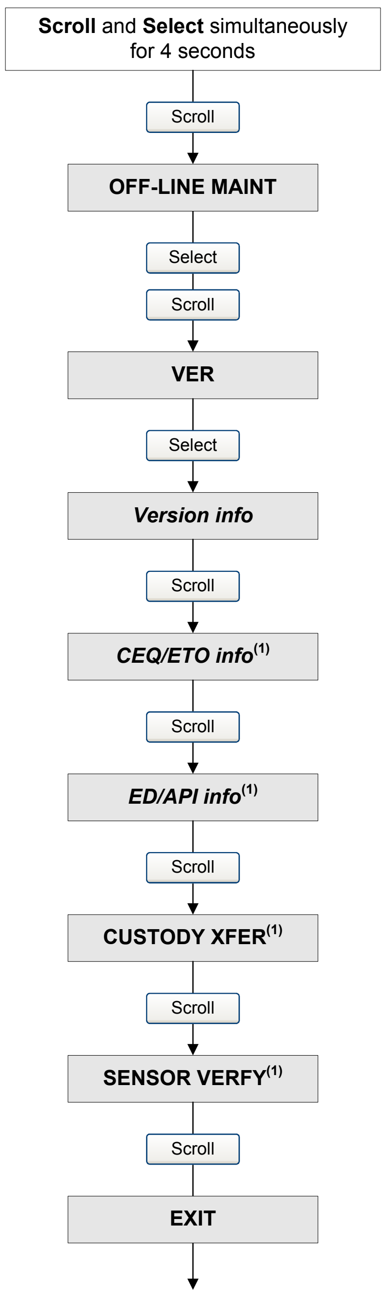
(1) *This option is displayed only if the transmitter is connected to an enhanced core processor and the meter verification software is installed on the transmitter.*

Figure G-13 Display menu – Alarms



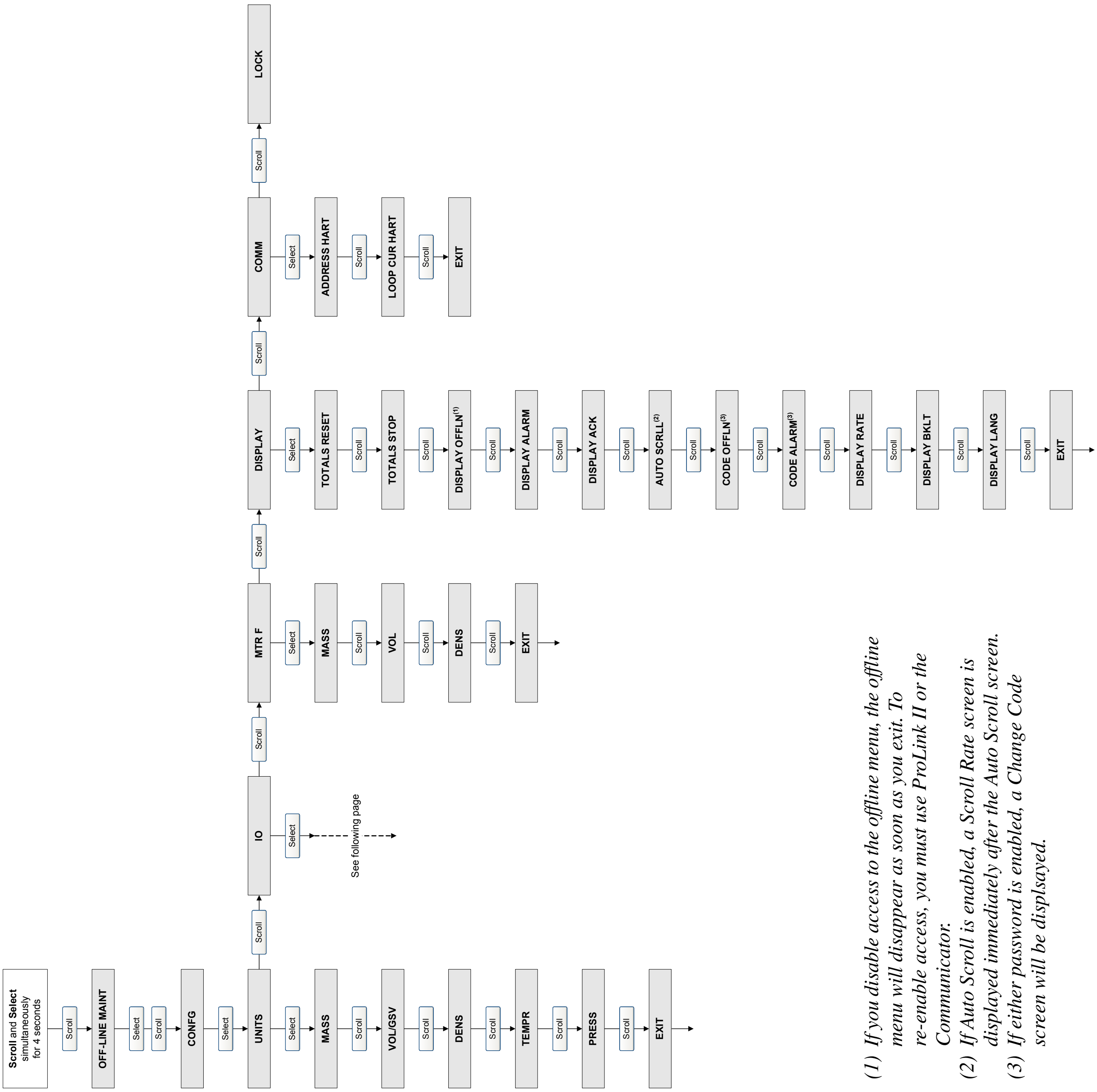
(1) This screen is displayed only if the ACK ALL function is enabled and there are unacknowledged alarms.

Figure G-14 **Display menu – Off-line maintenance: Version information**



(1) The option is displayed only if the corresponding CEQ/ETO or application is installed on the transmitter.

Figure G-15 Display menu – Off-line maintenance: Configuration



(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 either password is enabled, a Change Code screen will be displsayed.

Figure G-16 Display menu – Off-line maintenance: Configuration *continued*

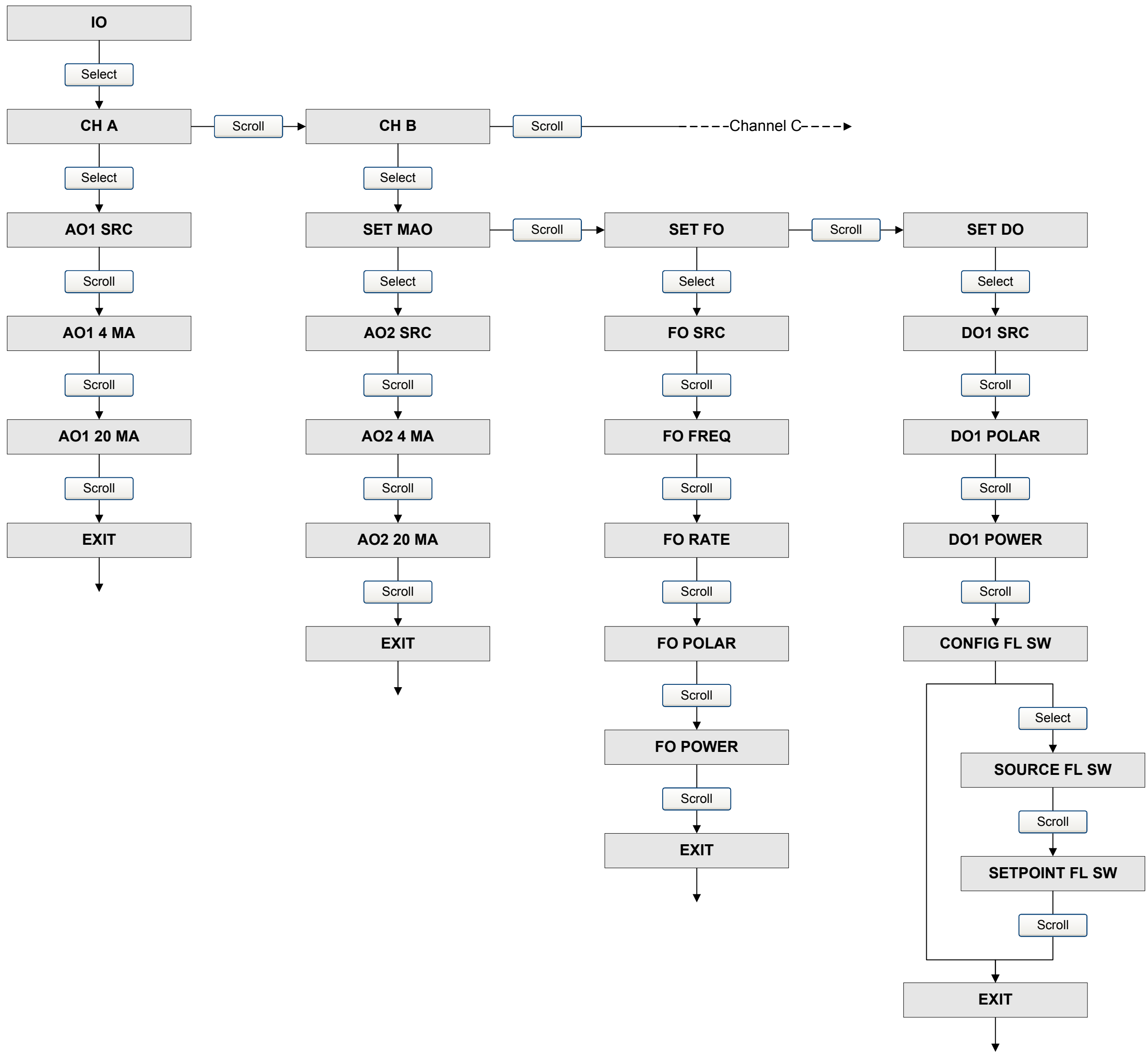
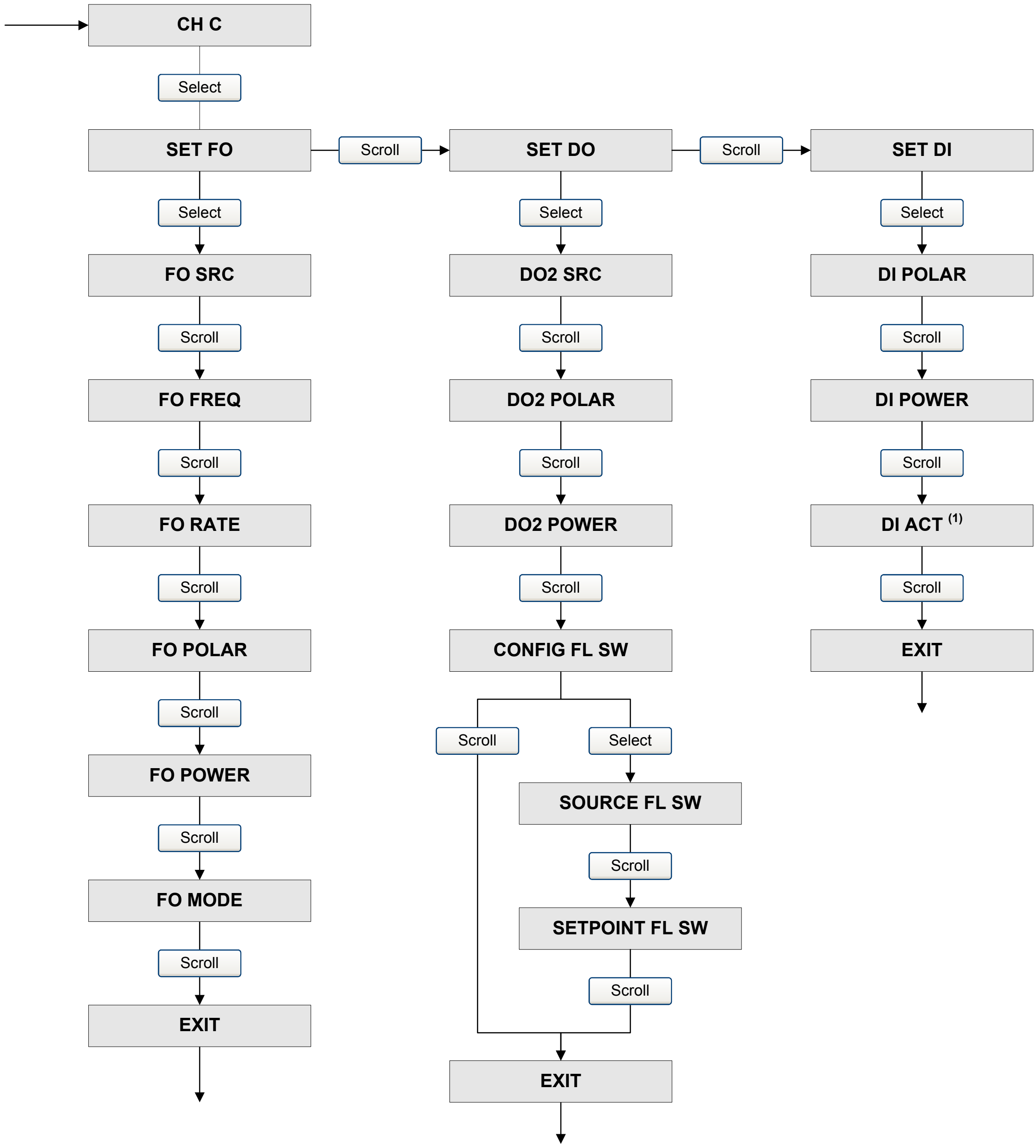
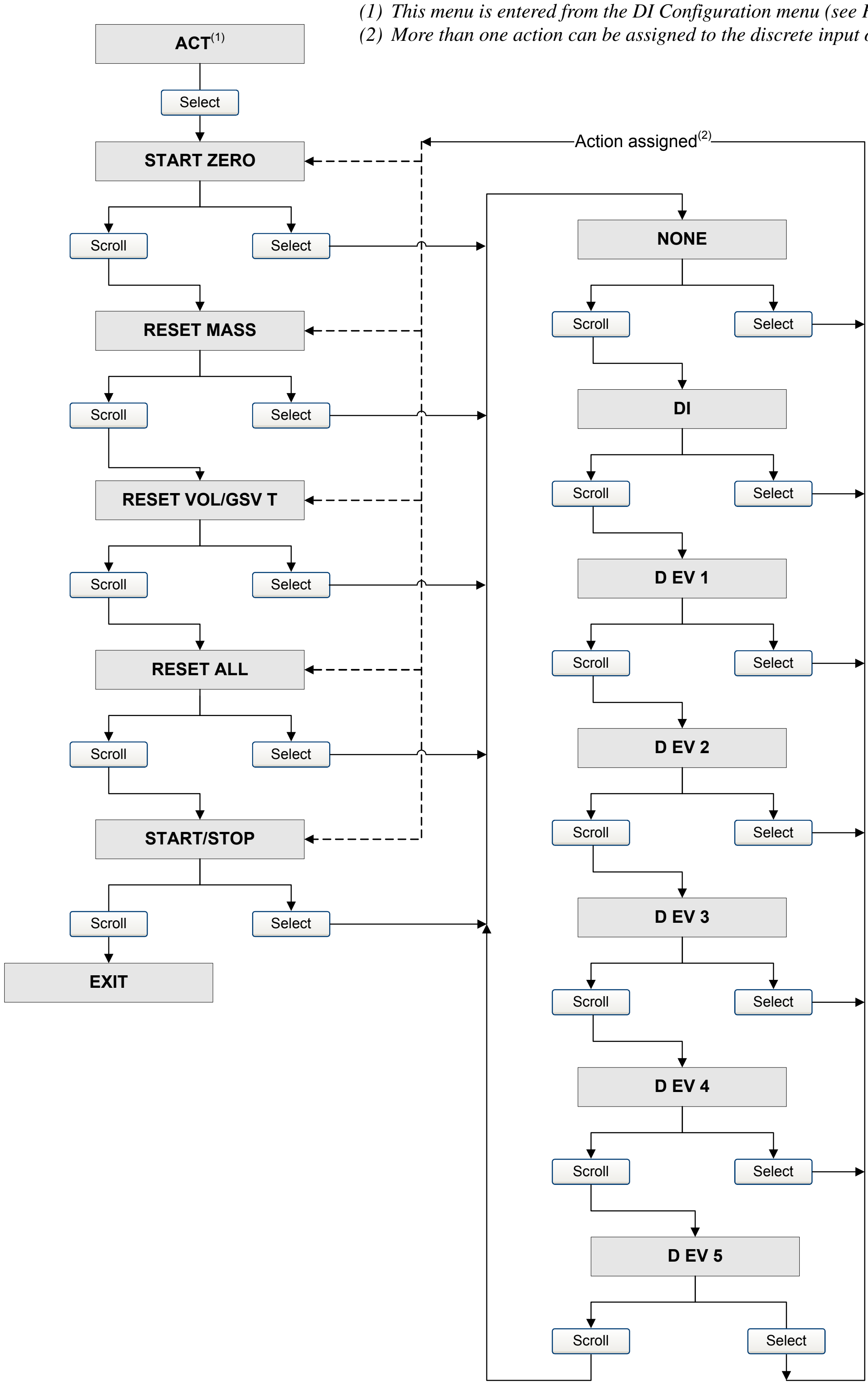


Figure G-17 Display menu – Off-line maintenance: Configuration *continued*



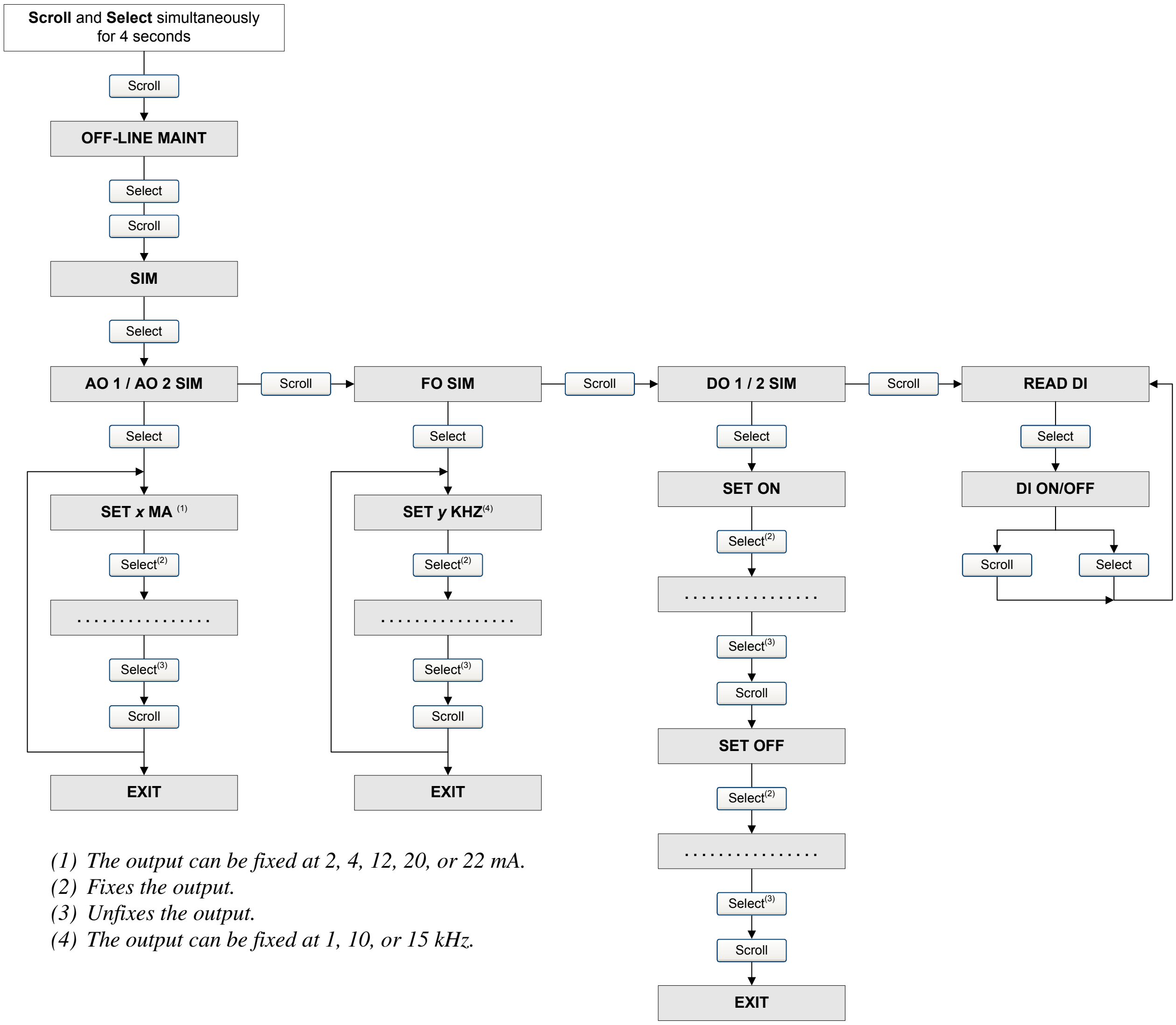
(1) *See Figure G-18.*

Figure G-18 **Display menu – Off-line maintenance: Discrete input and discrete event assignment**



(1) This menu is entered from the DI Configuration menu (see Figure G-17).
(2) More than one action can be assigned to the discrete input or a discrete event.

Figure G-19 Display menu – Off-line maintenance: Simulation (loop testing)



(1) The output can be fixed at 2, 4, 12, 20, or 22 mA.
(2) Fixes the output.
(3) Unfixes the output.
(4) The output can be fixed at 1, 10, or 15 kHz.

Figure G-20 **Display menu – Off-line maintenance: Zero**

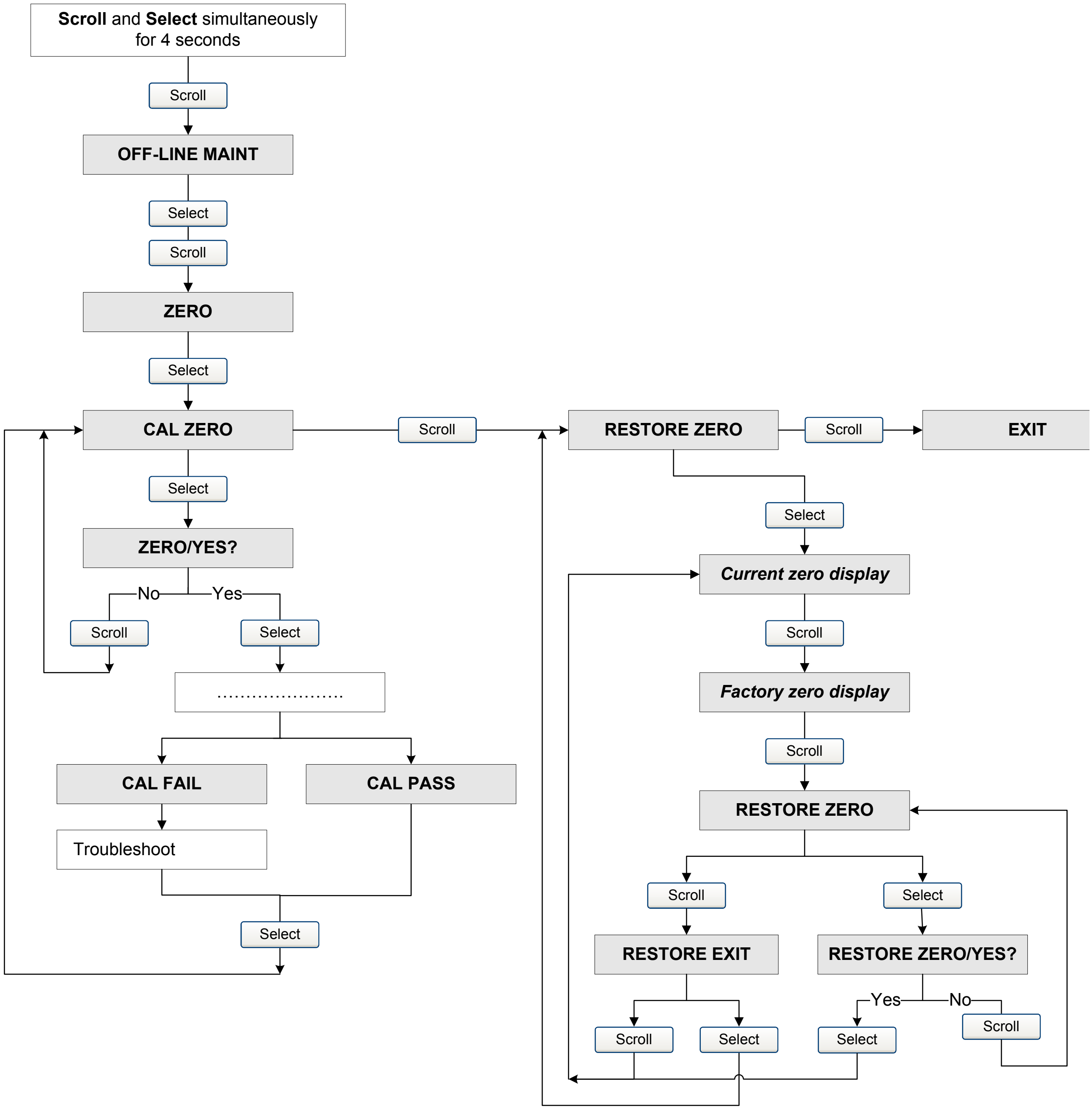
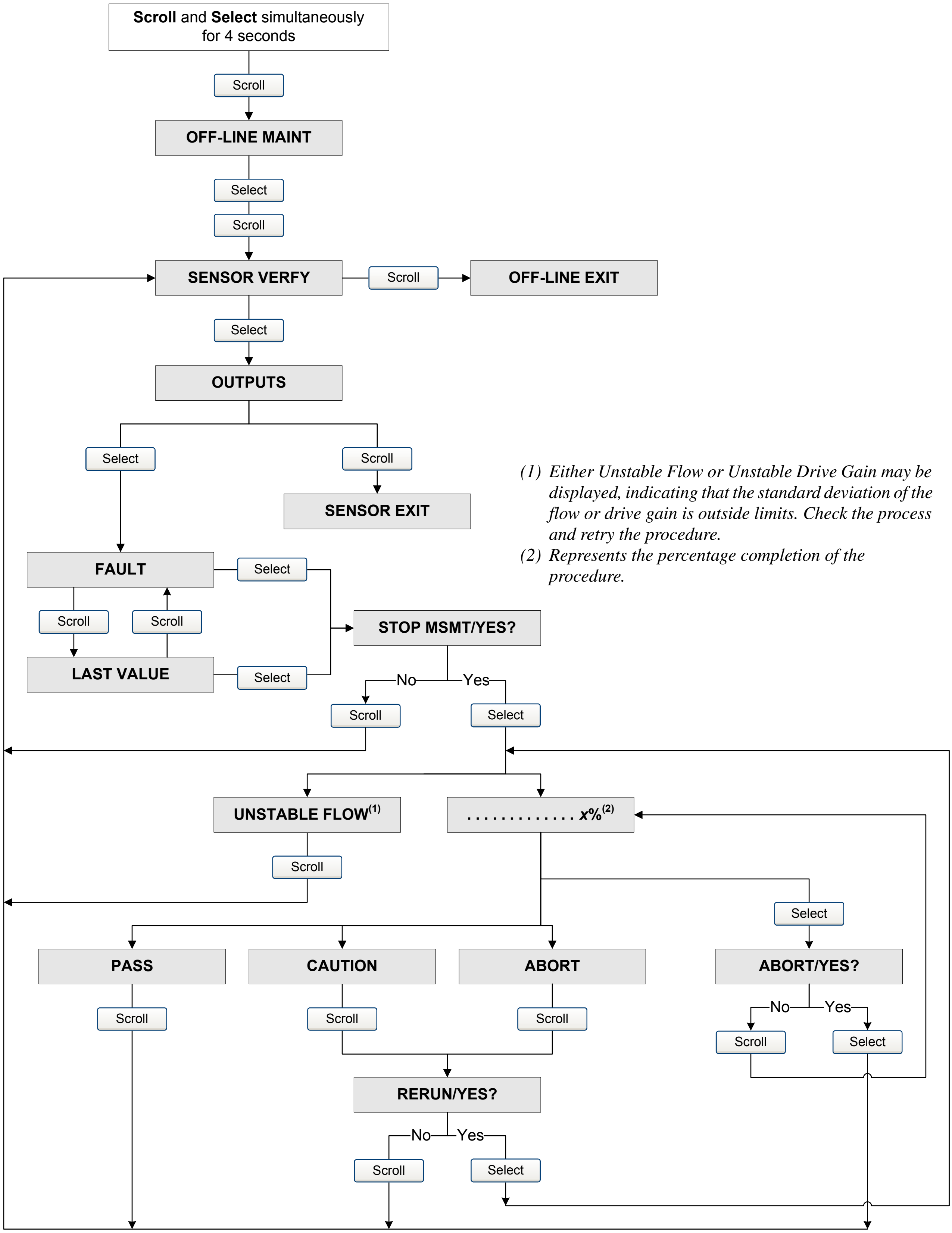


Figure G-21 Display menu – Off-line maintenance: Meter verification



(1) *Either Unstable Flow or Unstable Drive Gain may be displayed, indicating that the standard deviation of the flow or drive gain is outside limits. Check the process and retry the procedure.*

(2) *Represents the percentage completion of the procedure.*

Appendix H
Display Codes and Abbreviations

H.1 Overview

This appendix provides information on the codes and abbreviations used on the transmitter display.

Note: Information in this appendix applies only to transmitters that have a display.

H.2 Codes and abbreviations

Table H-1 lists and defines the codes and abbreviations that are used for display variables (see Section 8.15.1 for information on configuring display variables).

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

These tables do not list terms that are spelled out completely. These tables do not list most measurement units, but do list measurement units related to the petroleum measurement application or the enhanced density application.

Table H-1 Display codes used for display variables

Code or abbreviation	Definition	Comment or reference
AVE_D	Average density	
AVE_T	Average temperature	
BRD_T	Board temperature	
CONC	Concentration	
DRIVE%	Drive gain	
EXT_P	External pressure	
EXT_T	External temperature	
GSV F	Gas standard volume flow	
GSV I	Gas standard volume inventory	
GSV T	Gas standard volume total	
LPO_A	Left pickoff amplitude	
LVOLI	Volume inventory	
LZERO	Live zero flow	
MASSI	Mass inventory	
MTR_T	Case temperature (T-Series sensors only)	
NET M	Net mass flow rate	Enhanced density application only
NET V	Net volume flow rate	Enhanced density application only
NETMI	Net mass inventory	Enhanced density application only
NETVI	Net volume inventory	Enhanced density application only

Table H-1 Display codes used for display variables *continued*

Code or abbreviation	Definition	Comment or reference
PWRIN	Input voltage	Refers to power input to the core processor
RDENS	Density at reference temperature	Enhanced density application only
RPO_A	Right pickoff amplitude	
SGU	Specific gravity units	
STD V	Standard volume flow rate	Enhanced density application only
STDVI	Standard volume inventory	Enhanced density application only
TCDENS	Temperature-corrected density	Petroleum measurement application only
TCORI	Temperature-corrected inventory	Petroleum measurement application only
TCORR	Temperature-corrected total	Petroleum measurement application only
TCVOL	Temperature-corrected volume	Petroleum measurement application only
TUBEF	Raw tube frequency	
WTAVE	Weighted average	

Table H-2 Display codes used in off-line menu

Code or abbreviation	Definition	Comment or reference
ACK ALARM	Acknowledge alarm	
ACK ALL	Acknowledge all	
ACT	Action	
ADDR	Address	
AO1	Analog output 1	
AO2	Analog output 2	
AUTO SCRLL	Auto scroll	
BKLT, B LIGHT	Backlight	
CAL	Calibrate	
CH A	Channel A	
CH B	Channel B	
CH C	Channel C	
CHANGE PASSW	Change password	Change the password required for access to display functions
CHANGE CODE	Change password	Change the password required for access to display functions
CONFG	Configuration	
CORE	Core processor	
CUR Z	Current zero	
CUSTODY XFER	Custody transfer	
D EV	Discrete event	Events configured using the dual-setpoint event model (see Section 8.11)
DENS	Density	

Table H-2 Display codes used in off-line menu *continued*

Code or abbreviation	Definition	Comment or reference
DGAIN, DRIVE %	Drive gain	
DI	Discrete input	
DISBL	Disable	**Select** to disable
DO1	Discrete output 1	
DO2	Discrete output 2	
DSPLY	Display	
E1OR2	Event 1 or Event 2	Events configured using the single-setpoint event model (see Section 8.11)
ENABL	Enable	**Select** to enable
ENABLE ACK	Enable acknowledge	Enable or disable the ACK ALL function
ENABLE ALARM	Enable alarm menu	Access to alarm menu from display
ENABLE AUTO	Enable autoscroll	
ENABLE OFFLN	Enable off-line	Access to off-line menu from display
ENABLE PASSW	Enable password	Enable or disable password protection for display functions
ENABLE RESET	Enable totalizer reset	Enable or disable totalizer reset from display
ENABLE START	Enable totalizer start	Enable or disable totalizer start/stop from display
EVNT1	Event 1	Event configured using the single-setpoint event model only (see Section 8.11)
EVNT2	Event 2	Event configured using the single-setpoint event model only (see Section 8.11)
EXTRN	External	
FAC Z	Factory zero	
FCF	Flow calibration factor	
FL SW	Flow switch	
FLDIR	Flow direction	
FLSWT	Flow switch	
FO	Frequency output	
FREQ	Frequency	
GSV	Gas standard volume	
INTERN	Internal	
IO	Input/output	
LANG	Language	
LOCK	Write-protect	
LOOP CUR	Loop current	
MTR F	Meter factor	
M_ASC	Modbus ASCII	
M_RTU	Modbus RTU	
MAO1	mA output 1 (primary mA output)	
MAO2	mA output 2 (secondary mA output)	
MASS	Mass flow	

Table H-2 Display codes used in off-line menu *continued*

Code or abbreviation	Definition	Comment or reference
MBUS	Modbus	
MFLOW	Mass flow	
MSMT	Measurement	
OFFLN	Off-line	
OFF-LINE MAINT	Off-line maintenance	
POLAR	Polarity	
PRESS	Pressure	
QUAD	Quadrature	
r.	Revision	
SIM	Simulation	Used for loop testing, not simulation mode. Simulation mode is not accessible via the display.
SPECL	Special	
SRC	Source	Variable assignment for outputs
TEMP, TEMPR	Temperature	
VER	Version	
VERFY	Verify	
VFLOW	Volume flow	
VOL	Volume, volume flow	
WRPRO	Write protect	
XMTR	Transmitter	

Appendix I
NE53 History

I.1 Overview

This appendix documents the change history of the Series 1000/2000 transmitter software.

I.2 Software change history

Table I-1 describes the change history of the transmitter software. Operating instructions are English versions.

Table I-1 **Transmitter software change history**

Date	Software version	Changes to software	Operating instructions
08/2000	1.x	*Software expansion*	3600204 A
		Added writing of the device tag using Modbus	
		Software adjustment	
		Improved communication handling with the HART Tri-Loop	
		Feature addition	
		Indication of outputs option board type appears on display at power-up	
05/2001	2.x	*Software expansion*	3600204 B 3600647 A
		Added alarm A106 to indicate HART burst mode is enabled	
		Added access to the transmitter in fault status bit via Modbus	
		Control of HART burst mode now available via Modbus	
		Added support for the Model 1700 transmitter	
		Added support for the I.S. transmitter option	
		Added support to configure the process variable units for mass flow, volume flow, density and temperature from the display	
		Added support for assigning process variables to the milliamp and frequency output from the display	
		Software adjustment	
		Clarified the interaction of the digital fault setting and the last measured value timeout	
		Feature addition	
		Drive gain can be assigned to mA output	
		Pressure compensation added via HART	
		Channel B can be configured as a discrete output	

Table I-1 Transmitter software change history *continued*

Date	Software version	Changes to software	Operating instructions
12/2001	3.x	*Software expansion*	3600647 B 3600785 A 20000325 A 20000325 B 20000150 A 20000150 B 20000148 A
		Added support for the configurable I/O option board	
		Software version information available via the display or Modbus	
		Configurable density cut-off	
		Additional HART variables can be assigned to QV	
		The display start/stop totalizers function can be enabled or disabled	
		Petroleum measurement application improvements	
		Live zero available as display variable	
		Increased options for fault output settings	
		New cryogenic application temperature algorithms	
		Software adjustment	
		Improved frequency output stability and unit conversions	
		Improved the handling of volume flow rate when slug flow is detected	
		Improved handling of density values and calibrations during fault conditions	
		Display configuration, screen flow and optical switch changes	
		HART communication and burst mode improvements	
		Feature addition	
		Petroleum measurement application added	
		Custody transfer option added to Configurable I/O option board	
		HART polliing for external pressure/temperature added	
06/2003	4.x	*Software expansion*	20000325 C 20000150 C 3600647 C 20000148 B 20001715 A
		Added support for the Model 1500 transmitter	
		Increased variables displayed by the Model 1700	
		Software adjustment	
		Improved the handling of certain alarm conditions	
		Clarified the behavior of certain Modbus calibration coils	
		Clarified the interaction between certain density measurement units and density cutoff values	
		Improved the handling of the mA source setting via the display	
		Improvements to pressure and temperature polling	
		HART Tri-Loop and other communication improvements	
		Clarified the value returned by Modbus scaled integer registers during a fault condition	
		Feature addition	
		Discrete values now available through Modbus	

Table I-1 Transmitter software change history *continued*

Date	Software version	Changes to software	Operating instructions
09/2006	5.x	*Software expansion*	20001715 B
		Discrete output assignable as a flow switch	
		Discrete output fault indication configurability	
		Discrete input support for multiple action assignments	
		Added support for querying the display LED status via Modbus	
		Additional HART and Modbus commands	
		Process comparator expanded to five configurable events	
		Factory configuration restore function	
		Factory zero restore function	
		Alarm history expanded	
		Selectable write protection for configuration data	
		Expanded selection of source assignments for mA output	
		Expanded storage of mA range values	
		Expanded custody transfer application for independent implementation of NTEP and OIML compliance	
		Software adjustment	
		Display improvements for floating point data	
		Feature addition	
		Configurable alarm severity	
		Gas standard volume functionality	
		Meter verification availability as an option	
		Multiple display language selections	

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