Instruction Manual
P/N 20002373, Rev. B
May 2008

Micro Motion®
LF-Series Transmitters

Configuration and Use Manual

- Field-mount transmitter with 1 mA/1 FO flow-only
- Field-mount transmitter with 1 mA/1 FO multivariable
- Field-mount transmitter with 2 mA/1 FO multivariable
- DIN rail mount transmitter with 1 mA/1 FO flow-only
- DIN rail mount transmitter with 2 mA/ 1FO multivariable

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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 LF-Series transmitters:

- LF-Series field-mount transmitter with the 1 mA/1 FO outputs option board (flow-only)
- LF-Series field-mount transmitter with the 1 mA/1 FO outputs option board (multivariable)
- LF-Series field-mount transmitter with the 2 mA/1 FO outputs option board (multivariable, configurable)
- LF-Series DIN rail mount transmitter with the 1 mA/1 FO outputs option board (flow-only)
- LF-Series DIN rail mount transmitter with the 2 mA/1 FO outputs option board (multivariable, configurable), with or without the Filling and Dosing application

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

Note: Information on configuration and use of LF-Series transmitters with FOUNDATION™ fieldbus outputs is provided in a separate manual. 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 Transmitter codes used in this manual

In this manual, codes are used to identify specific LF-Series transmitter types. The codes are listed in Table 1-1.

Table 1-1 Transmitter codes

Transmitter type	Code
All LF-Series field-mount transmitters	FM
LF-Series field-mount transmitter with the 1 mA/1 FO outputs option board (flow-only)	FM AN F
LF-Series field-mount transmitter with the 1 mA/1 FO outputs option board (multivariable)	FM AN M
LF-Series field-mount transmitter with the 2 mA/1 FO outputs option board (multivariable, configurable)	FM CIO
LF-Series field-mount transmitter with the FOUNDATION fieldbus outputs option board	FM FB
All LF-Series DIN rail mount transmitters	DIN

Table 1-1 Transmitter codes *continued*

Transmitter type	Code
LF-Series DIN rail mount transmitter with the 1 mA/1 FO outputs option board (flow-only)	DIN AN
LF-Series DIN rail mount transmitter with the 2 mA/1 FO outputs option board (multivariable, configurable)	DIN CIO
LF-Series DIN rail mount transmitter with the 2 mA/1 FO outputs option board (multivariable, configurable) with the Filling and Dosing Application	DIN CIO FD

1.4 Determining your transmitter type and version

To configure, use, and troubleshoot the transmitter, you must know your transmitter type. This section provides instructions for this information. Record this information in the pre-configuration worksheet in Section 1.8.

1.4.1 Transmitter type and outputs option board

To determine your transmitter type:

1. Obtain the transmitter's model number, which is provided on a tag attached to the side of the transmitter.
2. The fourth character in the model number (**LFTXxxxxxxx**) represents the transmitter type that was ordered:
   - **1** = FM AN flow-only
   - **2** = DIN AN
   - **3** = FM AN multivariable
   - **4** = FM CIO
   - **5** = DIN CIO
   - **6** = FM FB
   - **8** = DIN CIO with the Filling and Dosing application

1.4.2 Version

Different configuration options are available with different versions of the components. Table 1-2 lists the version information that you may need and describes how to obtain the information.

Table 1-2 Obtaining version information

Component	With ProLink II	With Communicator	With Display
Transmitter software	View/Installed Options/ Software Revision	Review/Device info/ Software rev	OFF-LINE MAINT/VER
Sensor 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	Not applicable

1.5 Flowmeter documentation

Table 1-3 lists documentation sources for additional information.

Table 1-3 Flowmeter documentation resources

Topic	Document
Sensor installation	*LF-Series Flowmeters: Sensor/Transmitter Installation Manual*
Transmitter installation	*LF-Series Flowmeters: Sensor/Transmitter Installation Manual*

1.6 Using this manual

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

This manual describes features and procedures that apply to most or all of the LF-Series 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.

1.6.1 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
FM AN F	✓	✓	✓
FM AN M	✓	✓	✓
FM CIO	✓	✓	✓
DIN AN		✓(2)	✓
DIN CIO		✓(2)	✓
DIN CIO FD		✓(3)	

(1) LF-Series FM transmitters may be ordered with or without a display.
(2) Requires ProLink II v2.1 or later.
(3) Requires ProLink II v2.3 or later.

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, see the ProLink II manual, available on the Micro Motion website (www.micromotion.com).
- Basic information on the 375 Field Communicator and connecting the Communicator to your transmitter is provided in Chapter 4. For more information, see the Field Communicator documentation available on the Micro Motion web site (www.micromotion.com).

You may be able to use other tools from Emerson Process Management, such as AMS. Use of AMS is not dicussed in this manual; however, the user interface that AMS provides is similar to the ProLink II user interface.

1.7 Planning the configuration

The pre-configuration worksheet in Section 1.8 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.

1.8 Pre-configuration worksheet

Note: Not all options are available for all transmitters.

Item		Configuration data	
Transmitter model number		______________________	
Transmitter model		☐ FM AN F ☐ FM AN M ☐ FM CIO ☐ DIN AN ☐ DIN CIO ☐ DIN CIO FD	
Transmitter software version		______________________	
Sensor 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	☐ 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	______________________	

Item		Configuration data
Measurement units	Mass flow	________________
	Volume flow	________________
	Density	________________
	Pressure	________________
	Temperature	________________
ProLink II version		________________
Communicator device description version		________________

1.9 Customer service

For technical assistance, phone the Micro Motion Customer Service department:

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

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

Chapter 2
Using the Transmitter Display

2.1 Overview

- FM AN F
- FM AN M
- FM 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 2.4.2)

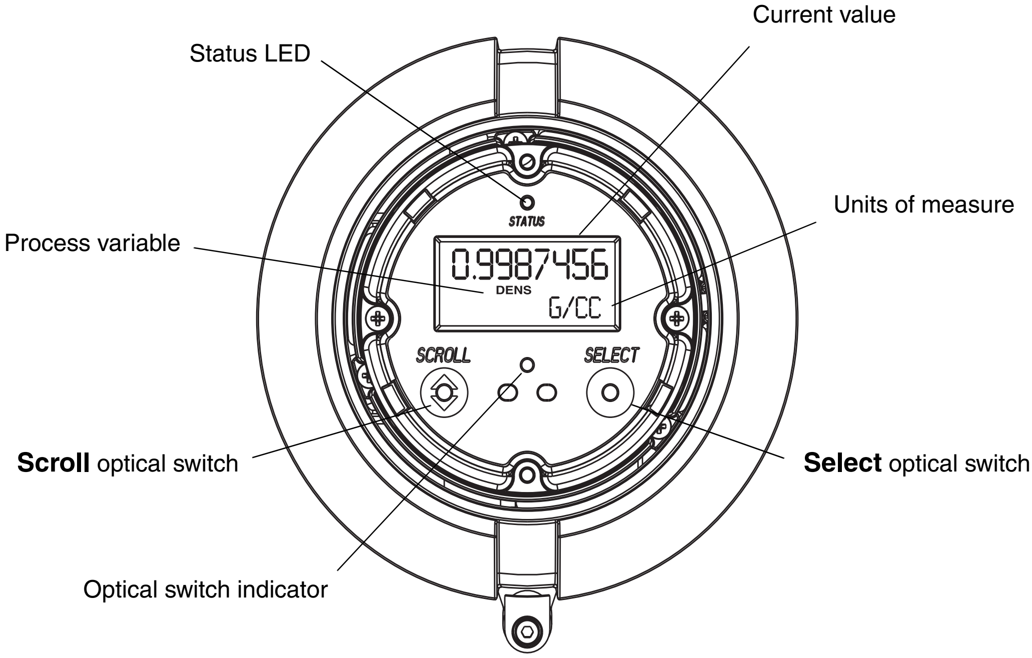
Note: The DIN rail mount transmitters do not have displays, and the field-mount transmitters can be ordered with or without displays.

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 the Communicator to communicate with the transmitter.

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.

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

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 8.14.4 for information on configuring the display variables.
- See Appendix H for information on the codes and abbreviations used for display variables.

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.
- 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.

2.4.1 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.

2.4.2 Display password

Some of the display functions, such as the off-line menu and resetting totalizers, can be protected by a password. For information about enabling and setting the password, refer to Section 8.14.

Note: If the petroleum measurement application is enabled on your transmitter, an off-line password is always required to start, stop, or reset a totalizer, even if the display off-line password parameter is disabled.

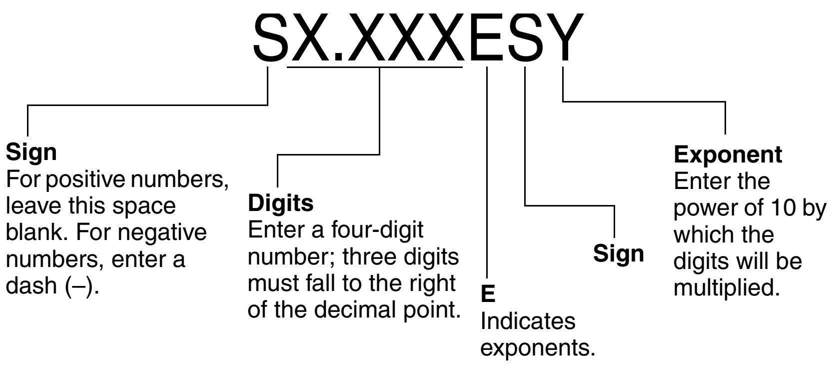
If a password is required, the word **CODE?** appears at the top of the password screen. Enter the digits of the password one at a time by using **Scroll** to choose a number and **Select** to move to the next digit.

If you encounter the display password screen but do not know the password, wait 60 seconds without activating any of the display optical switches. The password screen will time out automatically and you will be returned to the previous screen.

2.4.3 Entering milliamp and frequency range values with the display

If you are using the display to change transmitter settings, the display uses a standard format and procedure for entering range values for either mA or frequency outputs.

Enter range and scale values in scientific notation according to the following format:



Example of range value format

The correct format for the number –810,000 is shown below:

–8.100E 5

To enter mA or frequency range values with the display:

Note: This procedure assumes that you are already at the correct point in the display menu to begin entering the range values.

1. **Scroll**, if necessary, until the first space is either a minus sign (–) for a negative number or a blank space for a positive number.
2. **Select**.
3. **Scroll** until the first digit is the correct number.
4. **Select**.
5. **Scroll** until the second digit is the correct number.
6. **Select**.
7. **Scroll** until the third digit is the correct number.
8. **Select**.
9. **Scroll** until the fourth digit is the correct number.
10. **Select**.
11. **Scroll**, if necessary, until the sign for the exponent is either a dash (–) for a negative exponent or a blank space for a positive exponent.

12. **Select**.
13. **Scroll** until the exponent is the correct power of 10.
14. **Scroll** and **Select** simultaneously for four seconds to save and exit.

Chapter 3
Connecting with ProLink II Software

3.1 Overview

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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

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

- Requirements (see Section 3.2)
- Configuration upload/download (see Section 3.3)
- Connecting to a field-mount transmitter (see Section 3.4)
- Connecting to a DIN rail mount transmitter (see Section 3.5)

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

Note: ProLink II uses the Model 1500/1700/2500/2700 device descriptions for the LF-Series field-mount transmitters. Accordingly, when you connect to an LF-Series transmitter, you will see a Model 1500/1700/2500/2700 model code on the ProLink II screen.

3.2 Requirements

To use ProLink II with an LF-Series transmitter, the following are required:

- ProLink II v2.0 or later (some LF models require later versions of ProLink II)
- Signal converter, to convert the PC's serial port signal to the signal used by the transmitter
  - For RS-485 connections, an RS-485 to RS-232 signal converter. The Black Box® Async RS-232 <-> 2-wire RS-485 Interface Converter (Code IC521A-F) signal converter is available from Micro Motion. Contact Micro Motion if you need an RS-485 signal converter.
  - For Bell 202 connections, a HART interface. The MACTek® Viator® RS232 HART® Interface is available from Micro Motion. Contact Micro Motion if you need a HART interface.
- 25-pin to 9-pin adapter (if required by your PC)

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 an LF-Series field-mount transmitter

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

Note: 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.

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.

Table 3-1 Connection options for field-mount transmitters

Connection	Physical layer	Protocol	Transmitter	
			FM AN A	FM 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

- FM AN F
- FM AN M
- FM 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 port of your PC, using a 25-pin to 9-pin adapter if required.
2. Open the cover to the wiring compartment.

Opening the wiring compartment in a hazardous area can cause an explosion. When the transmitter is in an explosive atmosphere, do not use the service port to connect to your transmitter.

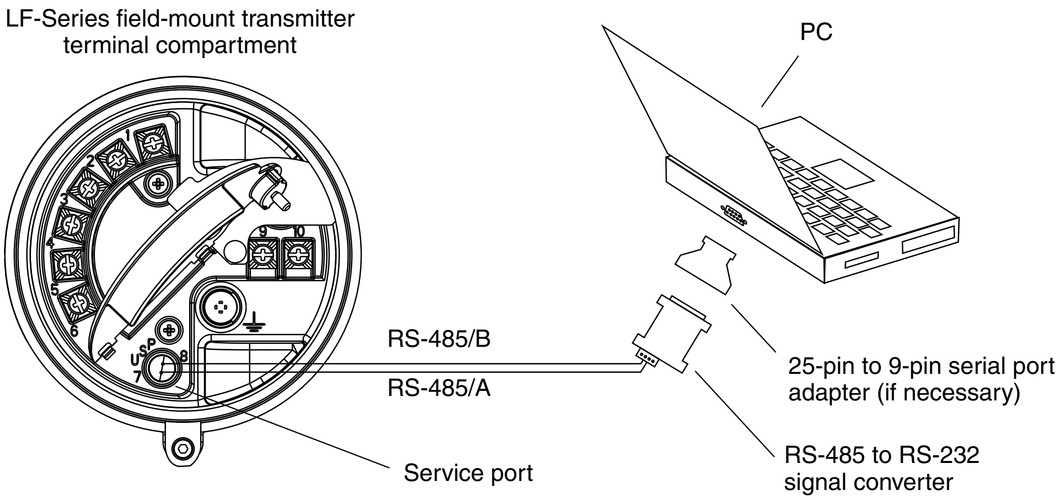
3. Open the power supply compartment.

Opening the power supply compartment in a hazardous area 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 of explosive gases.

Opening the power supply compartment can expose the operator to 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 an LF-Series field-mount transmitter



5. Start ProLink II software. From the Connection menu, click on **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 the **Connect** button. ProLink will attempt to make the connection.
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

- FM AN F
- FM AN M

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

1. Attach the signal converter to the serial 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 LF-Series FM AN transmitter

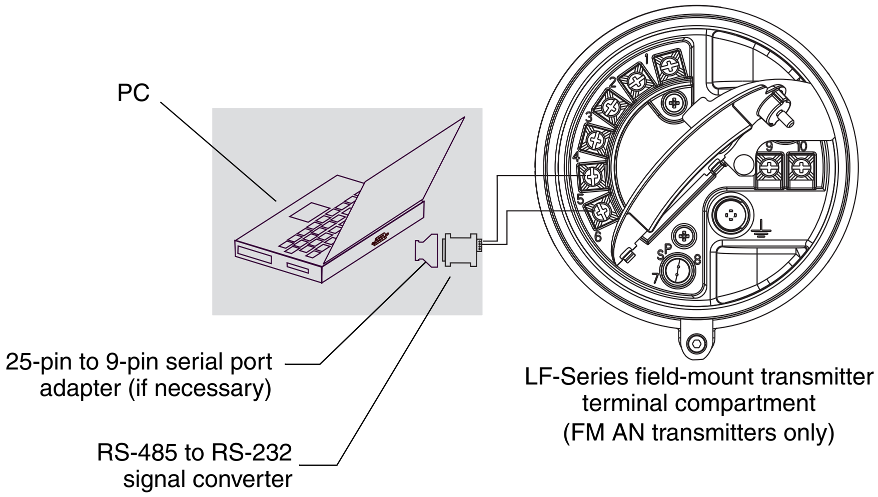
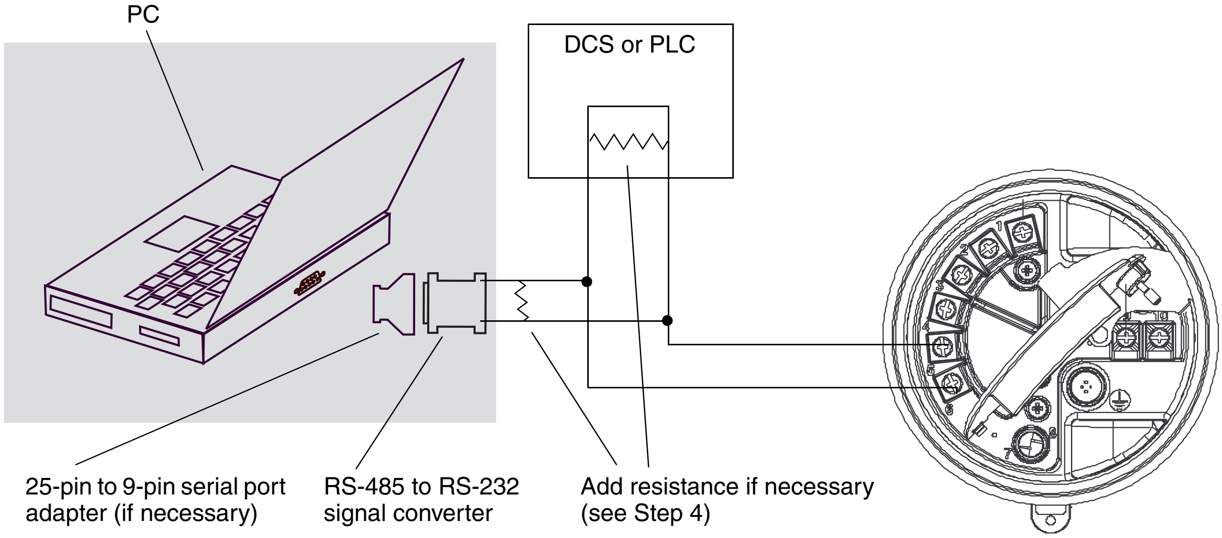


Figure 3-3 RS-485 network connections to LF-Series FM AN transmitter



5. Start ProLink II software. From the Connection menu, click on **Connect to Device**.
6. Set **Protocol**, **Baud Rate**, **Stop Bits**, and **Parity** to the RS-485 values configured in the transmitter. See Section 8.15.

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 8-8.

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 8.15.
8. Set the **COM Port** value to the PC COM port assigned to this connection.
9. Click the **Connect** button. ProLink will attempt to make the connection.
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.
    c. 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 terminals or to a HART multidrop network

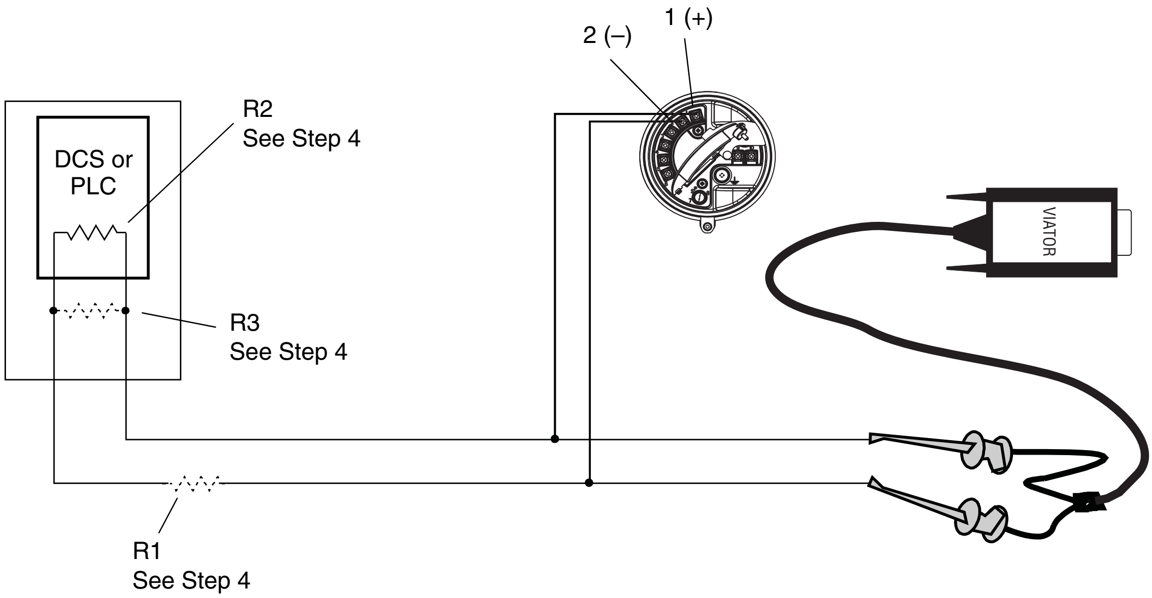
- FM AN F
- FM AN M
- FM CIO

Connecting a HART device to the transmitter's primary mA output terminals could cause transmitter output error. Set control devices for manual operation before connecting a HART interface to the transmitter's primary mA output loop.

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

1. Attach the HART interface to the serial port of your PC.
2. To connect to the primary mA terminals, open the cover to the wiring compartment and connect the HART interface leads to the terminals labeled **1** and **2**, or to the output wires from these terminals.
3. To connect to a HART multidrop network, connect the HART interface leads to any point on the network.

Figure 3-4 HART/Bell202 connections to LF-Series field-mount transmitters



4. Add resistance as required. The Viator HART interface must be connected across a resistance of 250–600 Ω. To meet the resistance requirements, you may use any combination of resistors R1, R2, and R3 (see Figure 3-4).
5. Start ProLink II software. From the Connection menu, click on **Connect to Device**.
6. Set **Protocol** to HART Bell 202. **Baud rate**, **Stop bits**, and **Parity** are automatically set to the values required by HART protocol.
7. Set the **Address/Tag** value to the HART polling address configured for the transmitter. The default HART polling address is 0. See Section 8.15 for information on the HART polling address.
8. Set the **COM Port** value to the PC COM port assigned to this connection.

9. Set **Master** as appropriate:
   - If another host such as a DCS is on the network, set **Master** to Secondary.
   - If no other host is on the network, set **Master** to Primary.

Note: The 375 Field Communicator is not a host.

10. Click the **Connect** button. ProLink will attempt to make the connection.
11. 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 an LF-Series DIN rail mount transmitter

- DIN AN
- DIN CIO
- DIN CIO FD

ProLink II software can communicate with an LF-Series DIN Rail mount transmitter using:

- Modbus/RS-485 protocol (see Section 3.5.1)
  - Configurable connection
  - SP (service port) standard connection
- A HART/Bell202 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 are available only for the 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 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 3-5.
3. To connect to an RS-485 network, connect the signal converter leads to any point in the network. See Figure 3-6.
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.

Figure 3-5 RS-485 terminal connections to LF-Series DIN rail mount transmitter

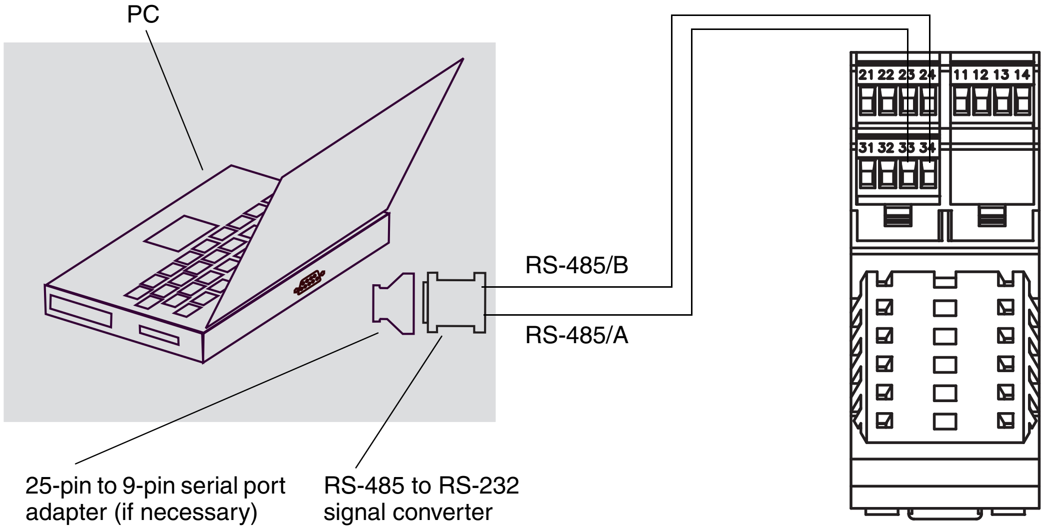
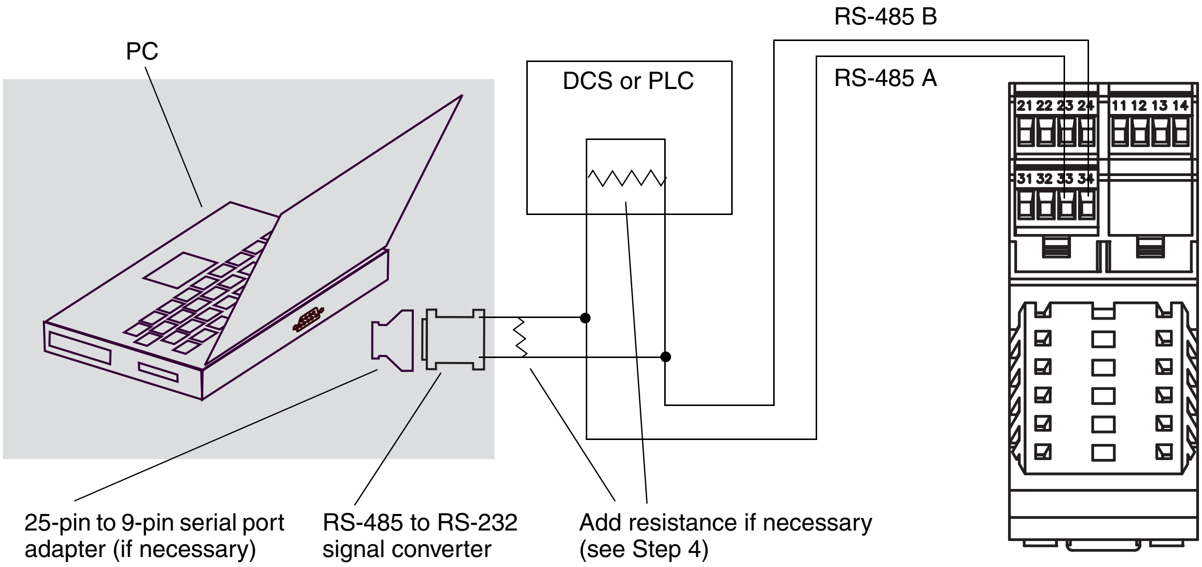


Figure 3-6 RS-485 network connections to LF-Series DIN rail mount transmitter



5. Start ProLink II software. From the Connection menu, click on **Connect to Device**. In the screen that appears, specify connection parameters appropriate to your connection:
   - 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 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 parameter	Connection type: Configurable (RS-485 mode)	Connection type: 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.

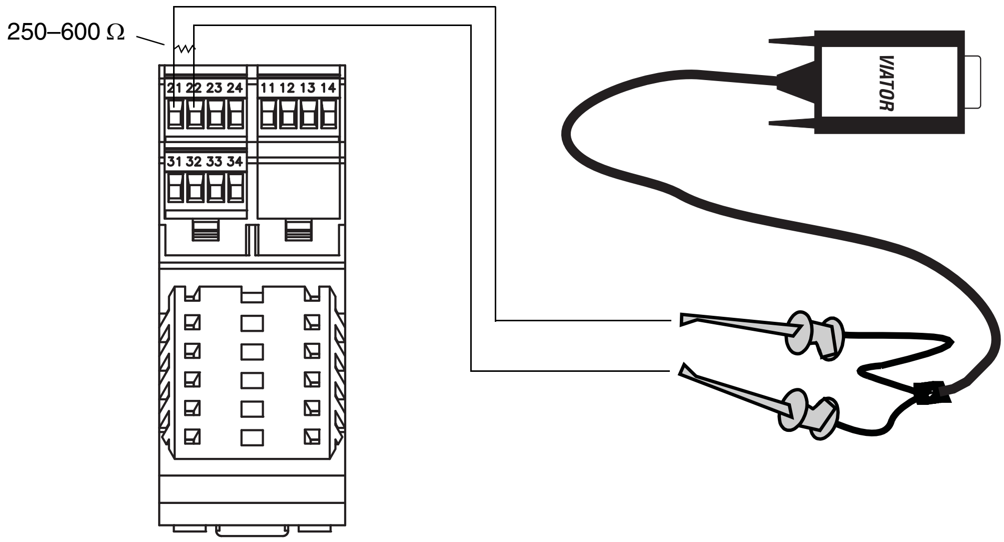
6. Click the **Connect** button. ProLink will attempt to make the connection.
7. If an error message appears:
   a. Swap the leads between the two terminals and try again.
   b. Ensure you are using the correct COM port.
   c. If you are in RS-485 mode, you may be using incorrect connection parameters.
      - 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.
   d. Check all the wiring between the PC and the transmitter.

3.5.2 HART/Bell202 connections

Connecting a HART device to the transmitter's primary mA output terminals could cause transmitter output error. Set control devices for manual operation before connecting a HART interface to the transmitter's primary mA output loop.

HART/Bell202 connections are made through terminals 21 and 22. See Figure 3-7.

Figure 3-7 HART/Bell202 connections to LF-Series DIN rail mount transmitter



Follow the instructions below to make the connection.

1. Connect the HART interface to your PC's serial port. Then connect the leads of the HART interface to terminals 21 and 22.
2. Add 250–600 Ω resistance to the connection, as required.
3. Start ProLink II software. From the Connection menu, click on **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 the **Connect** button. ProLink will attempt to make the connection.
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.

Chapter 4
Connecting with the 375 Field Communicator

4.1 Overview

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

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

Note: The DIN CIO FD transmitter can only be configured using ProLink II.

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

- Communicator device descriptions (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 software. The documentation is available on the Micro Motion website (www.micromotion.com).

4.2 Communicator device descriptions

The Communicator uses the Model 1500/1700/2500/2700 device descriptions for the LF-Series field-mount transmitters. Accordingly, when you connect to an LF-Series transmitter, you may see a Model 1500/1700/2500/2700 model code on the Communicator display.

Table 4-1 lists the Communicator device descriptions that are available for LF-Series transmitters.

Table 4-1 Transmitter models and device descriptions

Transmitter	Device description
DIN AN	1500 Mass Flow
FM AN F	1000 Mass Flow
FM CIO	2000C Mass Flow
FM AN M	2000 Mass Flow
DIN CIO	2000C Mass Flow

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**.

If you do not see the appropriate device description, contact Micro Motion Customer Support.

4.3 Connecting to a transmitter

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN 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:

Connecting a HART device to the transmitter's primary mA output terminals could cause transmitter output error. Set control devices for manual operation before connecting a HART interface to the transmitter's primary mA output loop.

1. If you are connecting to an LF-Series field-mount transmitter, open the cover to the wiring compartment.

Opening the wiring compartment in a hazardous area can cause an explosion. When the transmitter is in an explosive atmosphere, do not use the mA terminals to connect to your transmitter.

2. Connect the Communicator leads to the transmitter's primary mA output terminals:
   - FM transmitters: terminals 1 and 2 (see Figure 4-1)
   - DIN transmitters: terminals 21 and 22 (see Figure 4-2)
3. The Communicator must be connected across a resistance of 250–600 Ω. Add resistance to the connection. See Figure 4-1.

Connecting with the 375 Field Communicator

Figure 4-1 Connecting to communication terminals – field-mount transmitters

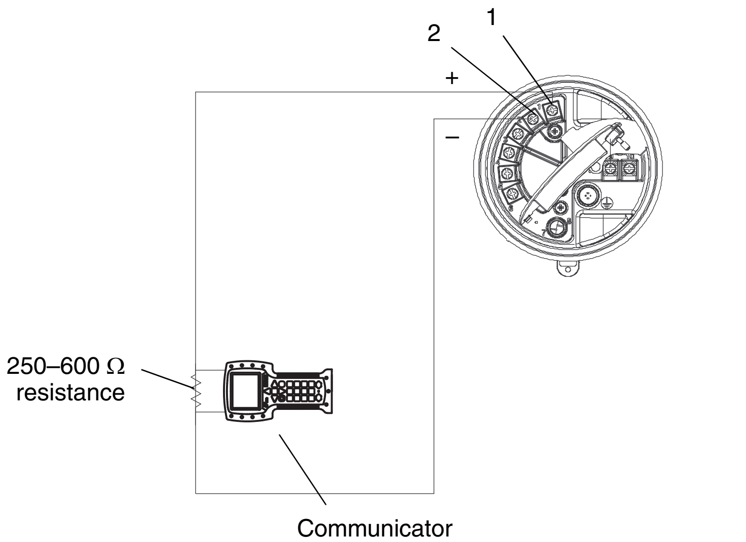
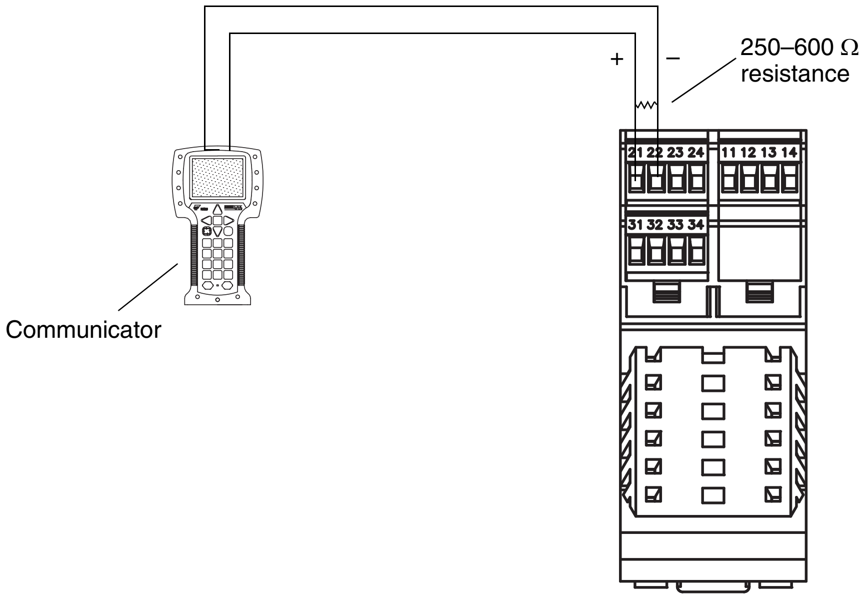


Figure 4-2 Connecting to communication terminals – DIN rail mount transmitters

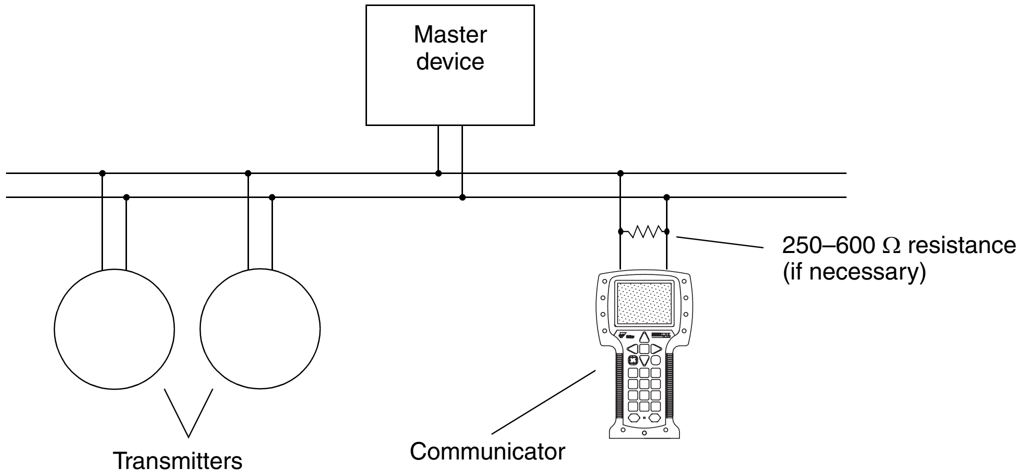


4.3.2 Connecting to a multidrop network

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.

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

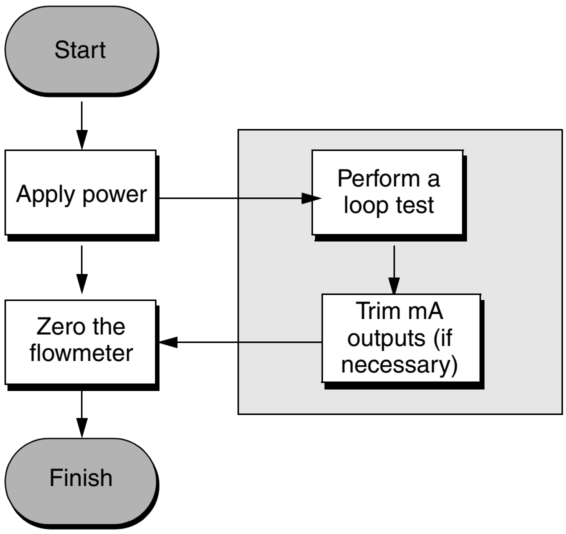
This chapter describes the procedures you should perform the first time you start the flowmeter. You do not need to use these procedures every time you cycle power to the flowmeter.

The following procedures are discussed:

- Applying power to the flowmeter (see Section 5.2)
- Zeroing the flowmeter (see Section 5.5)
- Performing a loop test on the transmitter outputs (see Section 5.3)
- Trimming the mA outputs (see Section 5.4)

Figure 5-1 provides an overview of the flowmeter startup procedures.

Figure 5-1 Startup procedures



Note: 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.

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

Note: 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.

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.

Using the service port to communicate with an LF-Series field-mount 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.

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 LF-Series field-mount transmitters under normal conditions, the status LED on the display will turn green and begin to flash,
- For LF-Series DIN rail mount 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 7.4.

5.2.1 Communication methods after power-up

For LF-Series field-mount transmitters, all communication methods supported by the transmitter are available immediately after power-up.

For LF-Series DIN rail mount transmitters:

- If you are using the Communicator, or ProLink II with HART protocol (HART/Bell202), you can establish communication with the transmitter immediately after power-up, using terminals 21 and 22. See Chapter 4 for more information on using the Communicator, or Chapter 3 for more information on using ProLink II.
- If you are using ProLink II via the RS-485 physical layer, terminals 33 and 34 are available in service port mode for 10 seconds immediately after power-up. If no 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 terminals are configured for the input/outputs that will be used in your application (see Section 6.2).

You can perform a loop test with the display, with ProLink II, or the Communicator.

5.3.1 Loop testing with the display

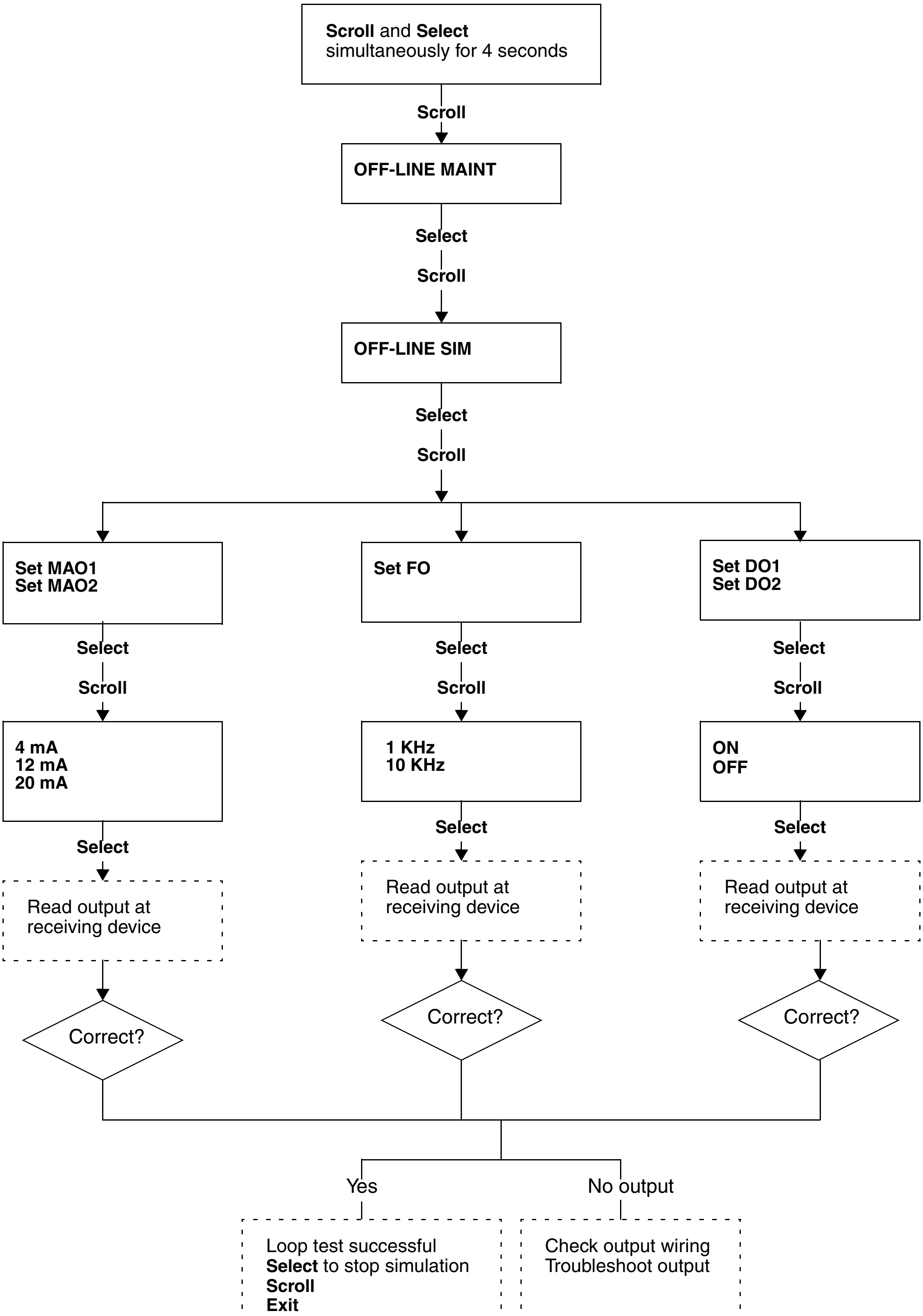
- FM AN F
- FM AN M
- FM CIO

See Figure 5-2 for the loop test procedure. Not all options are available on all transmitters.

Note the following:

- The display cannot be used to test the discrete input. If your transmitter has a discrete input, use ProLink II or a Communicator to perform the discrete input loop test.
- The mA reading does not need to be exact. You will correct differences when you trim the mA output. See Section 5.4.
- While the output is fixed:
  - Dots traverse the top line of the display.
  - The status LED blinks yellow.
- When the output is unfixed:
  - The dots disappear.
  - The status LED returns to the state it was in before the output was fixed.

Figure 5-2 **Display – Loop test procedure**



5.3.2 Loop testing with ProLink II

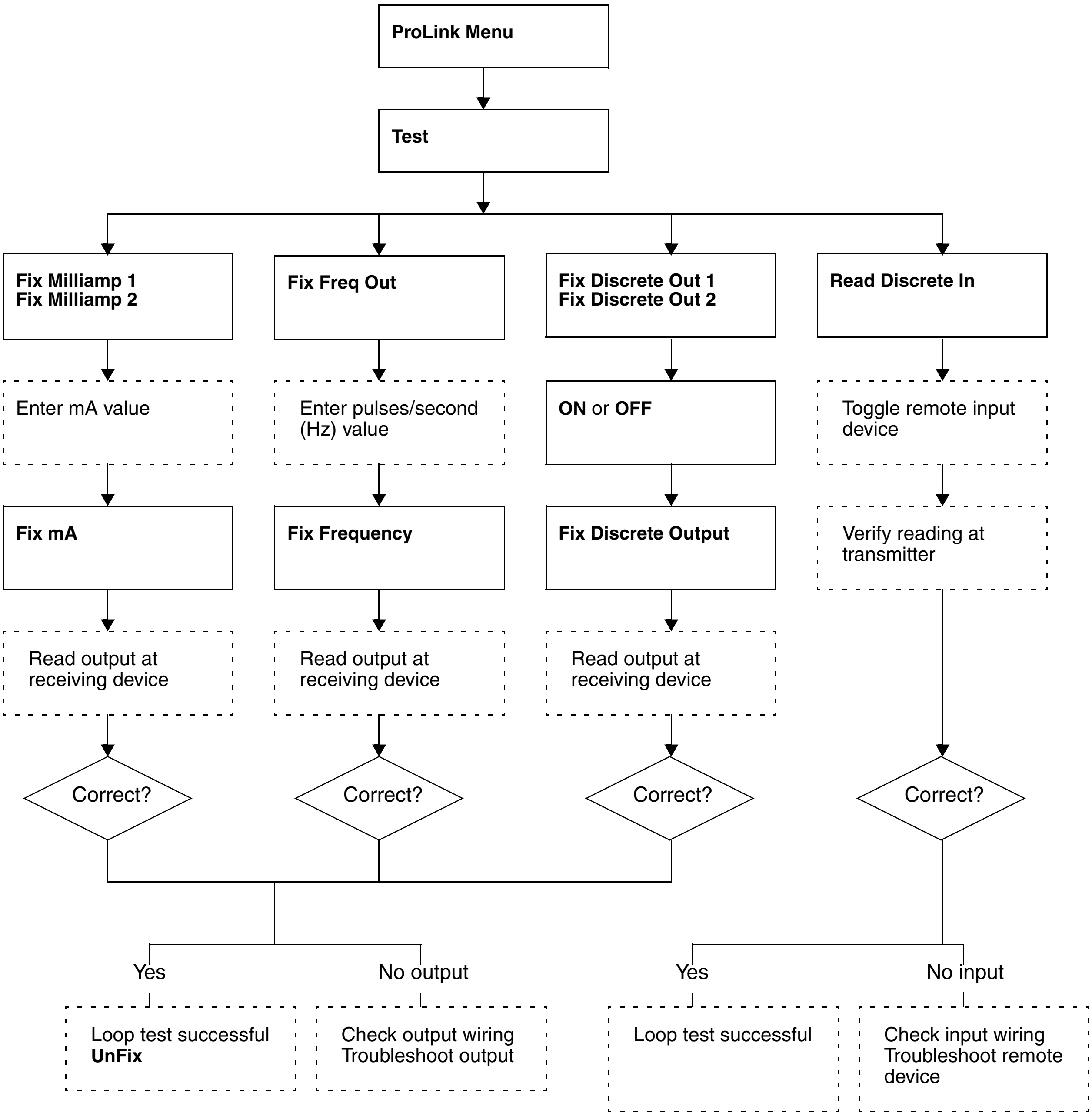
- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

See Figure 5-3 for the loop test procedure. Not all options are available on all transmitters.

Note the following:

- The mA reading does not need to be exact. You will correct differences when you trim the mA output. See Section 5.4.

Figure 5-3 ProLink II – Loop test procedure



5.3.3 Loop testing with a Communicator

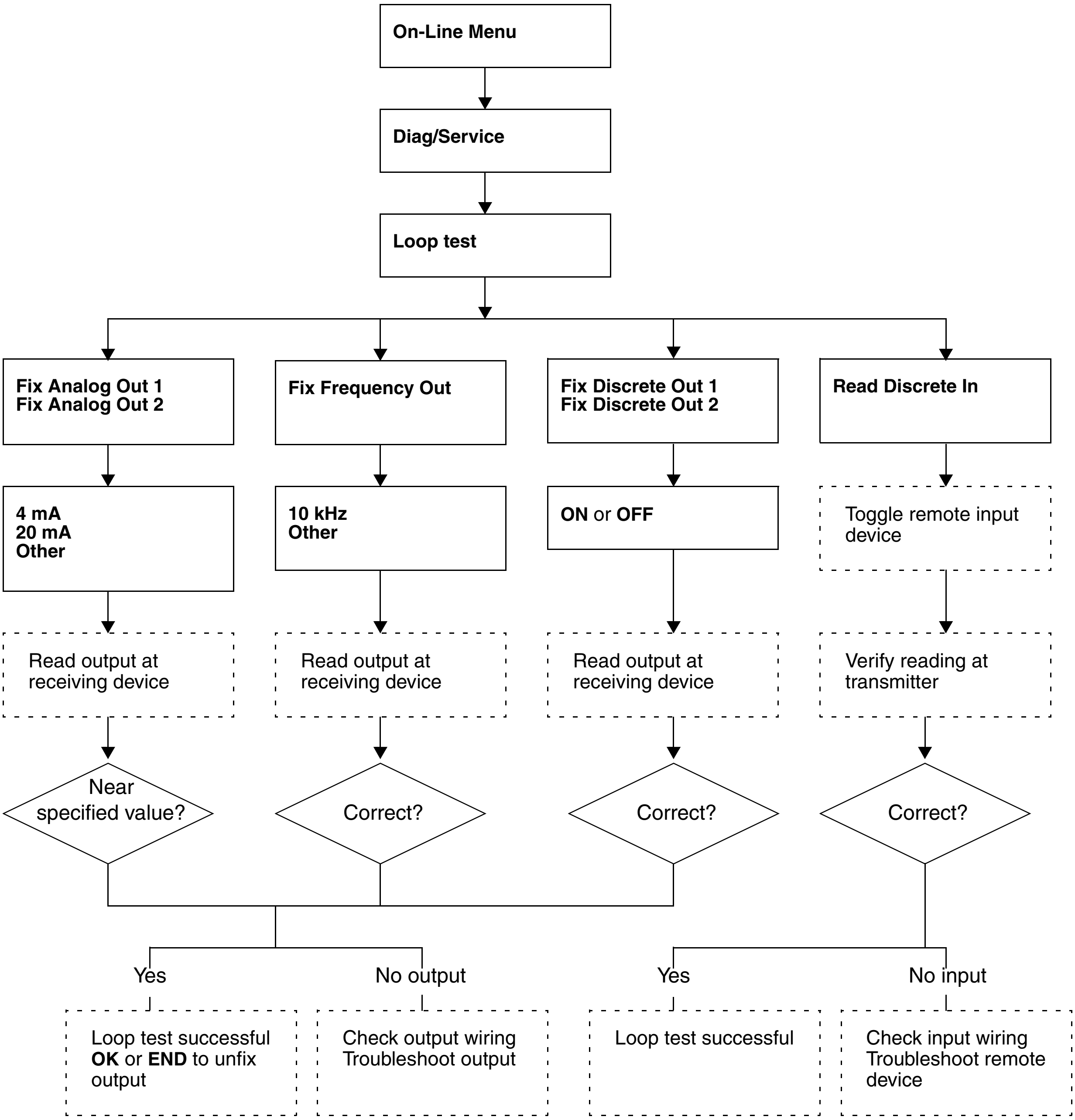
- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

See Figure 5-4 for the loop test procedure. Not all options are available on all transmitters.

Note the following:

- If you are testing the primary mA output, the HART/Bell202 signal to the Communicator will affect the reading. Disconnect the Communicator before reading the output, then reconnect the Communicator and resume the loop test after taking the reading.
- The mA reading does not need to be exact. You will correct differences when you trim the mA output. See Section 5.4.

Figure 5-4 Communicator – Loop test procedure



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 terminals are configured for the input/outputs that will be used in your application (see Section 6.2).

You can trim the outputs with ProLink II or a Communicator.

5.4.1 Milliamp output trim with ProLink II

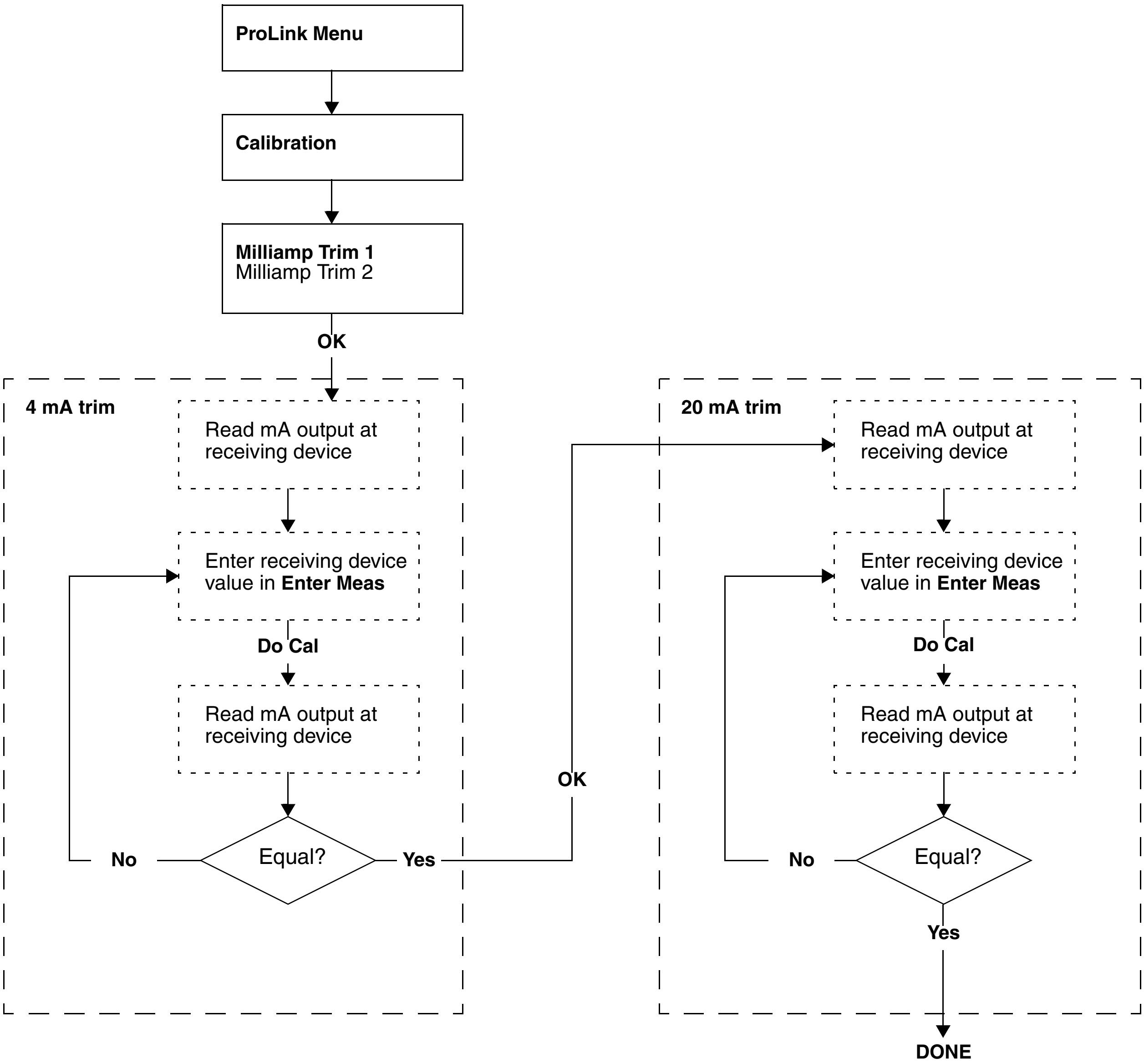
- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

See Figure 5-5 for the mA output trim procedure.

Note the following:

- If you are trimming the primary mA output, and you are connected to the transmitter via HART/Bell202, the HART/Bell202 signal to ProLink II will affect the reading. Disconnect ProLink II before reading the output, then reconnect and resume the trim, after taking the reading. If you are using any other protocol, this is not required.
- Any trimming performed on the output should not exceed ± 200 microamps. If more trimming is required, contact Micro Motion customer support.

Figure 5-5 **ProLink II – mA output trim procedure**



5.4.2 Milliamp output trim with a Communicator

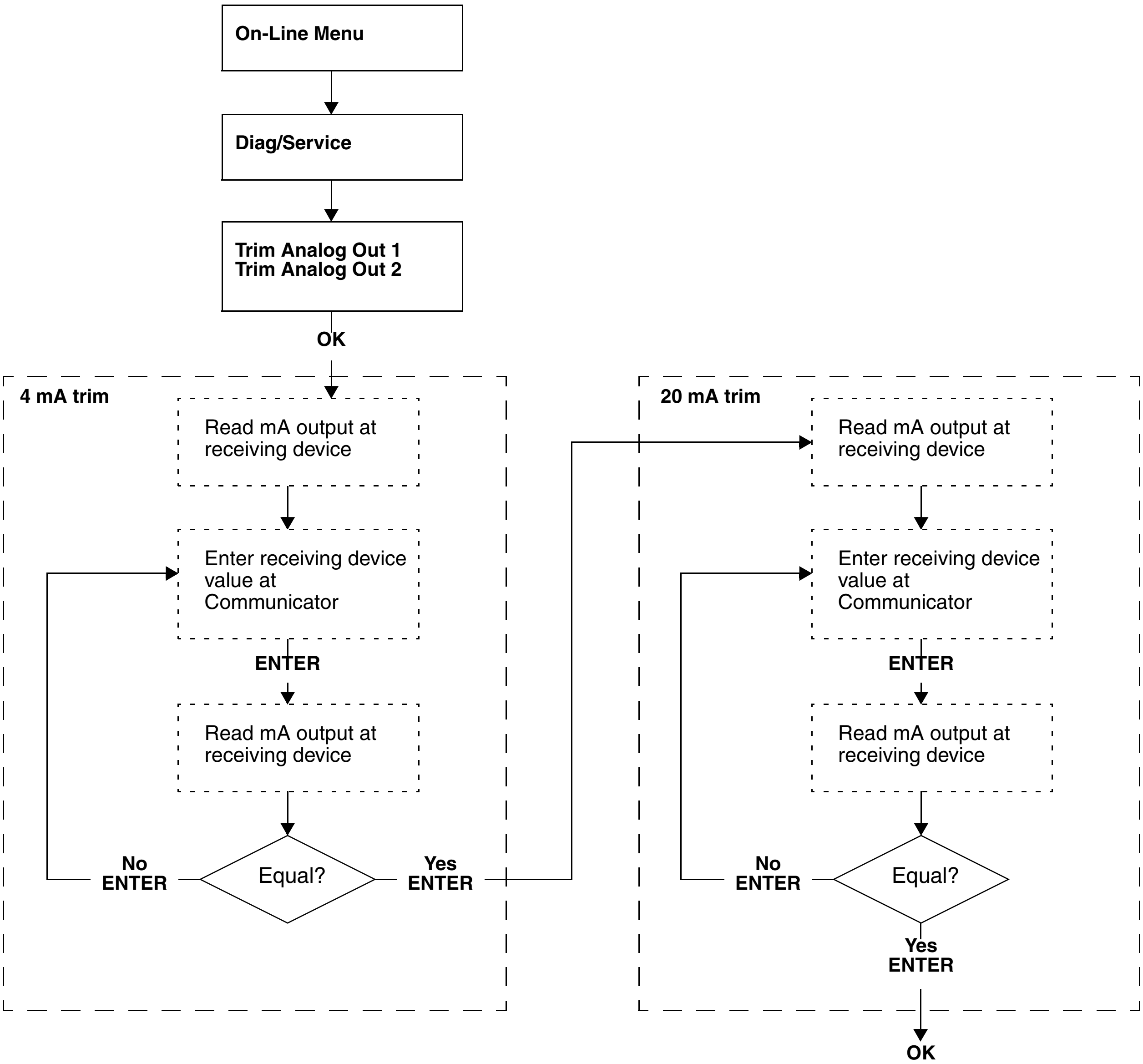
- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

See Figure 5-6 for the mA output trim procedure.

Note the following:

- If you are trimming the primary mA output, the HART/Bell202 signal to the Communicator will affect the reading. Disconnect the Communicator before reading the output, then reconnect and resume the trim, 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.
- The receiving device value that you enter in the Communicator can contain up to two decimal places.

Figure 5-6 **Communicator – mA output trim procedure**



5.5 Zeroing the flowmeter

Zeroing the flowmeter establishes the flowmeter's point of reference when there is no flow.

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 7.4 for information on viewing transmitter status and alarms.

You can zero the flowmeter with the display (if the transmitter has a display), ProLink II, the Communicator, or with the Zero button on the transmitter (DIN rail mount transmitters only).

If the zero procedure fails, see Section 11.6 for troubleshooting information.

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.

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 Zeroing with the display

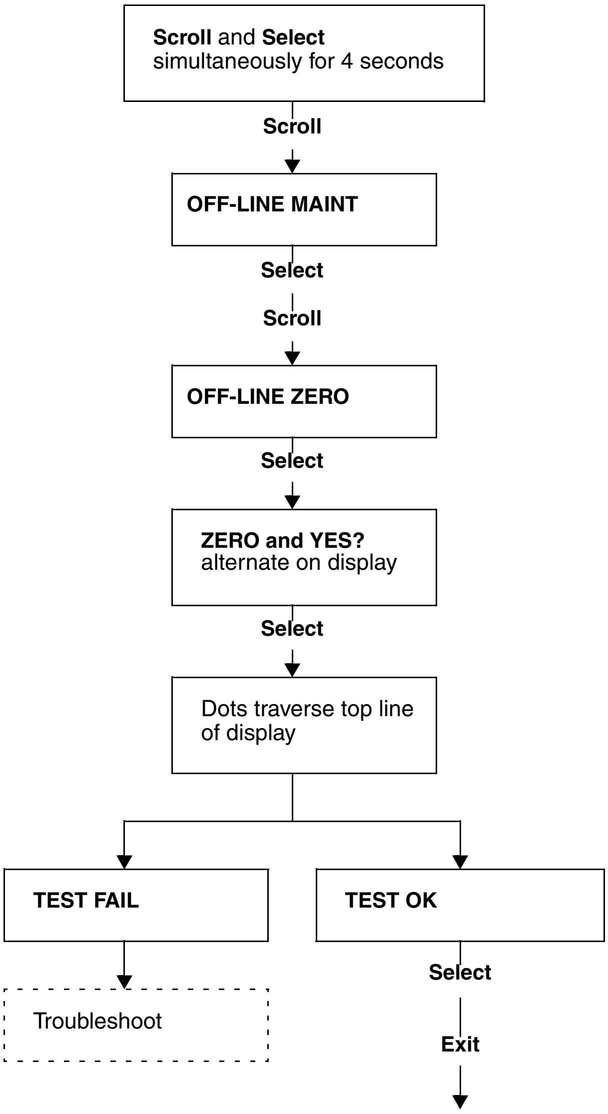
- FM AN F
- FM AN M
- FM CIO

See Figure 5-7 for the flowmeter zero procedure.

Note the following:

- If the off-line menu has been disabled, you will not be able to zero the transmitter with the display. For information about enabling and disabling the off-line menu, see Section 8.14.1.
- You cannot change the zero time with the display. If you need to change the zero time, you must use the Communicator or ProLink II software.

Figure 5-7 Display – Flowmeter zero procedure

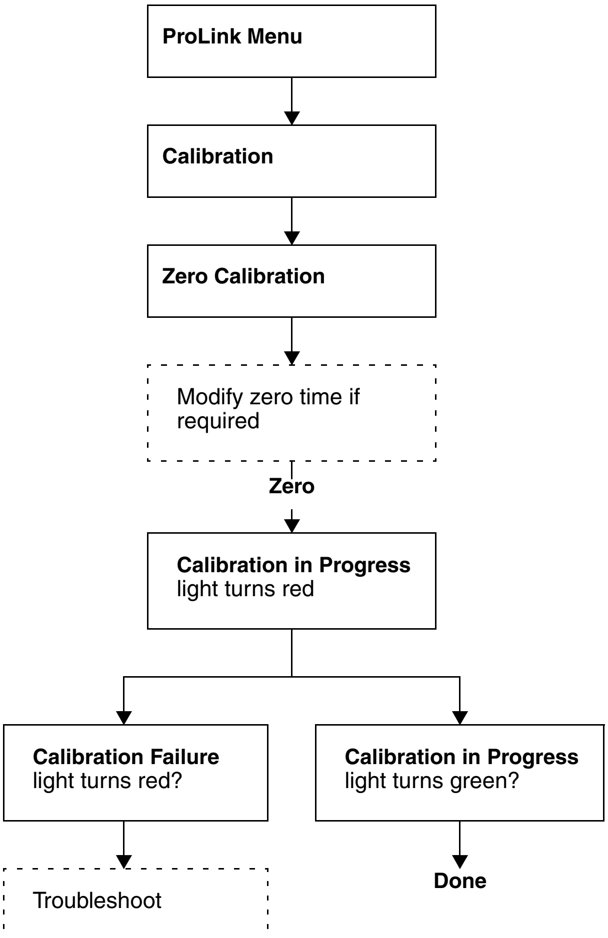


5.5.3 Zeroing with ProLink II

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

See Figure 5-8 for the flowmeter zero procedure.

Figure 5-8 ProLink II – Flowmeter zero procedure

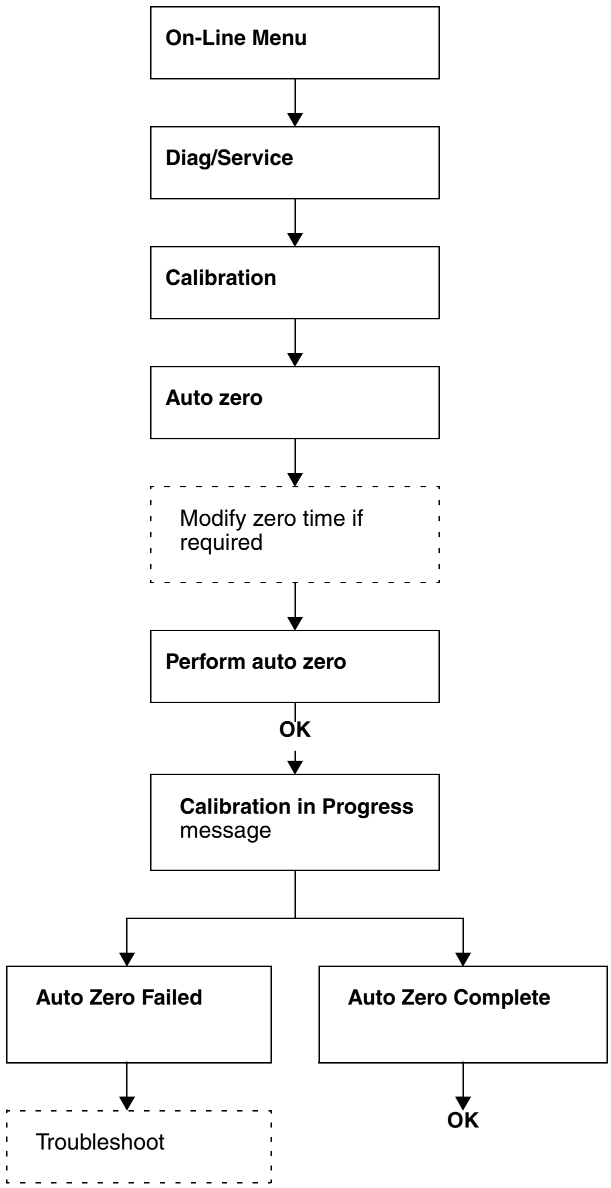


5.5.4 Zeroing with a Communicator

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

See Figure 5-9 for the flowmeter zero procedure.

Figure 5-9 **Communicator – Flowmeter zero procedure**



5.5.5 Zeroing with the Zero button

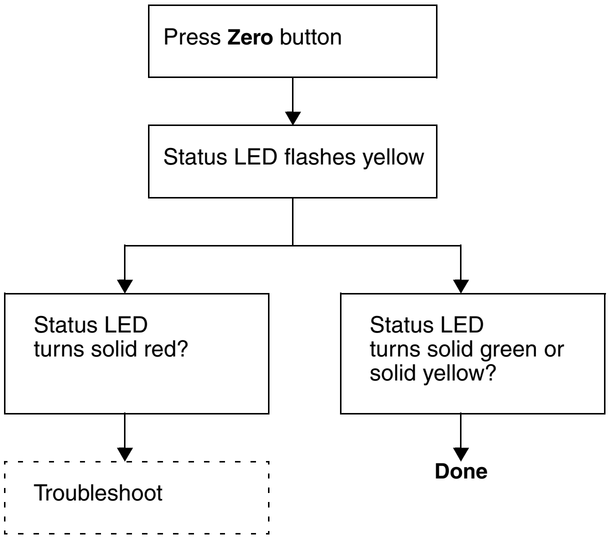
- DIN AN
- DIN CIO
- DIN CIO FD

See Figure 5-10 for the flowmeter zero procedure.

Note the following:

- You cannot change the zero time with the Zero button. If you need to change the zero time, you must use the Communicator or ProLink II software.
- The Zero button is located on the front panel of the transmitter. To press it, use a fine-pointed object such as the end of a paperclip. Hold the button down until the status LED on the front panel begins to flash yellow.

Figure 5-10 Zero button – 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 following procedures are discussed:

- Configuring transmitter terminals (see Section 6.2)
- Configuring measurement units (see Section 6.3)
- Configuring the mA output(s) (see Section 6.4)
- Configuring the frequency output (see Section 6.5)
- Configuring the discrete output (see Section 6.6)
- Configuring the discrete input (see Section 6.6.1)

This chapter provides basic flowcharts for each procedure. For more detailed flowcharts, 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.

For optional transmitter configuration parameters and procedures, see Chapter 8.

Note: 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.

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

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

6.2 Configuring transmitter terminals

- FM AN M
- FM CIO
- DIN CIO
- DIN CIO FD

Configuration of the transmitter terminals has consequences for many following configuration options. Therefore, it is important to configure or verify terminal configuration at the beginning of transmitter configuration.

- If you have an FM CIO or DIN CIO transmitter, you must configure the channels. Refer to Section 6.2.1.
- If you have a DIN CIO FD transmitter, you must configure the channels to specific values. Refer to Section 6.2.2.
- If you have an FM AN M transmitter, you must specify whether terminals 3 and 4 will operate as a frequency output (FO) or a discrete output (DO). Refer to Section 6.2.3.

6.2.1 Configuring the channels

- FM CIO
- DIN CIO

The six input/output terminals provided on these transmitters are organized into three pairs, or sets. These pairs are called Channels A, B, and C.

The outputs and variable assignments that you can configure are controlled by the channel configuration. Table 6-1 shows how each channel may be configured, to what default variable each configuration is set, and the power options for each channel.

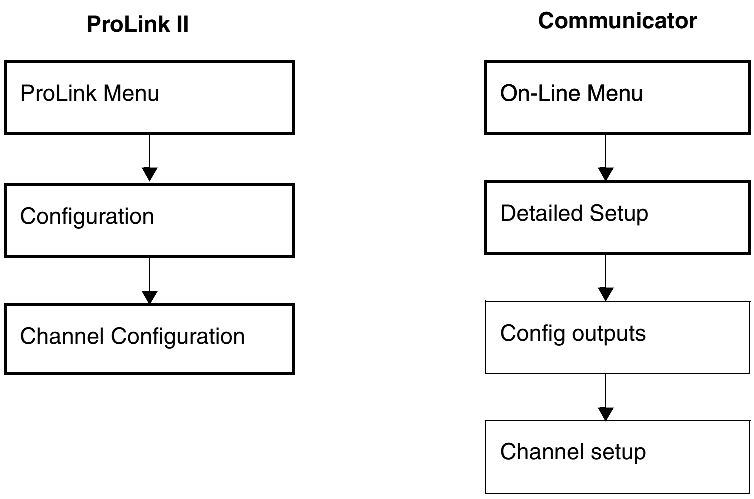
Table 6-1 Channel configuration options

	Terminals				
Channel	**DIN CIO**	**FM CIO**	**Configuration option**	**Default process variable assignment**	**Power**
A	21 & 22	1 & 2	mA output 1 (with Bell 202 HART)	Mass flow	Internal
B	23 & 24	3 & 4	mA output 2 (default)(1)	Density	Internal or external(2)
			Frequency output (FO)	Mass flow	
			Discrete output 1 (DO1)(3)	Fwd/Rev	
C	31 & 32	5 & 6	FO (default)(3)(4)	Mass flow	Internal or external(2)
			Discrete output 2 (DO2)	Flow switch	
			Discrete input (DI)	None	

(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 the channels, see the menu flowcharts in Figure 6-1.

Figure 6-1 Configuring the channels



6.2.2 Configuring the channels for the Filling and Dosing application

• DIN CIO FD

The six input/output terminals provided on the DIN CIO FD transmitter are organized into three pairs, or sets. These pairs are called Channels A, B, and C.

Table 6-1 shows how each channel must be configured for the Filling and Dosing application to function correctly. It may help to refer to Chapter 11.

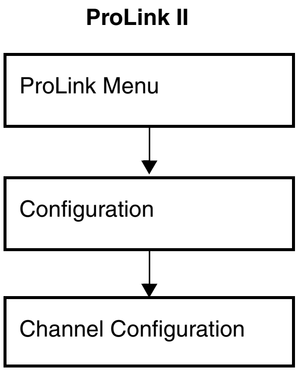
Table 6-2 Filling and Dosing channel configuration

Channel	Terminals	Configured as	Process variable assignment	Power
A	21 & 22	mA output 1 (with Bell 202 HART)	Mass flow	Internal
B	23 & 24	Discrete output 1 (DO1)	Fwd/Rev	External(1)
C	31 & 32	Discrete output 2 (DO2)	Flow switch	External(1)

(1) You must provide power to the outputs.

To configure the channels, see the menu flowcharts in Figure 6-1.

Figure 6-2 Configuring the channels



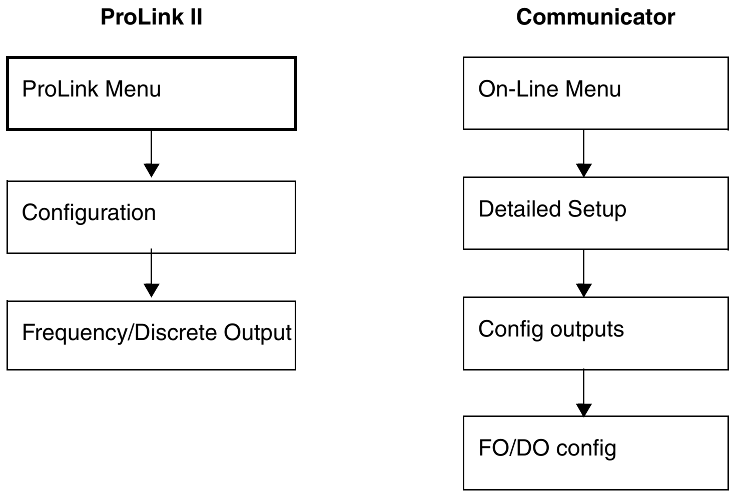
6.2.3 Configuring terminals 3 and 4

- FM AN M

On these transmitters, terminals 3 and 4 can operate as a frequency output (FO) or a discrete output (DO). The default is FO.

To configure the terminals, see the menu flowcharts in Figure 6-3.

Figure 6-3 Configuring terminals 3 and 4



6.3 Configuring the measurement units

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

For each process variable, the transmitter must be configured to use the measurement unit appropriate to your application.

For some transmitters, the density and temperature process variables can be viewed but cannot be assigned to an output. See Table 6-3.

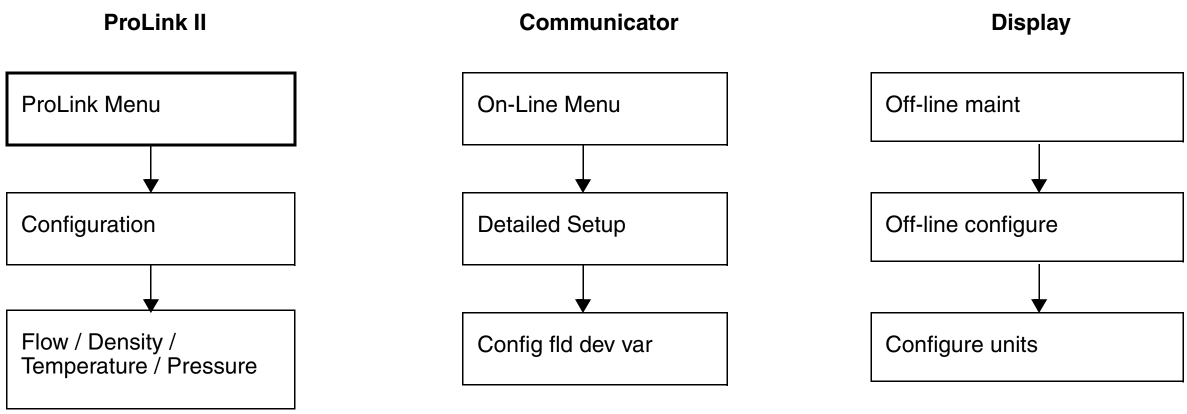
Table 6-3 Transmitter models and available process variables

Transmitter	Mass flow	Volume flow	Density	Temperature
FM AN F	✓	✓	✓(1)	✓(1)
FM AN M	✓	✓	✓	✓
FM CIO	✓	✓	✓	✓
DIN AN	✓	✓	✓(1)	✓(1)
DIN CIO	✓	✓	✓	✓
DIN CIO FD	✓			

(1) Can be viewed, but cannot be assigned to an output.

To configure measurement units, see the menu flowcharts in Figure 6-4. For details on measurement units for each process variable, see Sections 6.3.1 through 6.3.4.

Figure 6-4 Configuring measurement units



6.3.1 Mass flow units

The default mass flow measurement unit is **g/s**. See Table 6-4 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 8.4).

Table 6-4 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
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 8.4)

6.3.2 Volume flow units

The default volume flow measurement unit is **L/s**. See Table 6-5 for a complete list of volume flow measurement units.

If the volume flow unit you want to use is not listed, you can define a special measurement unit for volume flow (see Section 8.4).

Table 6-5 Volume flow measurement units

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
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	barrelsday	bbl/d	Barrels per day(1)
SPECL	special	Spcl	Special unit (see Section 8.4)

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

6.3.3 Density units

The default density measurement unit is **g/cm3**. See Table 6-4 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
Not configurable	degAPI	degAPI	API gravity (API feature only)
ST/CUY	sT/yd3	STon/Cuyd	Short ton per cubic yard

6.3.4 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	Degrees Kelvin

6.4 Configuring the mA output(s)

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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 6.2, page 39). The menu options for the secondary mA output will appear only if a secondary mA output is present on your transmitter.

Note: Configure the transmitter for the required input/output types before configuring individual outputs. See Section 6.2.

The following parameters must be set for the primary mA output, and for the secondary mA output if it is present:

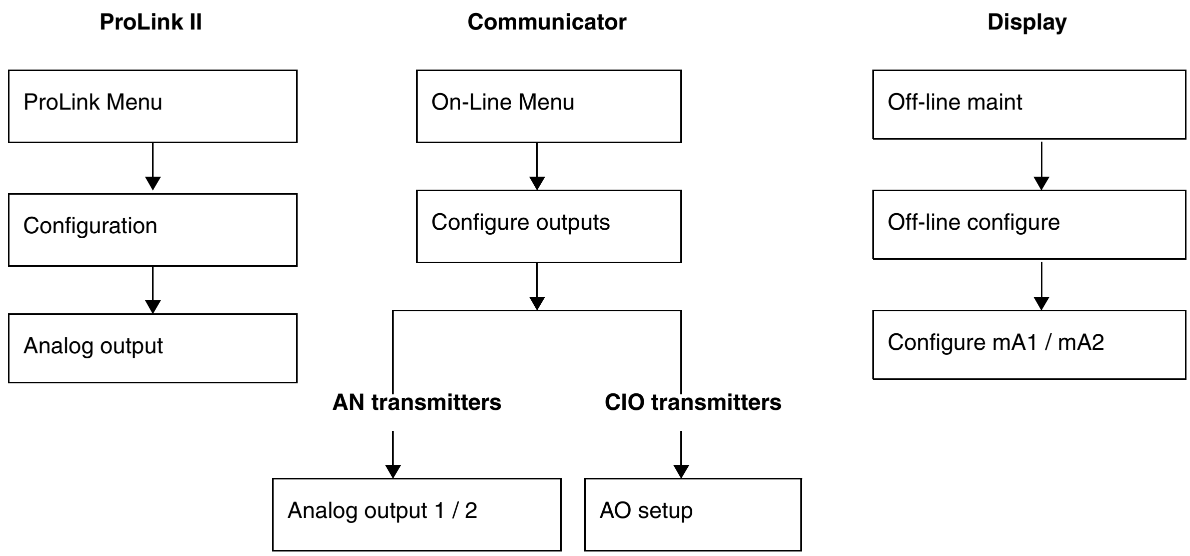
- Process variable
- Upper range value (URV) and lower range value (LRV)
- AO (analog output) cutoff
- Fault indicator and fault value

An additional parameter—added damping—can be configured if required.

To configure the mA outputs, see the menu flowcharts in Figure 6-4. For details on mA output parameters, see Sections 6.4.1 through 6.4.5.

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 6-5 Configuring the mA output(s)



6.4.1 Configuring the process variable

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

You can configure the process variables to be reported through the mA outputs. Table 6-8 lists the process variables that can be assigned to the primary and secondary mA outputs.

Note: Some transmitters can measure only mass flow and volume flow. See Table 6-3.

Table 6-8 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
Temperature	Temp	Temp	TEMPR
Density	Density	Dens	DENS
Drive gain	Drive Gain	Driv signl	DGAIN

Note: 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 8.15.6). 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 8.15.6). 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 8.15.6), and the value of the SV must be queried through an RS-485 connection, read through the Communicator, or reported through burst mode.

6.4.2 Configuring the mA output range (LRV and URV)

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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 6.3).

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.

6.4.3 Configuring the AO cutoff(s)

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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.

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 is used. Contact Micro Motion customer support before changing the AO cutoff.

Multiple cutoffs

Cutoffs can also be configured for the mass flow and volume flow process variables (see Section 8.5). 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.

6.4.4 Configuring the fault indicator and fault value

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

If the transmitter encounters an internal fault condition, it will indicate the fault 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 6-9.

Note: By default, the transmitter immediately reports a fault when a fault is encountered. You can delay reporting faults by changing the fault timeout. See Section 8.12.

Table 6-9 mA output fault indicators and values

Fault indicator	Fault output value
Upscale	21–24 mA (default: 22 mA)
Downscale	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

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.

6.4.5 Configuring added damping

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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.

Multiple damping parameters

Damping can also be configured for the flow (mass and volume), density, and temperature process variables (see Section 8.6). 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.

6.5 Configuring the frequency output(s)

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

Different transmitters have different frequency output options. See Section 6.2 for information on configuring your transmitter's outputs.

Note: Configure the transmitter for the required input/output types before configuring individual outputs. See Section 6.2.

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 (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 6.5.5).

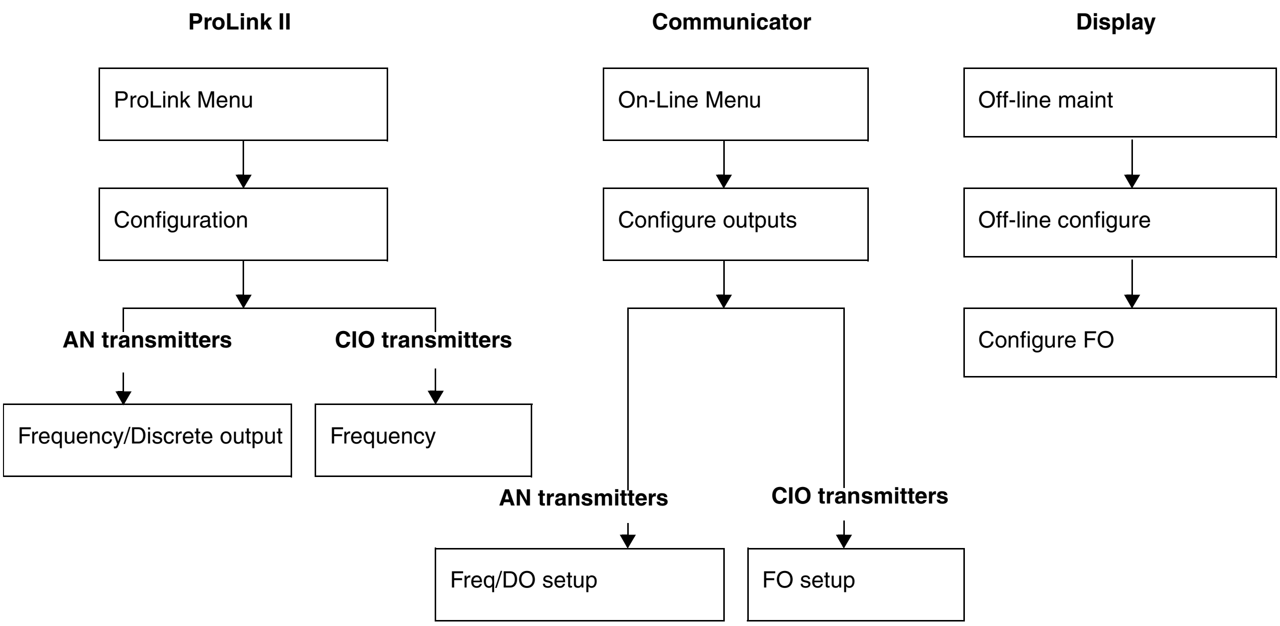
If a frequency output is present on your transmitter, the following parameters must be set:

- Process variable
- Output scale
- Pulse width
- Polarity
- Mode (CIO transmitters only, if two frequency outputs have been configured)
- Fault indicator

To configure the frequency output, see the menu flowcharts in Figure 6-4. For details on mA output parameters, see Sections 6.5.1 through 6.5.5.

Note: 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.

Figure 6-6 Configuring the frequency output(s)



6.5.1 Configuring the process variable

- FM AN M
- FM CIO
- DIN CIO

With a flow-only transmitter (FM AN A or DIN AN), the frequency output assignment is controlled by the primary mA output assignment. If mass flow or volume flow is assigned to the primary mA output, the same process variable is assigned to the frequency output.

With a multivariable transmitter (FM AN M, FM CIO, or DIN CIO), the frequency output is independent of the primary mA output. Table 6-10 lists the process variables that can be assigned to the frequency output.

Table 6-10 Frequency output process variable assignments for LF-Series multivariable transmitters

Process variable	ProLink II code	Communicator code	Display code
Mass flow	Mass Flow	Mass flo	MFLOW
Volume flow	Vol Flow	Vol flo	VFLOW

Note: 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 8.15.6). 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 8.15.6), and the value of the TV must be queried through an RS-485 connection, read through the Communicator, or reported through burst mode.

6.5.2 Configuring the output scale

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN 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 6-11.

Table 6-11 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 flowrate 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 flowrate (**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 flowrate (**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:

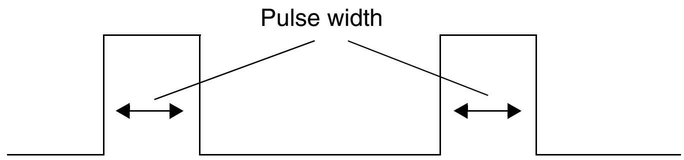
- TV frequency factor = 333.33
- TV rate factor = 2000

6.5.3 Configuring the maximum pulse width

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

The frequency output *maximum pulse width* defines the maximum duration of each pulse the transmitter sends to the frequency receiving device, as shown in Figure 6-7.

Figure 6-7 **Pulse width**



The pulse width is configurable to values between 0 and 277 milliseconds.

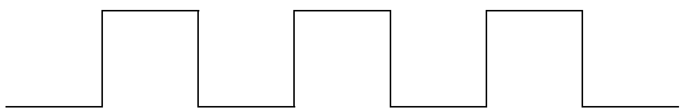
As the frequency increases, at some point the pulse width will become equivalent to the desired output frequency. This frequency is called the *crossover frequency*, and is calculated as follows:

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

Note: Although you can set maximum pulse width to 0, it is not useful because it will result in an undefined crossover frequency.

At frequencies above the crossover frequency, the output changes to a 50% duty cycle as shown in Figure 6-8.

Figure 6-8 **50% duty cycle**



The default pulse width is 277 milliseconds, which yields a crossover frequency of 1.8 Hz. In other words, above 1.8 Hz, the transmitter's frequency output will use a 50% duty cycle. At frequencies of 1.8 Hz or lower, the pulse width will be 277 ms. In both cases, the process variable is represented by the number of pulses per unit of time.

The transmitter's maximum crossover frequency is 922 Hz. This corresponds to a pulse width of 0.543 ms.

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 nonzero state duration and a varying zero state duration. Most low-frequency counters have a specified requirement for the 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.

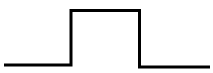
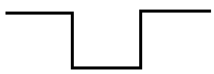
Note: If you are using the Frequency = Flow output scale method, and you set maximum pulse width to a value below 277 ms, Micro Motion recommends setting the frequency factor to a value below 200 Hz. See Section 6.5.2.

6.5.4 Configuring the frequency output polarity

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

The frequency output *polarity* controls how the output indicates the active (ON) state. See Table 6-12. The default value, Active high, is appropriate for most applications. Active low may be required by applications that use low-frequency signals.

Table 6-12 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

6.5.5 Configuring mode

- FM CIO
- DIN 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 6-9.

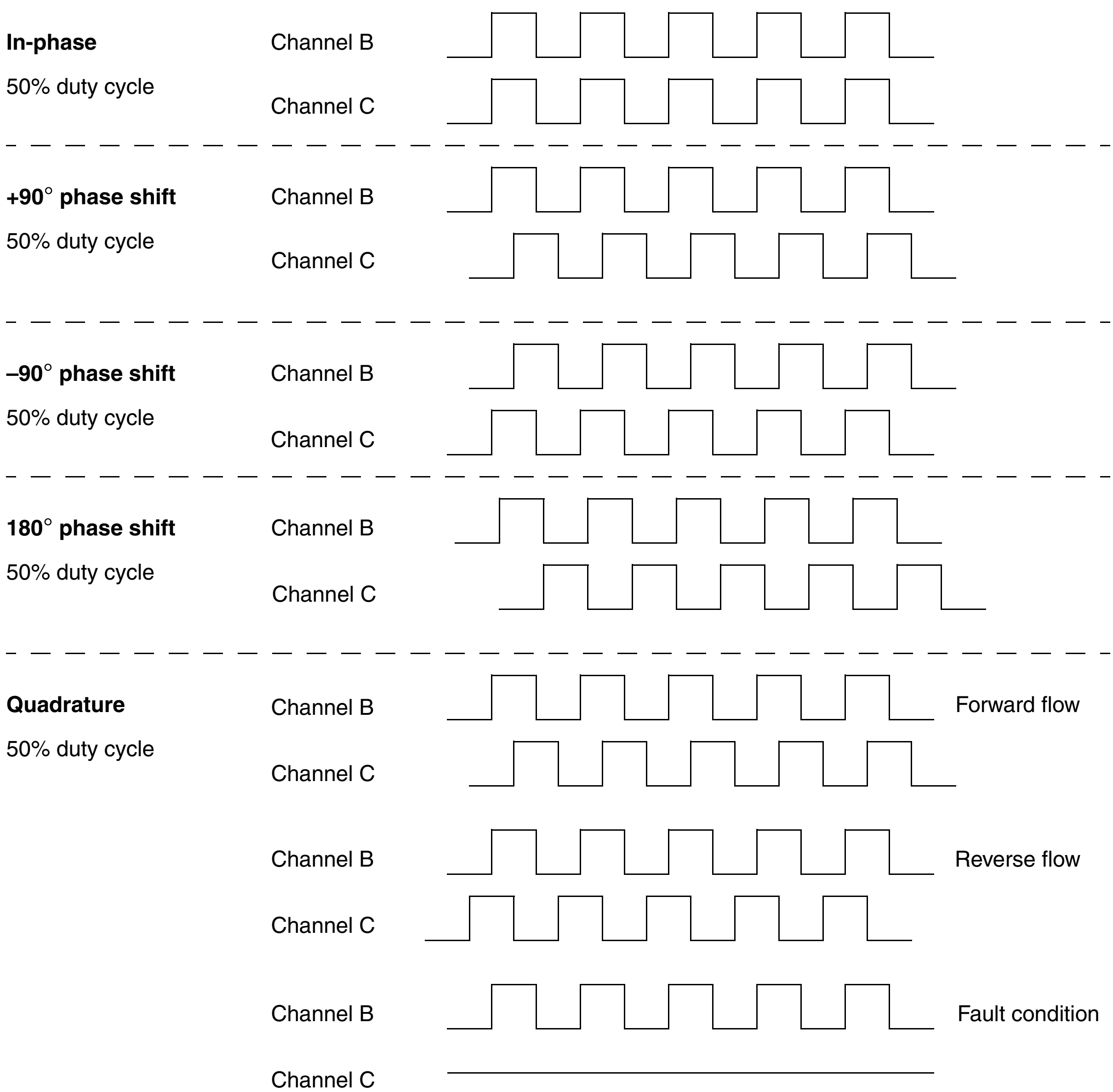
In Quadrature mode, Channel C:

- Lags Channel B by 90° during forward flow.
- Leads Channel C by 90° during reverse flow.
- Is driven to zero 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 6-9 Dual pulse output options



6.5.6 Configuring the fault indicator

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

If the transmitter encounters an internal fault condition, it will indicate the fault by sending a preprogrammed output level to the receiving device. You can specify the output level by configuring the fault indicator. See Table 6-13.

Note: By default, the transmitter immediately reports a fault when a fault is encountered. You can delay reporting faults by changing the fault timeout. See Section 8.12.

Table 6-13 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

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.

6.6 Configuring the discrete output(s)

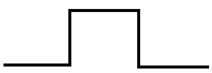
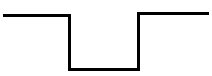
- FM AN M
- FM CIO
- DIN CIO
- DIN CIO FD

Different transmitters have different discrete output (DO) options. See Section 6.2, page 39, for information on configuring your transmitter's outputs.

Note: Configure the transmitter for the required input/output types before configuring individual outputs. See Section 6.2.

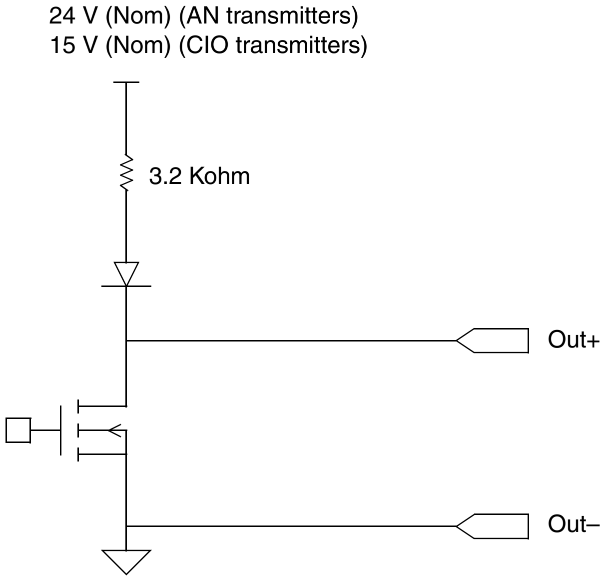
The discrete outputs generate two voltage levels to represent ON or OFF states. The voltage levels depend on the output's polarity, as shown in Table 6-14. Figure 6-10 shows a diagram of a typical discrete output circuit.

Table 6-14 Discrete output polarity

Polarity	Output power(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 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 6.2.1).

Figure 6-10 Discrete output circuit



The discrete outputs can be used to indicate the conditions described in Table 6-15. 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.

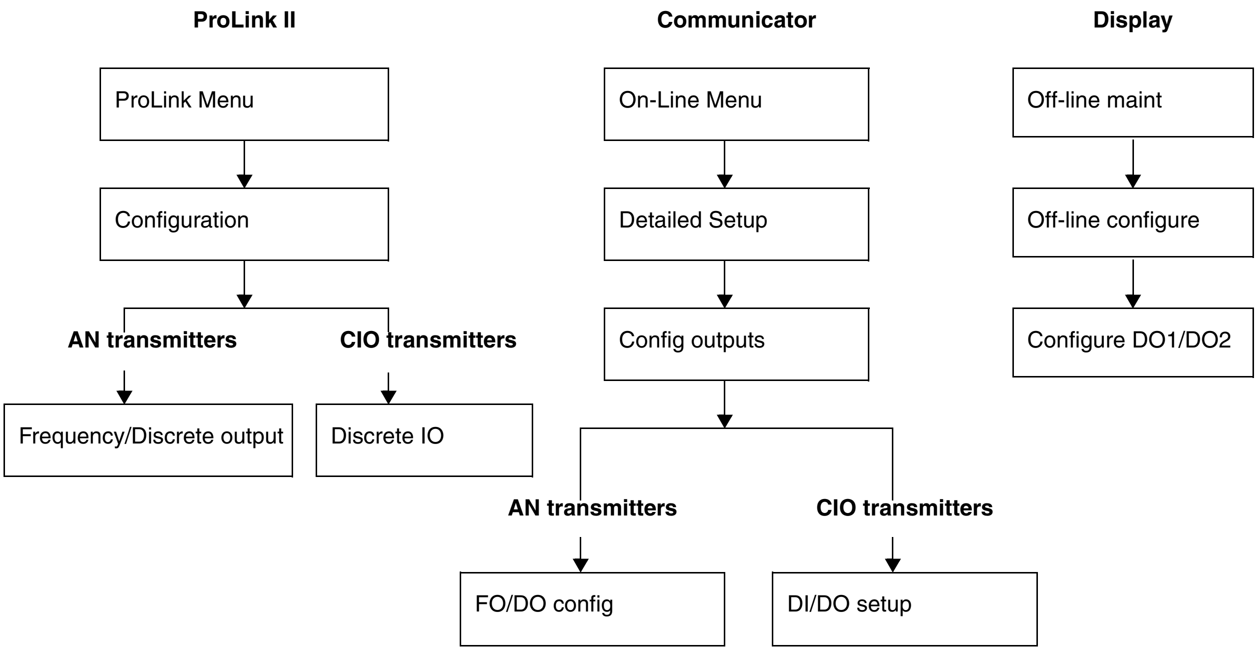
Table 6-15 Discrete output assignments and output levels

Assignment	ProLink II code	Communicator code	Display code	Condition	Discrete output level(1)
Event 1 (see Section 8.9)	Event 1	Event 1	EVNT1	ON	Site-specific
				OFF	0V
Event 2 (see Section 8.9)	Event 2	Event 2	EVNT2	ON	Site-specific
				OFF	0V
Event 1 or Event 2	Event 1 or Event 2	Event1 or Event2	E1OR2	ON	Site-specific
				OFF	0V
Flow switch(2)	Flow Switch	Flow Switch	FLSWT	ON	Site-specific
				OFF	0V
Flow direction	Fwd/Rev	Forward/Reverse	FLDIR	Forward	0V
				Reverse	Site-specific
Calibration in progress	Cal in Progress	Calibration in progr	ZERO	ON	Site-specific
				OFF	0V
Fault	Fault	Fault	FAULT	ON	Site-specific
				OFF	0V

(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) See Section 6.6.1.

To configure the discrete output, see the menu flowcharts in Figure 6-11. Note that if you want to configure polarity for the discrete output, you must use ProLink II.

Figure 6-11 **Configuring the discrete output(s)**



6.6.1 Flow switch

Flow switch refers to the flow rate moving past a user-configured setpoint, in either direction. For example, if the setpoint is 100 lb/min, a flow switch occurs if the flow rate changes from 101 lb/min to 99 lb/min, or from 99 lb/min to 101 lb/min.

The flow switch has a 5% hysteresis. For example, if the setpoint is 100 lb/min, the flow switch will be triggered when the flow rate falls below 100 lb/min, but not turned off until a 5% (5 lb/min) change occurs (i.e., the flow rate rises to 105 lb/min).

If a discrete output is assigned to flow switch, the flow switch setpoint must be configured.

Note: If your transmitter is configured with two discrete outputs, it is possible to configure both DO1 and DO2 for flow switch, but it is not useful because you cannot configure independent setpoints.

6.7 Configuring the discrete input

- FM CIO
- DIN CIO

The discrete input is used to initiate a transmitter action from a remote input device. If your transmitter has been configured for a discrete input, the actions listed in Table 6-16 may be assigned to the discrete input.

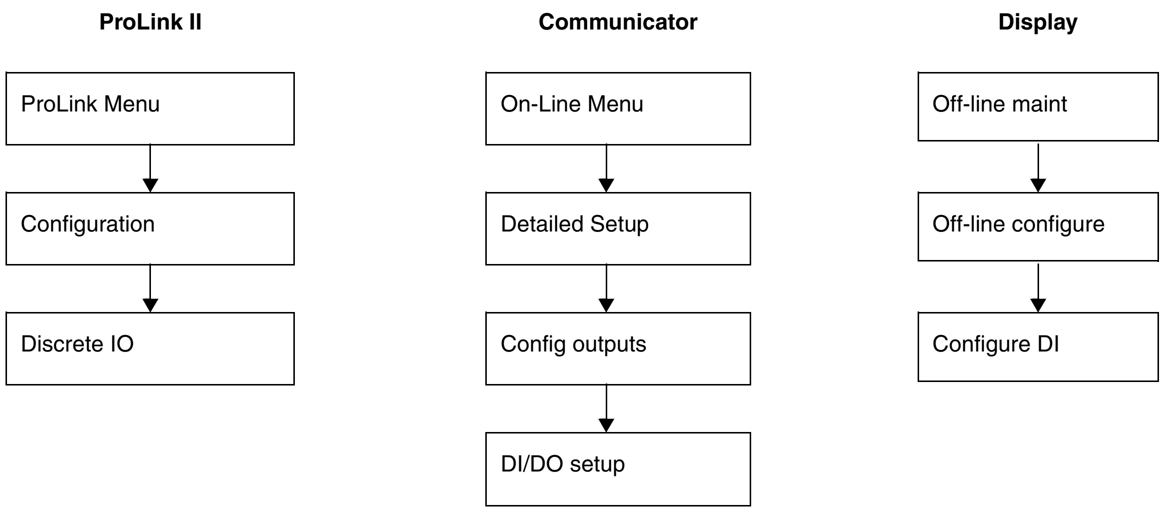
Note: Configure the transmitter for the required input/output types before configuring the discrete input. See Section 6.2.

To configure the discrete input, see the menu flowcharts in Figure 6-12.

Table 6-16 Discrete input assignments

Assignment	ProLink II code	Communicator code	Display code
None (default)	None	None	NONE
Flowmeter zero	Start Mechanical Zero	Perform auto zero	ZERO
Reset mass totalizer	Reset Mass Total	Reset mass total	MASS
Reset volume totalizer	Reset Volume Total	Reset volume total	VOL
Reset all totalizers	Reset Totals	Reset totals	ALL

Figure 6-12 Configuring the discrete input



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:

- Viewing process variables (see Section 7.3)
- Viewing transmitter status and alarms (see Section 7.4)
- Acknowledging alarms (see Section 7.5)
- Viewing and using the totalizers and inventories (see Section 7.6)

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

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

7.2 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 11.12.

7.3 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 (field-mount transmitters only), ProLink II, or the Communicator.

7.3.1 With the display

- FM AN F
- FM AN M
- FM CIO

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 must be configured. For instructions on how to configure the display, see Section 8.14.1.

To view a process variable with the display, press **Scroll** 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.

7.3.2 With ProLink II

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

To view process variables with ProLink II software:

1. The **Process Variables** window opens automatically when you first connect to the transmitter.
2. If you have closed the **Process Variables** window, open the **ProLink** menu and select **Process Variables**.

7.3.3 With a Communicator

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

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**.

7.4 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 11-5.

To acknowledge alarms, you must use the display. Acknowledging alarms is required only for transmitters that have a display.

7.4.1 Using the status LED

- DIN AN
- DIN CIO
- DIN CIO FD

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 status LED on DIN rail mount transmitters**

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

7.4.2 Using the display

- FM AN F
- FM AN M
- FM 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 queue, which reports each specific alarm

Note: If access to the alarm menu from the display has been disabled (see Section 8.14.1), then the display will not list alarm codes in an alarm queue, and the status LED will not flash. It will indicate status using solid green, yellow, or red.

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**

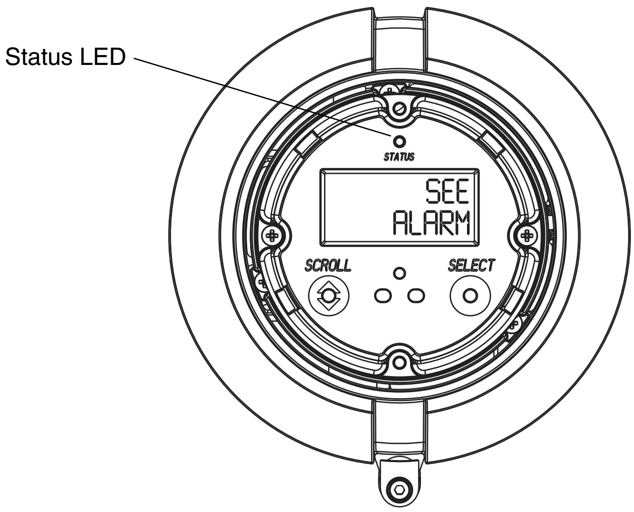


Table 7-2 **Priorities reported by the status LED on field-mount transmitters**

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 display alarm menu has been disabled, alarms cannot be acknowledged. In this case, the status LED will never flash.

Alarms in the alarm queue are arranged according to priority. To view specific alarms in the queue:

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 queue. See Section 11.11 for an explanation of the alarm codes reported by the display.
6. **Scroll** until the word **EXIT** appears.
7. **Select**.

7.4.3 Using ProLink II

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

To view status and alarms with ProLink II software:

1. Click **ProLink**.
2. Select **Status**.
3. The status indicators are divided into three categories: Critical, Informational, and Operational. To view the indicators in a category, click on the tab.
   - A tab is red if one or more status indicators in that category is on.
   - Within the tabs, current status alarms are shown by red status indicators.

7.4.4 Using the Communicator

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

To view status and alarms with a Communicator:

1. Press **1**.
2. Select **View Status**.
3. Press **OK** to scroll through the list of current alarms.

7.5 Acknowledging alarms

- FM AN F
- FM AN M
- FM CIO

Acknowledging alarms is a display function. It is required only for transmitters that have a display, and when access to the alarm menu from the display is enabled.

For transmitters with a display, access to the alarm menu can be enabled or disabled.

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 8.14.1 for information on controlling these functions.

If access to the alarm menu is disabled, the status LED will always be solid red, green, or yellow.

To acknowledge alarms:

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**.

7.6 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.

7.6.1 Viewing the totalizers and inventories

You can view the current value of the totalizers and inventories with the display (field-mount transmitters with displays only), ProLink II, or the Communicator.

With the display

- FM AN F
- FM AN M
- FM CIO

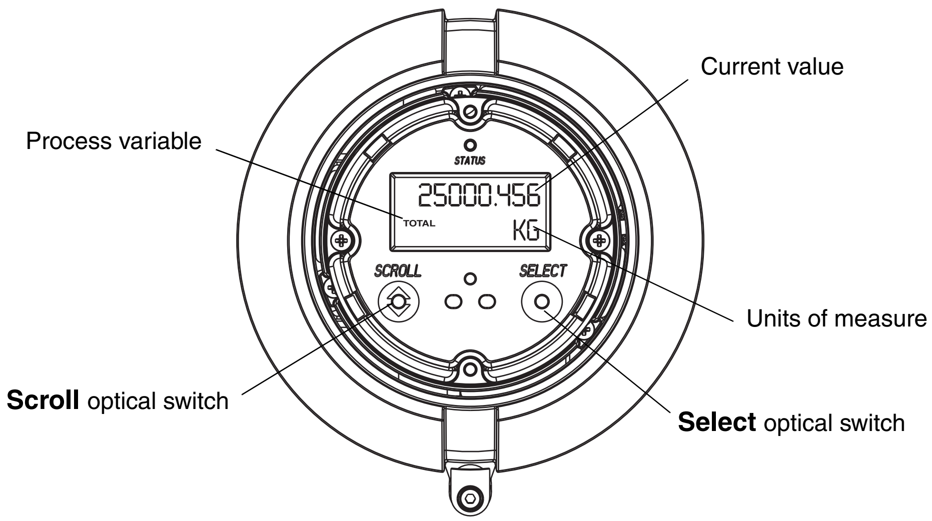
You cannot view totalizers or inventories with the display unless the display has been configured to show them. See Sections 8.14.1 and 8.14.4.

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)

   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

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

Figure 7-2 Display totalizer



With ProLink II software

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

To view the current value of the totalizers and inventories with ProLink II software:

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

With a Communicator

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

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**.

7.6.2 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 software	Display(1)
Stop all totalizers and inventories	Yes	Yes	Yes(2)
Start all totalizers and inventories	Yes	Yes	Yes(2)
Reset mass totalizer only	Yes	Yes	Yes(2)
Reset volume totalizer only	Yes	Yes	Yes(2)
Simultaneously reset all totalizers	Yes	Yes	Yes(2)
Simultaneously reset all inventories	No	Yes(3)	No

(1) LF-Series FM transmitters with display only.
(2) If enabled. See Section 8.14.1.
(3) If enabled in the ProLink II preferences.

With the display

- FM AN F
- FM AN M
- FM CIO

Table 7-4 shows how you can control the totalizers and inventories with the display.

Table 7-4 Totalizer and inventory control with the display

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

(1) With rev3.3 or higher of the transmitter software, this feature may be enabled or disabled. See Section 8.14.1.

With ProLink II software

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

Table 7-5 shows how you can control the totalizers and inventories using ProLink II software. To get to the Totalizer Control screen:

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

Table 7-5 Totalizer and inventory control with ProLink II software

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

(1) If enabled in the ProLink II preferences.

With a Communicator

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

Table 7-6 shows how you can control the totalizers and inventories with a Communicator.

Table 7-6 Totalizer and inventory control with a Communicator

To accomplish this	Press this sequence of buttons
Stop all totalizers and inventories	• **1** (Process Variables) • **4** (Totalizer cntrl) • **Stop totalizer**
Start all totalizers and inventories	• **1** (Process Variables) • **4** (Totalizer cntrl) • **Start totalizer**
Reset mass totalizer	• **1** (Process Variables) • **4** (Totalizer cntrl) • **Reset mass total**
Reset volume totalizer	• **1** (Process Variables) • **4** (Totalizer cntrl) • **Reset volume total**
Reset all totalizers	• **1** (Process Variables) • **4** (Totalizer cntrl) • **Reset all totals**

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.

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.

For the transmitter codes used in the configuration map, see Section 1.3.

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.

Note: DIN CIO FD transmitters can be configured only with ProLink II.

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.

- LF-Series FM AN – see Appendix D
- LF-Series FM CIO – see Appendix E
- LF-Series DIN AN – see Appendix F
- LF-Series DIN CIO or DIN CIO FD – see Appendix G

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

Table 8-1 Configuration map

Topic	Subtopic	Transmitter					Section
		FM			DIN		
		AN F	AN M	CIO	AN	CIO[1]	
Special measurement units		✓	✓	✓	✓	✓	8.4
Cutoffs		✓	✓	✓	✓	✓	8.5
Damping		✓	✓	✓	✓	✓	8.6
Update rate		✓	✓	✓	✓	✓	8.7
Flow direction		✓	✓	✓	✓	✓	8.8
Events		✓	✓	✓	✓	✓	8.9
Slug flow		✓	✓	✓	✓	✓	8.10
Entrained air handling[2]		✓	✓	✓	✓	✓	8.11
Fault timeout		✓	✓	✓	✓	✓	8.12
Meter factors		✓	✓	✓	✓	✓	8.13
Display functionality[3]	Enable and disable functions	✓[3]	✓[3]	✓[3]			8.14.1
	Scroll rate	✓	✓	✓			8.14.2
	Password	✓	✓	✓			8.14.3
	Display variables	✓	✓	✓			8.14.4
Digital communication settings	Fault indicator	✓	✓	✓	✓	✓	8.15.1
	HART polling address	✓[3]	✓[3]	✓[3]	✓	✓	8.15.2
	Modbus address	✓[4]	✓[4]		✓[4]	✓[4]	8.15.3
	RS-485 settings	✓[3]	✓[3]		✓	✓	8.15.4
	HART burst mode	✓	✓	✓	✓	✓	8.15.5
	PV, SV, TV, QV assignments	✓	✓	✓	✓	✓	8.15.6
Device settings		✓	✓	✓	✓	✓	8.16
Sensor parameters		✓	✓	✓	✓	✓	8.17

(1) Includes DIN CIO FD transmitters.
(2) Can be configured only with ProLink II.
(3) Can be configured with ProLink II, the Communicator, or the display.
(4) Can be configured with ProLink II or the display; cannot be configured with the Communicator.

8.4 Creating special measurement units

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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 volume flow.

8.4.1 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, m^3)
  - 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 terms above are related by the following formula:

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

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

To create a special unit, you must:

1. 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*
2. 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

3. 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 contain up to 8 characters, but only the first 5 characters appear on the display.

4. To apply the special measurement unit to mass flow or volume flow measurement, select **Special** from the list of measurement units (see Section 6.3.1 or 6.3.2).

8.4.2 Special mass flow unit

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

To create a special mass flow measurement unit:

1. Specify the base mass unit.
2. Specify the base time unit.
3. Specify the mass flow conversion factor.
4. Assign a name to the new special mass flow measurement unit.
5. Assign a name to the mass totalizer measurement unit.

Note: You cannot create a special mass flow measurement unit with the display, but you can view the special mass flow measurement on the display.

8.4.3 Special volume flow unit

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

To create a special volume flow measurement unit:

1. Specify the base volume unit.
2. Specify the base time unit.
3. Specify the volume flow conversion factor.
4. Assign a name to the new special volume flow measurement unit.
5. Assign a name to the volume totalizer measurement unit.

Note: You cannot create a special volume flow measurement unit with the display, but you can view the special volume flow measurement on the display.

8.4.4 Special unit for gas

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

For many gas applications, standard or normal volume flow rate is used as the quasi mass flow rate. Standard or normal volume flow rate is calculated as the mass flow rate divided by the density of the gas at a reference condition.

To configure a mass flow special unit that represents standard or normal volume flow rate, you must calculate the mass flow conversion factor from the density of the gas at a reference temperature, pressure, and composition.

ProLink II offers a Gas Unit Configurator tool to calculate this mass flow conversion factor. The tool will automatically update the mass flow conversion factor in the **Special Units** tab. If ProLink II is not available, special mass units can be used to set up standard or normal volume flow units for gas applications.

Note: Micro Motion recommends that you do not use the flowmeter to measure actual volume flow of a gas (volumetric flow at line conditions). If you need to measure actual volume flow, contact Micro Motion customer support.

⚠ **The flowmeter should not be used for measuring the actual volume of gases. Standard or normal volume is the traditional unit for gas flow. Coriolis flowmeters measure mass. Mass divided by standard or normal density yields standard or normal volume units.**

To use the Gas Unit Configurator:

1. Start ProLink II and connect to your transmitter.
2. Open the **Configuration** window.
3. Click the **Special Units** tab.
4. Click the **Gas Unit Configurator** button.
5. Select the **Time Unit** that your special unit will be based on.
6. Click a radio button to specify that your special unit will be defined in terms of **English Units** or **SI** (*Système International*) **Units**.
7. Click **Next**.
8. Define the standard density to be used in calculations.
   - To use a fixed standard density, click the top radio button, enter a value for standard density in the **Standard Density** textbox, and click **Next**.
   - To use a calculated standard density, click the second radio button and click **Next**. Then enter values for **Reference Temperature**, **Reference Pressure**, and **Specific Gravity** on the next panel, and click **Next**.
9. Check the values displayed.
   - If they are appropriate for your application, click **Finish**. The special unit data will be written to the transmitter.
   - If they are not appropriate for your application, click **Back** as many times as necessary to return to the relevant panel, correct the problem, then repeat the above steps.

8.5 Configuring cutoffs

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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 sensor software 2.1 or above and MVD software rev 3.0 or above.

See Table 8-2 for cutoff default values and related information. See Sections 8.5.1 and 8.5.2 for information on how the cutoffs interact with other transmitter measurements.

Table 8-2 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 flowrate
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
Density	0.2 g/cm^3	Range: 0.0–0.5 g/cm^3

8.5.1 Cutoffs and volume flow

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.

However, the density cutoff is applied to the volume flow calculation. Accordingly, if the density drops below its configured cutoff value, both the density and the volume flow rate will go to zero.

8.5.2 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 and volume flow:

- And the AO cutoffs are set to a greater value than the mass and volume cutoffs, the flow indicators will go to zero when the AO cutoff is reached.
- And the AO cutoffs are set to a lower value than the mass or volume cutoff, the flow indicator will go to zero when the mass or volume cutoff is reached.

See Section 6.4.3 for more information on the AO cutoff(s).

8.6 Configuring the damping values

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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 8-3.

Note: For gas applications, Micro Motion recommends a flow damping value of 3.2 or higher.

Before setting the damping values, review Sections 8.6.1 through 8.6.3 for information on how the damping values interact with other transmitter measurements and parameters.

Table 8-3 Valid damping values

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

(1) See Section 8.6.3.

8.6.1 Damping and volume measurement

When configuring damping values, be aware that volume measurement is derived from mass and density measurements; therefore, any damping applied to mass flow and density will affect volume measurements. Be sure to set damping values accordingly.

8.6.2 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 6.4.5 for more information on the added damping parameter.

8.6.3 Interaction with the update rate

Flow and density damping values depend on the configured update rate (see Section 8.7). If you change the update rate, the damping values are automatically adjusted.

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

8.7 Configuring the update rate

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

The update rate is the rate at which the sensor reports the process variables to the transmitter. This affects transmitter response time to changes in the process.

There are two settings for the update rate: Normal and Special.

- When Normal is selected, all process variables are reported at the rate of 20 times per second (20 Hz).
- When Special is selected, a single, user-specified process variable is updated at 100 times per second (100 Hz), and all other process variables are updated at 6.25 times per second (6.25 Hz). If you set the update rate to Special, you must also specify which process variable will be updated at 100 Hz.

Note: Most users should select the Normal update rate. Use the Special update rate only if required by your application. Contact Micro Motion before setting the update rate to Special.

Note: If you change the update rate, the setting for damping is automatically adjusted. See Section 8.6.3.

8.8 Configuring the flow direction parameter

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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 only
- Reverse only
- Absolute value
- Bidirectional
- Negate/Forward only (LF-Series DIN transmitters only)
- Negate/Absolute value (LF-Series DIN transmitters only)

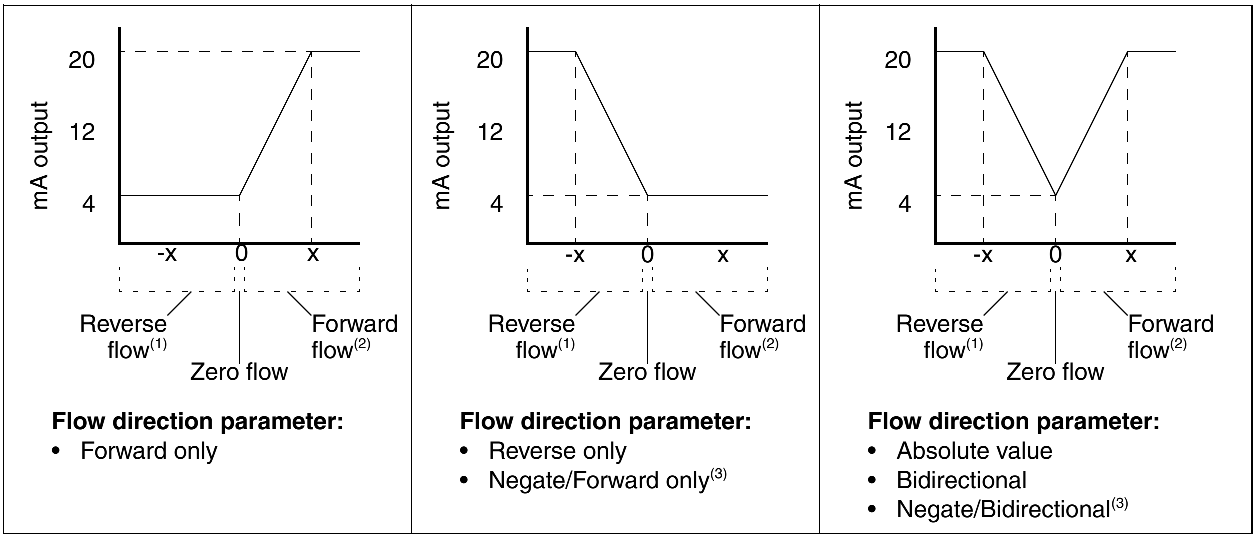
For the effect of flow direction on mA outputs:

- 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 8-4.

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



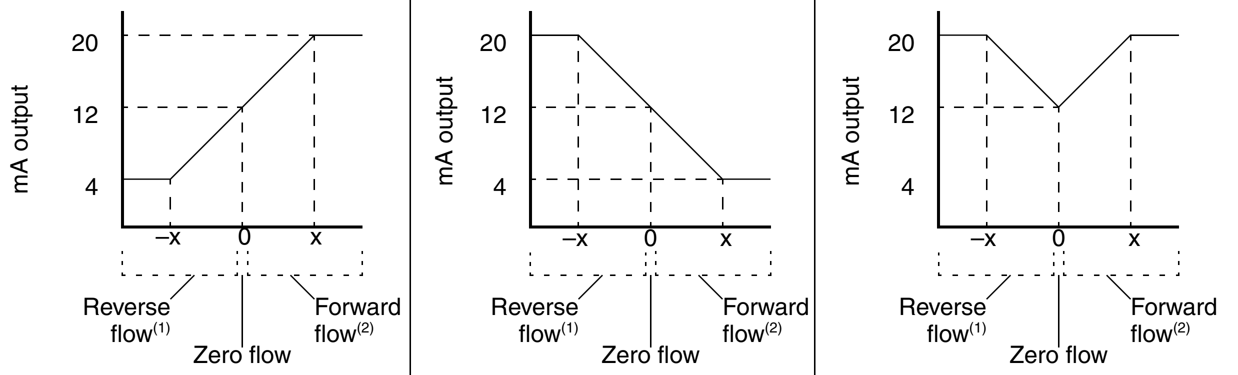
mA output configuration:

- 20 mA value = x
- 4 mA value = 0

To set the 4 mA and 20 mA values, see Section 6.4.2.

(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.
(3) Supported only by DIN rail mount transmitters.

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



Flow direction parameter:	Flow direction parameter:	Flow direction parameter:
• Forward only	• Reverse only • Negate/Forward only(3)	• Absolute value • Bidirectional • Negate/Bidirectional(3)

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

To set the 4 mA and 20 mA values, see Section 6.4.2.

(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.
(3) Supported only by DIN rail mount transmitters.

Example 1

Configuration:
- Flow direction = Forward only
- 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 only • 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 only • 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 8-4 **Effect of flow direction on frequency outputs, totalizers, and digital communications**

	Forward flow(1)		
Flow direction value	**Frequency outputs**	**Flow totals**	**Flow values via digital comm.**
Forward only	Increase	Increase	Positive
Reverse only	0 Hz	No change	Positive
Bidirectional	Increase	Increase	Positive
Absolute value	Increase	Increase	Positive(2)
Negate/Forward only	Zero(2)	No change	Negative
Negate/Bidirectional	Increase	Decrease	Negative
	Reverse flow(3)		
Flow direction value	**Frequency outputs**	**Flow totals**	**Flow values via digital comm.**
Forward only	0 Hz	No change	Negative
Reverse only	Increase	Increase	Negative
Bidirectional	Increase	Decrease	Negative
Absolute value	Increase	Increase	Positive(2)
Negate/Forward only	Increase	Increase	Positive
Negate/Bidirectional	Increase	Increase	Positive

(1) Process fluid flowing in same direction as flow direction arrow on sensor.
(2) Refer to the digital communications status bits for an indication of whether flow is positive or negative.
(3) Process fluid flowing in opposite direction from flow direction arrow on sensor.

8.9 Configuring events

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

An *event* occurs if the real-time value of a user-specified process variable varies beyond a user-specified value. Events are used to perform specific actions on the applications platform. For example, the event can be defined to activate a discrete output if the flow rate is above a specified value. The discrete output, then, may be configured to close a valve.

You can define one or two events. You may define the events on a single process variable or on two different process variables. Each event is associated with either a high or a low alarm.

Configuring an event includes the following steps:

1. Selecting event 1 or event 2.
2. Assigning a process variable to the event.
3. Specifying an alarm type:
   - *Active high* – alarm is triggered if process variable goes above setpoint
   - *Active low* – alarm is triggered if process variable goes below setpoint
4. Specifying the setpoint – the value at which the event will occur or switch state (ON to OFF, or vice versa).

Note: Events do not occur if the process variable equals the setpoint. The process variable must be greater than (Active high) or less than (Active low) the setpoint for the event to occur.

8.9.1 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 status (see Section 6.6).
- The display shows Alarm 108 (Event 1 On) or Alarm 109 (Event 2 On).
- 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 Alarm 108 (Event 1 On) or Alarm 109 (Event 2 On), and also shows event status in **Process Variables/View Status**.

8.10 Configuring slug flow limits and duration

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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

Slug flow parameters are as follows:

- *Low slug flow limit* – the point below which a condition of slug flow will exist. Typically, this is the lowest density point in your process's normal density range. Default value is 0.0 g/cm^3; range is 0.0–10.0 g/cm^3.
- *High slug flow limit* – the point above which a condition of slug flow will exist. Typically, this is the highest density point in your process's normal density range. Default value is 5.0 g/cm^3; range is 0.0–10.0 g/cm^3.
- *Slug flow duration* – the number of seconds the transmitter waits for a slug flow condition (*outside* the slug flow limits) to return to normal (*inside* the slug flow limits). If the transmitter detects slug flow, it will post a slug flow alarm and hold its last "pre-slug flow" flow rate until the end of the slug flow duration. If slugs are still present after the slug flow duration has expired, the transmitter will report a flow rate of zero. Default value for slug flow duration is 0.0 seconds; range is 0.0–60.0 seconds.

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

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.

8.11 Configuring entrained air handling

Entrained air refers to bubbles of air or other gas in the process fluid. These are also known as slugs (see Section 8.10). The terms "slug flow" and "two-phase flow" are used to refer to the situation in which the proportion of slugs to process fluid is outside the defined limits. (See Section 8.10 for information on defining the slug flow limits.)

By default, if slug flow occurs, alarms are posted, totalizers stop, and outputs go to the configured fault output level. This means that no process measurement occurs during conditions of slug flow. Entrained air handling is used to allow process measurement to continue during conditions of slug flow.

If entrained air handling is enabled:

- The fault indicator is set to None for the mA output and digital output (see Sections 6.4.4 and 8.15.1).
- Update rate is set to Special (see Section 8.7).
- Mass flow is specified as the 100 Hz variable (see Section 8.7).

The slug flow alarm is still posted.

8.12 Configuring fault timeout

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

By default, the transmitter immediately reports a fault when a fault is encountered. You can configure the transmitter to delay reporting a fault by changing the fault timeout to a nonzero value. During the fault timeout period, the transmitter continues to report its last valid measurement.

Note: Although some communication tools allow you to configure the fault timeout in two locations, only one value is stored. If you change the fault timeout in one location, the value displayed on the other location is changed.

8.13 Configuring meter factors

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO

Meter factors allow you to modify the transmitter's output so that it matches an external measurement standard. Meter factors are used for proving the flowmeter against a Weights & Measures standard. You may need to calculate and configure meter factors periodically to comply with regulations.

You can adjust meter factors for mass flow, volume flow, and density. Only values between 0.8 and 1.2 may be entered. If the calculated meter factor exceeds these limits, contact Micro Motion Customer Service.

8.13.1 Calculating meter factors

Use the following formula to calculate a meter factor:

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

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.

8.14 Configuring the display

- FM AN F
- FM AN M
- FM CIO

If your transmitter has a display, you can enable or disable specific display functions, set the off-line password, set the auto scroll rate, and specify the process variables to be shown on the display.

8.14.1 Enabling and disabling display parameters

Table 8-5 lists the display parameters and describes their behavior when enabled or disabled.

Table 8-5 Display parameters

Parameter	Enabled	Disabled
Display totalizer start/stop	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	Operators must use a password to access the off-line menu.	Operators can access the off-line menu without a 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.

(1) 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.

8.14.2 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 8.14.4) 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 8.14.1).

8.14.3 Changing the off-line password

The off-line password prevents unauthorized users from gaining access to the off-line menu.

The password can contain up to four numbers.

If you are using the Communicator, you must enable the off-line password before you can configure it (see Section 8.14.1).

8.14.4 Changing the display variables

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. The first display variable is permanently set to the process variable assigned to the primary mA output.

Table 8-6 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.

Note: When you are configuring display variables, all defined special measurement units will be listed, and can be selected.

Table 8-6 Example of a display variable configuration

Display variable	Process variable
Display variable 1(1)	Mass flow
Display variable 2	Mass totalizer
Display variable 3	Volume flow
Display variable 4	Volume totalizer
Display variable 5	Density
Display variable 6	Temperature
Display variable 7	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

(1) Display variable 1 always represents the process variable that is assigned to the primary mA output, and cannot be changed.

8.15 Configuring digital communications

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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 fault indicator

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

The transmitter can indicate fault conditions using a digital fault indicator. Table 8-7 lists the options for the digital fault indicator.

Table 8-7 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 HART polling address

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN 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/Bell202 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.

Zero is a special-purpose polling address that enables the primary mA output to vary according to the assigned process variable. When a transmitter's HART polling address is set to any value other than zero, the primary mA output is fixed at 4 mA, and will not report any variation in the assigned process variable.

8.15.3 Changing the Modbus address

- FM AN F
- FM AN M
- DIN AN
- DIN CIO
- DIN CIO FD

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:

- 1–15
- 32–47
- 64–79
- 96–110

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.

8.15.4 Changing the RS-485 parameters

- FM AN F
- FM AN M
- DIN AN
- DIN CIO
- DIN CIO FD

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

Table 8-8 RS-485 communication settings

	Transmitter	
Parameter	**FM options**	**DIN options**
Protocol	Modbus ASCII Modbus RTU (default) HART	Modbus ASCII Modbus RTU (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: 9600)

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. To allow the mA output to vary with the assigned process variable, this address must be set to 0.
- 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 8.14.1.
  - 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: 1–15, 32–47, 64–79, or 96–110. Valid addresses for HART protocol must be in the range 0–15. If Protocol is set to **NONE**, the address item will not appear.

8.15.5 Configuring HART burst mode

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN 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 8-9.

Table 8-9 **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.

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

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN 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 6.4.1.
- 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 6.4.1.
- 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 6.5.1.
- The QV is not reported through an output. It can be queried via digital communications or reported via burst mode.

Table 8-9 lists the valid process variable assignments for the PV, SV, TV, and QV on LF-Series transmitters.

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

Table 8-10 Process variable assignments for PV, SV, TV, and QV

	FM AN F, DIN AN				FM AN M, FM CIO, DIN CIO			
Process variable	**PV**	**SV**	**TV**	**QV**	**PV**	**SV**	**TV**	**QV**
Mass flow	✓	✓	✓	✓	✓	✓	✓	✓
Volume flow	✓	✓	✓	✓	✓	✓	✓	✓
Temperature					✓	✓		✓
Density					✓	✓		✓
Drive gain					✓	✓		✓
Mass total				✓				✓
Volume total				✓				✓
Mass inventory				✓				✓
Vol inventory				✓				✓
External pressure								✓
External temperature								✓

8.16 Configuring device settings

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

The device settings are used to describe the flowmeter components. Table 8-11 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.

Note: The HART tag has no significance for the DIN CIO FD transmitter.

Table 8-11 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 8.15.2) 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

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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

Filler Configuration

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Defaults

Chapter 9
Configuring the Filling and Dosing Application

9.1 About this chapter

This chapter explains how to configure the filling and dosing application on the DIN CIO FD transmitter. For information on using the filling and dosing application, see Chapter 10.

Changing configuration can affect transmitter operation, including filling. Changes made to filling configuration while a fill is running do not take effect until the fill is ended. Changes made to other configuration parameters may affect filling. To ensure correct filling, do not make any configuration changes while a fill is in progress.

9.2 User interface requirements

ProLink II v2.3 or later is required to configure the filling and dosing application.

Alternatively, configuration can be performed via a customer-written program using the Modbus interface to the DIN CIO FD transmitter and the filling and dosing application. Micro Motion has published the Modbus interface in the following manuals:

- *Using Modbus Protocol with Micro Motion Transmitters*, November 2004, P/N 3600219, Rev. C (manual plus map)
- *Modbus Mapping Assignments for Micro Motion Transmitters*, October 2004, P/N 20001741, Rev. B (map only)

Both of these manuals are available on the Micro Motion web site.

9.3 About the filling and dosing application

The filling and dosing application is used to begin flow, then end flow automatically when the target amount of process fluid has flowed through the sensor. During a fill, flow may be paused and resumed. A fill may also be ended before the target is reached.

Transmitter outputs change state according to fill status or operator commands. The control system opens or closes valves in response to the signals from the transmitter. The filling and dosing application must be configured for the type of valve used for fill control:

- One-stage discrete – Fill controlled by a single discrete (ON/OFF) valve. The valve opens completely when the fill begins, and closes completely when the fill target is reached (or the fill is paused or ended).
- Two-stage discrete – Fill controlled by two discrete valves: a primary valve and a secondary valve. One valve must open at the beginning of the fill; the other opens at a user-defined point. One valve must stay open until the end of the fill; the other closes at a user-defined point. See Figure 9-1 for illustrations of the different opening and closing options.
- Three-position analog – Fill controlled by one analog valve which can be fully open, fully closed, or partially closed. See Figure 9-2 for an illustration of the three-position analog fill.

The DIN CIO FD transmitter provides three outputs which can be used for valve control:

- Channel B always functions as a discrete output, and can be used to control the primary valve.
- Channel C can function as a discrete output or a discrete input. When used as a discrete output, it can be assigned to control the secondary valve.
- The mA output on Channel A can function as:
  - A discrete output, to control either the primary or secondary valve. When used as a discrete output, an interposing solid-state relay is required.
  - A three-level output, to control a three-position analog valve. When used as a three-level output, the 20 mA output level sets the valve to open full, and two user-specified output levels are used to set the valve to closed and to closed partial.

Note: If Channel A is configured for valve control, the channel cannot be used to report alarm status and the mA output will never go to fault levels.

Accordingly:

- A one-stage discrete fill requires either Channel A or Channel B configured to control the primary valve.
- A two-stage discrete fill requires any valid pair of Channels A, B, and C configured to control the primary and secondary valves.
- A three-position analog fill requires Channel A configured as a three-level output.

Note: See Table 9-1 for detailed information on output options.

Figure 9-1 **Two-stage discrete fill**

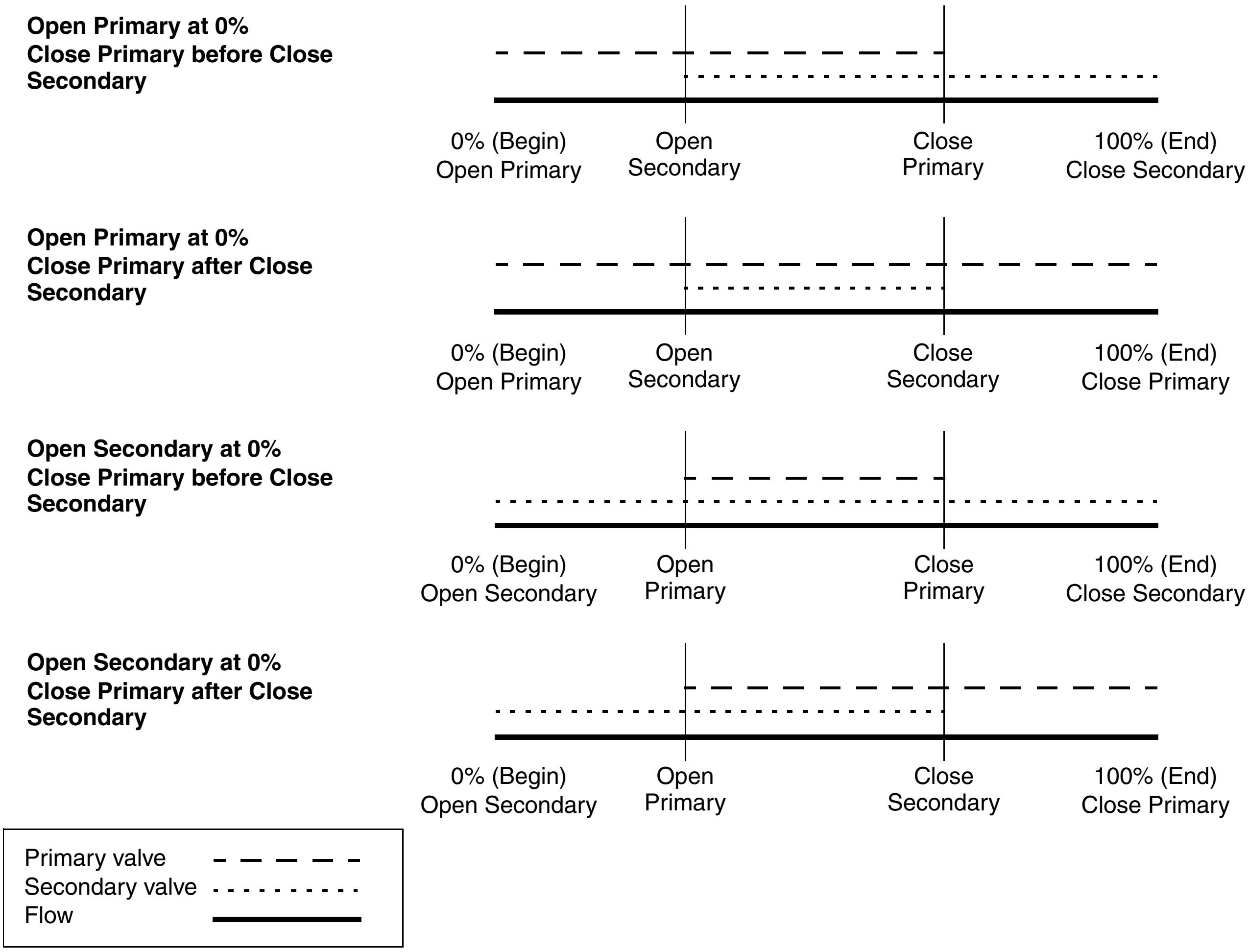
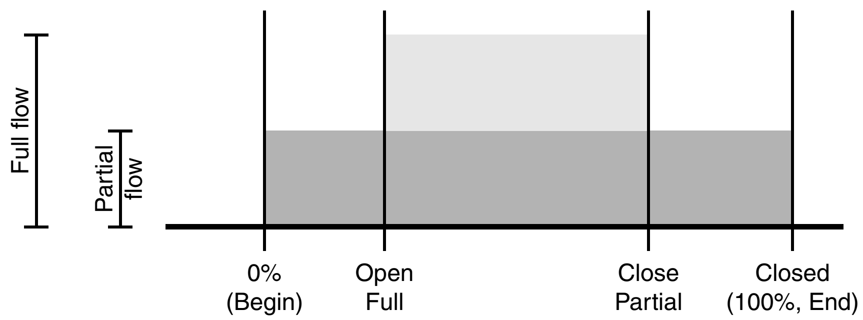


Figure 9-2 **Three-position analog fill**



9.3.1 Purge

Note: Two-stage discrete filling is not supported if a purge cycle is configured. If this functionality is required, configure the mA output as a three-level output, to control the fill, and configure Channel C as a discrete output, to control the purge.

If purge will be performed, one of the following valve control configurations is required:

- Two discrete outputs (one may be the mA output configured as a discrete output). One must be assigned to the primary valve and the other must be assigned to the secondary valve. The primary valve is used to control the fill, and the secondary valve controls the purge.
- The mA output configured as a three-level output, and Channel C configured as a discrete output assigned to the secondary valve.

The second discrete output is typically set up to control compressed air or a vacuum. These techniques are used to clear any process fluid that may be left in the piping from the previous fill.

There are two purge modes: manual and automatic.

- If **Manual** is configured, the **Begin Purge** and **End Purge** buttons on the **Run Filler** window are used to control the purge. The **End Fill** button also stops a purge.
- If **Auto** is configured, the purge starts automatically after the configured **Purge Delay**, and continues for the configured **Purge Time**. The purge may be stopped manually using the **End Fill** button.

In both cases, the discrete output assigned to the secondary valve transmits an Open signal when the purge begins, and transmits a Closed signal when the purge ends. The primary valve remains closed throughout the purge.

The purge can be stopped at any point, by using the **End Purge** or **End Fill** button.

9.3.2 Cleaning

Cleaning does not require any special valve configuration. When cleaning is started, all valves assigned to the system (except any valves configured for purging, as discussed in the previous section) are opened; when cleaning is stopped, all valves assigned to the system are closed.

Typically, cleaning involves flowing water or air through the system.

9.4 Configuring the filling and dosing application

To configure the filling and dosing application:

1. Open the ProLink II **Configuration** window.
2. Click the **Filling** tab. The panel shown in Figure 9-3 is displayed. In this panel:
   a. Configure the flow source (see Section 9.4.1) and click **Apply**.
   b. Configure **Fill Type** and other filling control options (see Section 9.4.2) and click **Apply**.

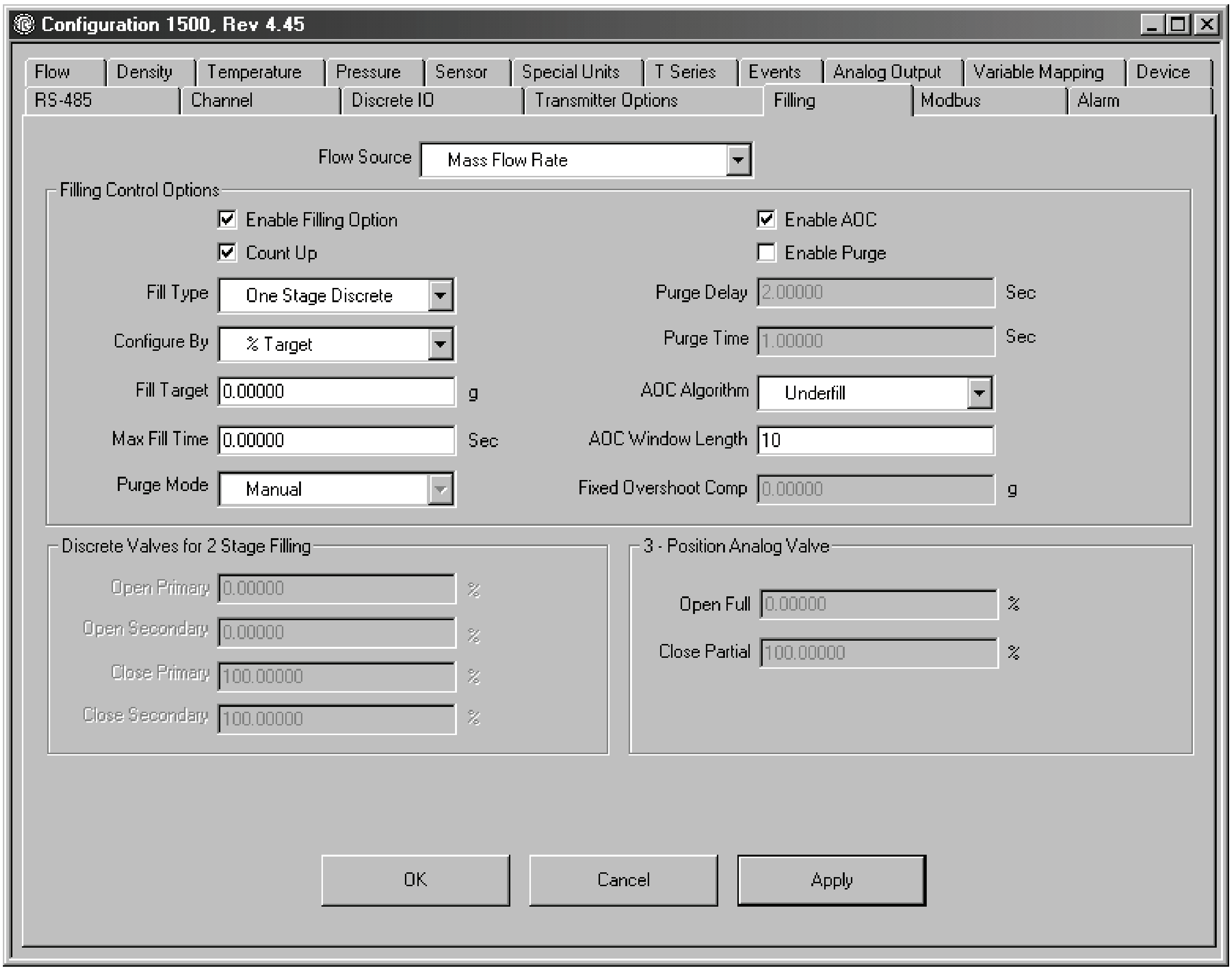
Note: You must configure Fill Type before configuring valve control.

3. Configure valve control as required:
   - If you are configuring a one-stage discrete fill, skip this step and continue with Step 6.
   - If you are configuring a two-stage discrete fill, configure **Open Primary**, **Open Secondary**, **Close Primary**, and **Close Secondary** (see Section 9.4.3 and Table 9-4), then click **Apply**.

Note: Either Open Primary or Open Secondary must be set to 0. Either Close Primary or Close Secondary must be set to 100% (if configured by %) or 0 (if configured by quantity). Settings are adjusted automatically to ensure that these requirements are met.

- If you are configuring a three-position analog fill, configure **Open Full** and **Closed Partial** values (see Section 9.4.3 and Table 9-5), then click **Apply**.

Figure 9-3 Filling panel



4. Configure transmitter outputs for the requirements of your filling application. Options are listed in Table 9-1.
   - To configure Channel B or C as a discrete output, use the **Channel Configuration** panel in the ProLink II **Configuration** window (see Section 6.6). To assign a function to Channel B or Channel C, use the **Discrete IO** panel in the ProLink II **Configuration** window (see Figure 9-4).
   - To configure Channel A as a discrete output, use the **Analog Output** panel in the ProLink II **Configuration** window (see Figure 9-5). In this panel:
     - Set **Primary Variable** to **Primary Valve** or **Secondary Valve**.
     - Ensure that **Enable 3 Position Valve** is disabled.

- To configure Channel A as a three-level output, use the **Analog Output** panel and:
  - Set **Primary Variable** to **Primary Valve**.
  - Ensure that **Enable 3 Position Valve** is enabled.
  - Specify the **Setpoint**, which is the mA output level that sets the valve to closed partial.
  - Specify the **Closed Value**, which is the mA output level that sets the valve to closed full. This value must be between 0 and 4 mA, and should be set according to the requirements of the valve.

Table 9-1 Output requirements and assignments

Fill type	Output requirements	Options	Assignment
One-stage discrete	One discrete output	Channel A	Primary valve
		Channel B	Primary valve
One-stage discrete with purge cycle	Two discrete outputs	Channel A Channel C	Primary valve; 3-position valve disabled Secondary (purge) valve
		Channel B Channel A	Primary valve Secondary (purge) valve with 3-position valve disabled
		Channel B Channel C	Primary valve Secondary(purge) valve
Two-stage discrete	Two discrete outputs	Channel A Channel C	Primary valve with 3-position valve disabled Secondary valve
		Channel B Channel A	Primary valve Secondary valve with 3-position valve disabled
		Channel B Channel C	Primary valve Secondary valve
Three-position analog	One three-level output	Channel A	Primary valve with 3-position valve enabled
Three-position analog with purge cycle	One three-level output and one discrete output	Channel A Channel C	Primary valve with 3-position valve enabled Secondary (purge) valve

Figure 9-4 Discrete IO panel

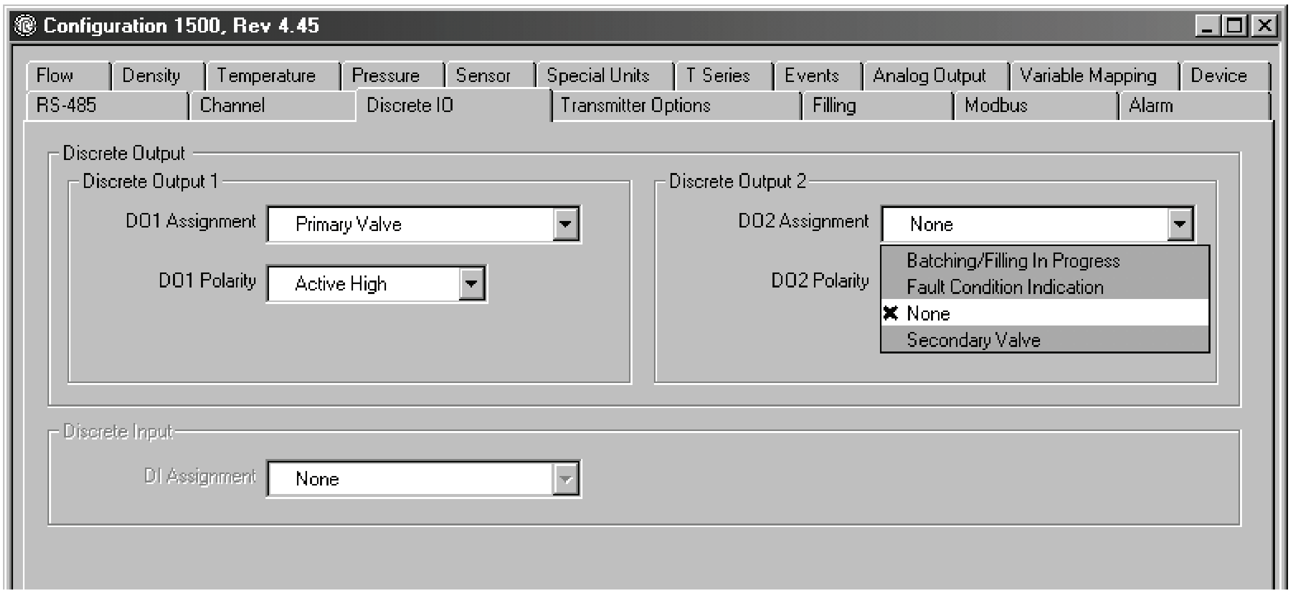
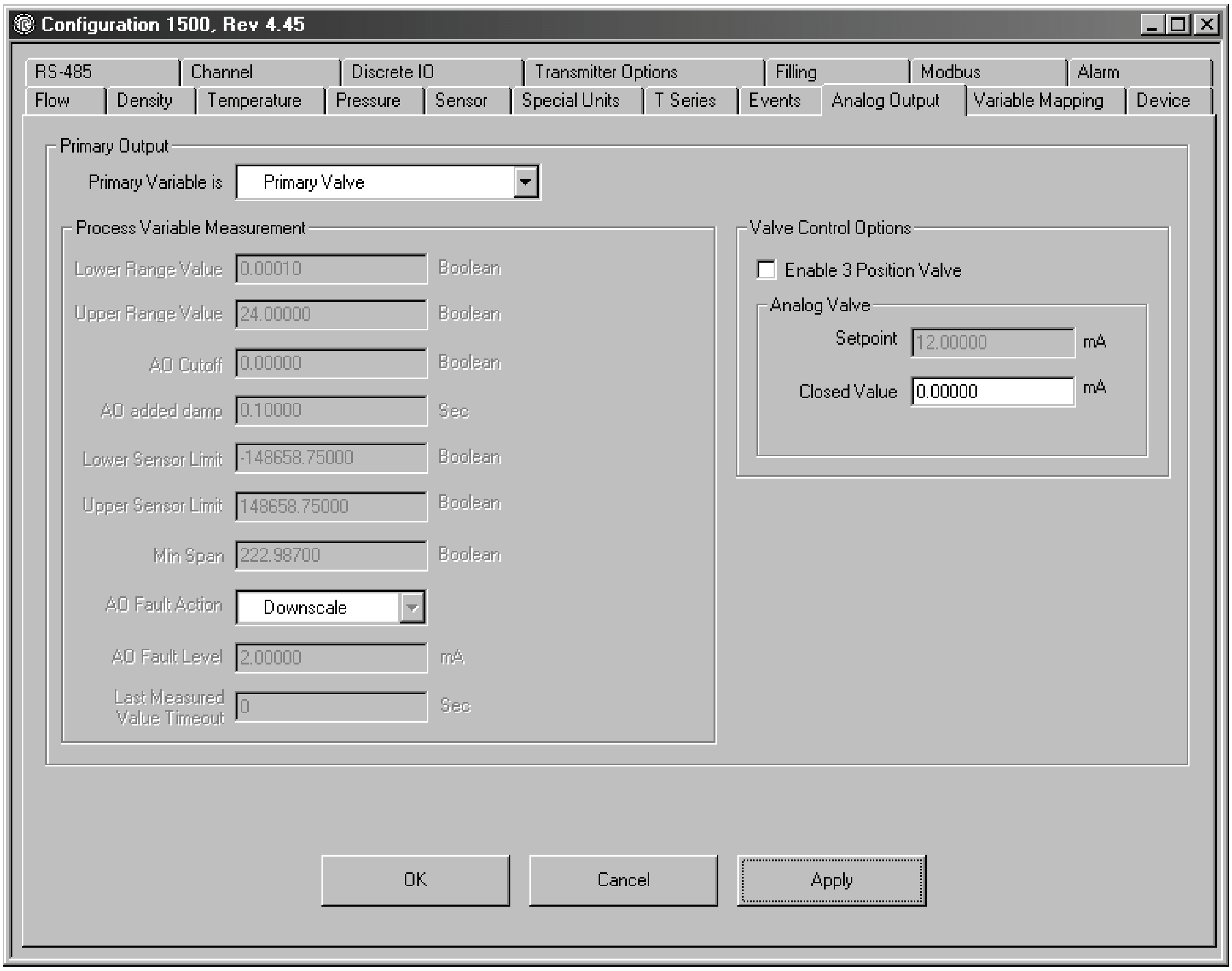


Figure 9-5 Analog Output panel



5. If you want to use overshoot compensation, see Section 9.5 for options and configuration instructions. This applies to both fixed and automatic overshoot compensation (AOC).
6. If Channel C has been configured as a discrete input, you can assign a fill control function to this channel. See Section 10.3.2.

9.4.1 Flow source

The flow source specifies the flow variable that will be used to measure fill quantity. Select one of the flow sources defined in Table 9-2.

- If you select **None**, the filling application is automatically disabled.
- If you select **Mass Flow Rate** or **Volume Flow Rate**, that variable will automatically be defined as the 100 Hz variable, and **Update Rate** will automatically be set to **Special**. See Section 8.7 for more information.

Note: If the filling application is enabled, you should not specify any variable other than the flow source variable as the 100 Hz variable.

Table 9-2 Flow sources

Flow source	Default	Description
None		Fill controller is disabled.
Mass flow rate	✓	Mass flow process variable as measured by transmitter
Volume flow rate		Volume flow process variable as measured by transmitter

9.4.2 Filling control options

The filling control options are used to define the fill process. Filling control options are listed and defined in Table 9-3.

Table 9-3 Filling control options

Control option	Default	Description
Enable Filling Option	Enabled	If enabled, the filling application is available for use. If disabled, the filling application is not available for use. However, it is still installed on the transmitter.
Count Up	Enabled	Controls how the fill total is calculated and displayed: • If enabled, fill totals increase from zero to the target value. • If disabled, fill totals decrease from the target value to zero. Does not affect fill configuration.
Enable AOC	Enabled	Automatic Overshoot Compensation (AOC) instructs the fill controller to compensate for the time required to close the valve, using the calculated AOC coefficient. See Section 9.5 for overshoot compensation options.
Enable Purge	Disabled	If enabled, the secondary valve is used for purging. See Section 9.3.1.
Fill Type	One Stage Discrete	Specify One Stage Discrete, Two Stage Discrete, or Three Position Analog. See Section 9.3. If Purge is enabled, you may not specify Two Stage Discrete. See Section 9.3.1.
Configure By	% Target	Select % Target or Quantity. • If set to % Target, Open Primary, Open Secondary, Close Primary, and Close Secondary values are configured as a percentage of the fill target. • If set to Quantity, Open Primary and Open Secondary are each configured as a quantity at which the valve should open; Close Primary and Close Secondary are configured as a quantity that is subtracted from the target.
Fill Target	0.00000 g	Enter the value at which the fill will be complete. • If Mass Flow Rate was specified for flow source, enter the value in the current measurement unit for mass. This unit is derived from the mass flow measurement unit (see Section 6.3.1). • If Volume Flow Rate was specified for flow source, enter the value in the current measurement unit for volume. This unit is derived from the volume flow measurement unit (see Section 6.3.2).
Max Fill Time	0.00000 sec	Enter a value of 0.00000 or any positive number (in seconds). There is no upper limit. If the fill does not reach the target before this time has elapsed, the fill is aborted and fill timeout error messages are posted. If Max Fill Time is set to 0, it is disabled.
Purge Mode	Manual	Select the purge control method: • Auto: A purge cycle occurs automatically after every fill, as defined by the Purge Delay and Purge Time parameters. • Manual: Purge must be started and stopped using the buttons on the Run Filler window. Purge must be enabled before Purge Mode can be configured.
Purge Delay	2.00000 sec	Used only if Purge Mode is set to Auto. Enter the number of seconds that will elapse after a fill is complete before the purge will begin. At this point, the purge (secondary) valve will be opened automatically.

Table 9-3 **Filling control options** *continued*

Control option	Default	Description
Purge Time	1.00000 sec	Used only if Purge Mode is set to Auto. Enter the purge duration, in seconds. When Purge Time has elapsed, the purge (secondary) valve will be closed automatically.
AOC Algorithm	Underfill	Select the type of overshoot compensation to be performed: • Underfill – The actual quantity delivered will never exceed the target quantity. • Overfill – The actual quantity delivered will never be less than the target quantity. • Fixed – The valve will close at the point defined by the target quantity minus the Fixed Overshoot Comp parameter. Underfill and Overfill are available only if AOC is enabled. Fixed is available only if AOC is disabled.
AOC Window Length	10	For standard AOC calibration, specify the maximum number of fills that will be run during calibration. For rolling AOC calibration, specify the number of fills that will be used to calculate AOC.
Fixed Overshoot Comp	0.00000	Used only if AOC is disabled and AOC Algorithm is set to Fixed. Enter the value to be subtracted from the target quantity to determine the point at which the valve will close. Enter the value in mass or volume units, as appropriate to the configured flow source.

9.4.3 Valve control parameters

The valve control parameters are used to open and close the valves at particular points in the fill process.

- Valve control parameters for two-stage discrete filling are listed and defined in Table 9-4.
- Valve control parameters for three-position analog filling are listed and defined in Table 9-5.

Note: Valve control parameters are not used for one-stage discrete filling. In one-stage discrete filling, the valve opens when the fill is started, and closes when the fill target is reached.

Table 9-4 Valve control parameters – Two-stage discrete fill

Flow option	Default	Description
Open Primary	0.00% of target	Enter the quantity or the percent of the target at which the primary valve will open. Either Open Primary or Open Secondary must be set to 0. If one of these parameters is set to a non-zero value, the other is set to 0 automatically. Before a fill of this type can be started, the primary valve must be assigned to a discrete output. See Section 9.4, Step 4.
Open Secondary	0.00% of target	Enter the quantity or the percent of the target at which the secondary valve will open. Either Open Primary or Open Secondary must be set to 0. If one of these parameters is set to a non-zero value, the other is set to 0 automatically. Before a fill of this type can be started, the secondary valve must be assigned to a discrete output. See Section 9.4, Step 4.
Close Primary	100.00% of target	Enter the percent of the target, or the quantity to be subtracted from the target, at which the primary valve will close.(1) Either Close Primary or Close Secondary must be set to close when the target is reached. If one of these parameters is set to a value that is not the target, the other is adjusted accordingly.
Close Secondary	100.00% of target	Enter the percent of the target, or the quantity to be subtracted from the target, at which the secondary valve will close.(1) Either Close Primary or Close Secondary must be set to close when the target is reached. If one of these parameters is set to a value that is not the target, the other is adjusted accordinly.

(1) See the definition of Configure By in Table 9-3.

Table 9-5 Valve control parameters – Three-position analog fill

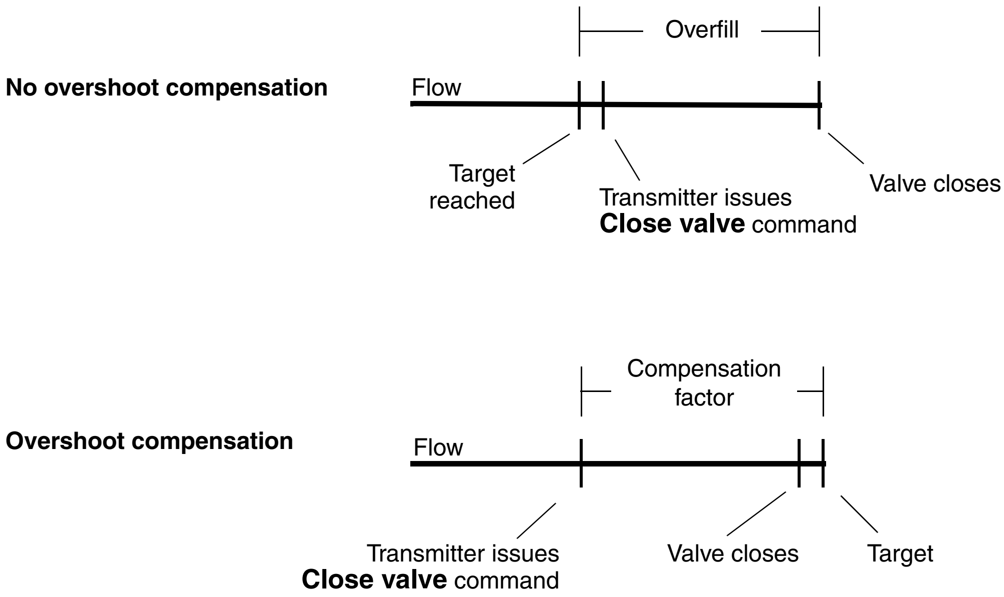
Flow option	Default	Description
Open Full	0.00% of target	Enter the quantity or the percent of the target at which the valve will transition from partial flow to full flow.
Close Partial	100.00% of target	Enter the percent of the target, or the quantity to be subtracted from the target, at which the valve will transition from full flow to partial flow.(1)

(1) See the definition of Configure By in Table 9-3.

9.5 Overshoot compensation

Overshoot compensation keeps the actual quantity delivered as close as possible to the fill target by compensating for the time required to close the valve. Without overshoot compensation, there will always be some amount of overfill because of the time required for the transmitter to observe that the target has been reached and send the command to close the valve, and then for the control system and valve to respond. When overshoot compensation is configured, the transmitter issues the valve close command before the target is reached. See Figure 9-6.

Figure 9-6 Overshoot compensation and flow



Three types of overshoot compensation can be configured:

- *Fixed* – The valve will close at the point defined by the target minus the quantity specified in **Fixed Overshoot Comp**.
- *Underfill* – The valve will close at the point defined by the AOC coefficient calculated during AOC calibration, adjusted to ensure that the actual quantity delivered never exceeds the target. (The initial adjusted target is less than the actual target, and moves upward toward the target during calibration.)
- *Overfill* – The valve will close at the point defined by the AOC coefficient calculated during AOC calibration, adjusted to ensure that the actual quantity delivered is never less than the target. (The variance of the fills is added to the AOC-adjusted target.)

AOC calibration is required only if Underfill or Overfill is configured. There are two forms of AOC calibration:

- *Standard* – Several fills are run during a special "calibration period." The AOC coefficient is calculated from data collected from these fills. See Section 9.5.2 for instructions on the standard AOC calibration procedure.
- *Rolling* – The AOC coefficient is calculated from data collected from the *x* most recent fills, where *x* is the value specified for **AOC Window Length**. There is no special calibration period. For example, if **AOC Window Length** is set to 10, the first AOC coefficient is calculated from the first ten fills. When the eleventh fill is run, the AOC coefficient is recalculated, based on the ten most recent fills, and so on. No special calibration procedure is required.

9.5.1 Configuring overshoot compensation

Fixed overshoot compensation is used if the compensation value is already known. To configure fixed overshoot compensation:

1. Disable the **Enable AOC** checkbox in the **Filling** panel (see Figure 9-3).
2. Set **AOC Algorithm** to **Fixed**.
3. Click **Apply**.
4. Specify the appropriate value for **Fixed Overshoot Comp**. Enter values in the unit used for the flow source.
5. Click **Apply**.

Note: Do not enable the Enable AOC checkbox. The Enable AOC checkbox is enabled only for underfill or overfill.

To configure automatic overshoot compensation for underfill or overfill:

1. Enable the **Enable AOC** checkbox in the **Filling** panel (see Figure 9-3).
2. Set **AOC Algorithm** to **Underfill** or **Overfill**.
3. Set **AOC Window Length**:
   - If standard AOC calibration will be used, specify the maximum number of fills that will be used to calculate the AOC coefficient during calibration.
   - If rolling AOC calibration will be used, specify the number of fills that will be used to calculate the AOC coefficient.
4. Click **Apply**.
5. If standard AOC calibration will be used, follow the instructions in Section 9.5.2. If rolling AOC calibration will be used, follow the instructions in Section 9.5.3.

9.5.2 Standard AOC calibration

Note: In common use, the first training fill will always be slightly overfilled because the default compensation factor is 0. To prevent this, set the AOC Coeff value in the Run Filler window (see Figure 10-1) to a small positive number. This value must be small enough so that when it is multiplied by the flow rate, the resulting value is less than the fill target.

To perform standard AOC calibration:

1. Click **ProLink > Run Filler**. The window shown in Figure 10-1 is displayed.
2. Click **Start AOC Cal**. The **AOC Calibration Active** light turns red, and will remain red while AOC calibration is in progress.
3. Run as many fills as desired, up to the number specified in **AOC Window Length**.

Note: If you run more fills, the AOC coefficient is calculated from the x most recent fills, where x is the value specified for AOC Window Length.

4. When the fill totals are consistently satisfactory, click **Save AOC Cal**.

The AOC coefficient is calculated from the fills run during this time period, and is displayed in the **Run Filler** window. This factor will be applied to all subsequent fills while AOC is enabled, until another AOC calibration is performed.

Another AOC calibration is recommended:

- If equipment has been replaced or adjusted
- If flow rate has changed significantly
- If fills are consistently missing the target value

9.5.3 Rolling AOC calibration

Note: In common use, the first fill may be slightly overfilled because the default compensation factor is 0.2. To prevent this, increase the AOC Coeff value in the Run Filler window (see Figure 10-1). This value must be small enough so that when it is multiplied by the flow rate, the resulting value is less than the fill target.

To enable rolling AOC calibration:

1. Click **ProLink > Run Filler**. The window shown in Figure 10-1 is displayed.
2. Click **Start AOC Cal**. The **AOC Calibration Active** light turns red.
3. Begin filling. Do not click **Save AOC Cal**. The AOC coefficient is recalculated after each fill, and the current value is displayed in the **Run Filler** window.

At any time, you can click **Save AOC Cal.** The current AOC coefficient will be saved in the transmitter and used for all overshoot compensation during subsequent fills. In other words, this action changes the AOC calibration method from rolling to standard.

Chapter 10
Using the Filling and Dosing Application

10.1 About this chapter

This chapter explains how to use the filling and dosing application on the DIN CIO FD transmitter. For information on configuring the filling and dosing application, see Chapter 9.

Changing configuration can affect transmitter operation, including filling. Changes made to filling configuration while a fill is running do not take effect until the fill is ended. Changes made to other configuration parameters may affect filling. To ensure correct filling, do not make any configuration changes while a fill is in progress.

10.2 User interface requirements

ProLink II can be used to operate the filling and dosing application. If desired, a discrete input can be configured to perform a fill control function.

Alternatively, the filling and dosing application can be operated by a customer-written program using the Modbus interface to the DIN CIO FD transmitter and the filling and dosing application. Micro Motion has published the Modbus interface in the following manuals:

- *Using Modbus Protocol with Micro Motion Transmitters*, November 2004, P/N 3600219, Rev. C (manual plus map)
- *Modbus Mapping Assignments for Micro Motion Transmitters*, October 2004, P/N 20001741, Rev. B (map only)

Both of these manuals are available on the Micro Motion web site.

10.3 Operating the filling and dosing application from ProLink II

To operate the filling and dosing application from ProLink II, open the ProLink II **Run Filler** window and use the fill control buttons. The following actions may performed:

- Beginning, ending, pausing, and resuming a fill
- Manually starting and stopping a purge
- Manually starting and stopping a clean
- Performing standard AOC calibration (see Section 9.5.2)

In addition, the **Run Filler** window allows you to reset various fill parameters and displays a variety of fill status information.

Figures 10-3 through 10-7 illustrate the various fill sequences for two-stage discrete filling or three-position analog filling when the fill is paused and resumed at different points in the fill.

Note: The fill total is not held across a transmitter power cycle.

10.3.1 Using the Run Filler window

The ProLink II **Run Filler** window is shown in Figure 10-1.

The Fill Setup, Fill Control, AOC Calibration, Fill Statistics, and Fill Data displays and controls are listed and defined in Table 10-1.

The Fill Status fields show the current status of the fill or the filling application:

- A green LED indicates that the condition is inactive or the valve is closed.
- A red LED indicates that the condition is active or the valve is open.

The Fill Status fields are defined in Table 10-2.

Figure 10-1 Run Filler window

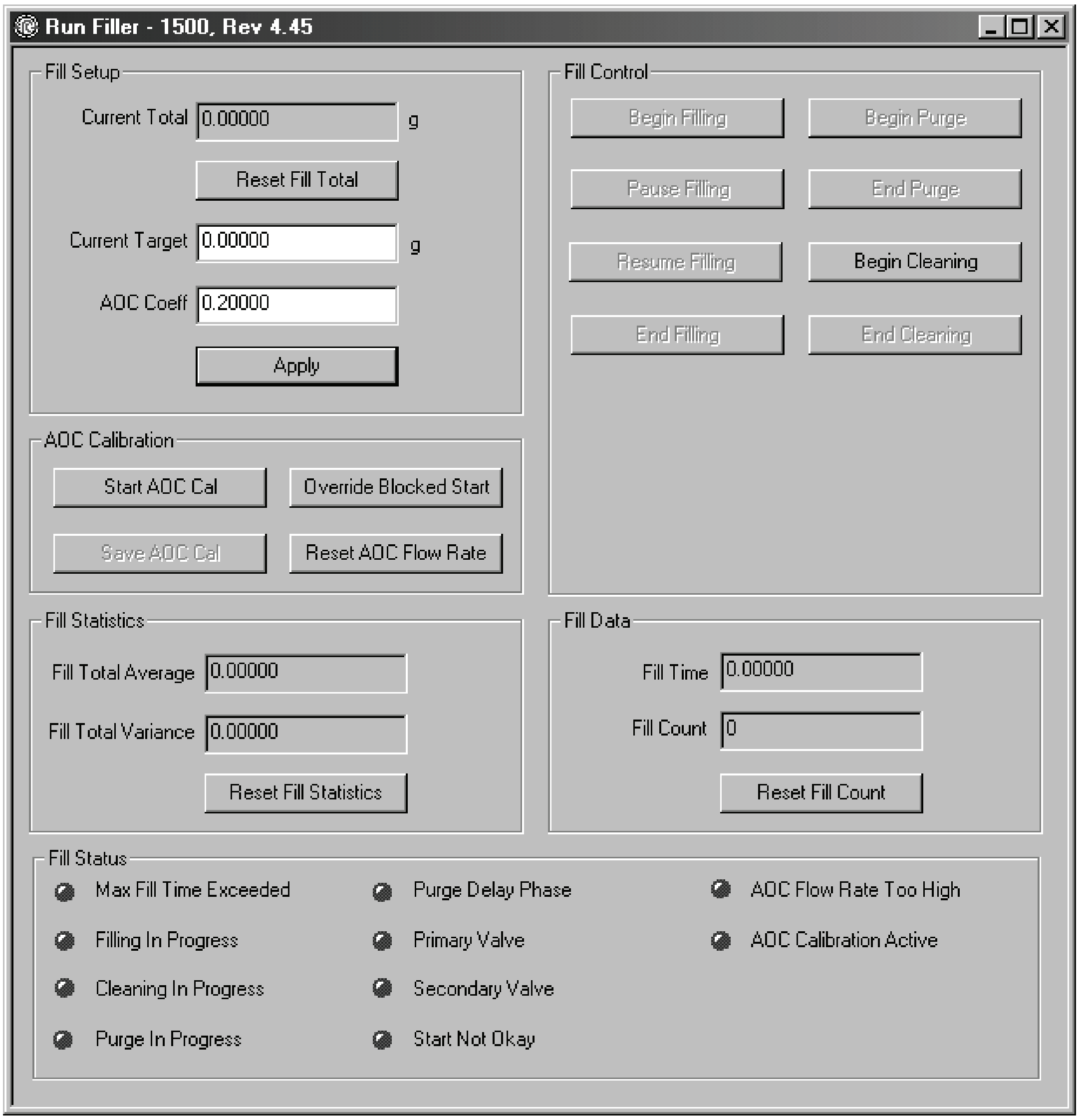


Table 10-1 Run Filler displays and controls

Display/Control		Description
Fill Setup	Current Total	Displays the running fill total, updated periodically, for the current fill. This value is not updated between fills. However, if flow is present while a fill is paused, the value is updated.
	Reset Fill Total	Resets the fill total to 0.
	Current Target	Displays the target quantity for the current fill. • To change this value, enter the new target value and click Apply. • You cannot change the target while a fill is in progress, unless the fill is paused.
	AOC Coeff	Displays the factor used to adjust the target, if AOC is enabled.(1) • To change this value, enter the new AOC value and click Apply. WARNING: Writing to this parameter will overwrite any existing AOC calibration results. • You cannot change the AOC coefficient while a fill is in progress, whether the fill is currently flowing or is paused.
Fill Control	Begin Filling	Starts the fill. The fill total is automatically reset before filling begins.
	Pause Filling	Temporarily stops the fill. The fill can be resumed if the fill total is less than the fill target.
	Resume Filling	Restarts a fill that has been paused. Counting resumes from the total at which the fill was paused.
	End Filling	Permanently stops the fill or purge. The fill cannot be resumed.
	Begin Purge	Begins a manual purge by opening the secondary valve. You cannot begin a purge while a fill is in progress. You cannot begin a fill while a purge is in progress.
	End Purge	Ends a manual purge by closing the secondary valve.
	Begin Cleaning	Opens all valves (except purge valve) that are assigned to a transmitter output. Cleaning cannot be started if a fill or purge is in progress.
	End Cleaning	Closes all valves that are assigned to a transmitter output.
AOC Calibration	Start AOC Cal	Begins AOC calibration.
	Save AOC Cal	Ends AOC calibration and saves the calculated AOC coefficient.
	Override Blocked Start	Enables filling if the fill has been blocked by: • Slug flow • A core processor fault • The last measured flow rate is too high, as indicated by the corresponding status LED (see Table 10-2).
	Reset AOC Flow Rate(2)	Resets the last measured flow rate to zero, to bypass the condition indicated by the AOC Flow Rate Too High status LED (see Table 10-2). If the flow rate is too high, and this is not a one-time condition: • And you are using standard AOC calibration, try resetting the AOC flow rate (see below). If this does not clear the condition, repeat AOC calibration. • And you are using rolling AOC calibration, overriding the blocked start once or twice should correct the condition.

Table 10-1 Run Filler displays and controls *continued*

Display/Control		Description
Fill Statistics	Fill Total Average	Displays the calculated average of all fill totals since fill statistics were reset.
	Fill Total Variance	Displays the calculated variance of all fill totals since fill statistics were reset.
	Reset Fill Statistics	Resets fill total average and fill total variance to zero.
Fill Data	Fill Time	Displays the number of seconds that have elapsed in the current fill. Seconds that the fill was paused are not included in the fill time value.
	Fill Count	Displays the number of fills that have been performed since fill statistics were reset. Only completed fills are counted; fills that were ended before the target was reached are not included in this total. The maximum number is 65535; after that number has been reached, counting resumes with 1.
	Reset Fill Count	Resets the fill counter to zero.

(1) This field displays the result of AOC calibration. If you reset it manually, AOC calibration data is lost. Typically, the only reason to set it manually is to prevent overfill on the first few fills. See Section 9.5.
(2) Applicable only when AOC Algorithm is set to Underfill.

Table 10-2 Fill Status fields

Status LED	Description
Max Fill Time Exceeded	The current fill has exceeded the current setting for Max Fill Time. The fill is aborted.
Filling In Progress	A fill is currently being performed.
Cleaning In Progress	The Start Clean function has been activated, and all valves assigned to transmitter outputs are open (except purge valve)
Purge In Progress	A purge has been started, either automatically or manually.
Purge Delay Phase	An automatic purge cycle is in progress, and is currently in the delay period between the completion of the fill and the start of the purge.
Primary Valve	The primary valve is open. If a three-position analog valve has been configured, the valve is either open or closed partial.
Secondary Valve	The secondary valve is open.
Start Not Okay	One or more conditions required to start a fill are not met.
AOC Flow Rate Too High	The last measured flow rate is too large to allow the fill to start. In other words, the AOC coefficient, compensated for the flow rate, specifies that the valve close command should be issued before the fill has begun. This can happen if the flow rate has increased significantly with no corresponding change in the AOC coefficient. AOC calibration is recommended. To adjust the AOC value, you can use the Override Blocked Start function to run a fill without AOC (see Table 10-1).
AOC Calibration Active	AOC calibration is in progress.

10.3.2 Using a discrete input

If a discrete input is assigned to a fill control function, the function is triggered when the discrete input is in an ON state.

Table 10-3 lists the fill control functions. To assign a discrete input to trigger a fill function:

1. Ensure that Channel C is configured as a discrete input (see Section 6.2).
2. Open the ProLink II **Configuration** window and click on the **Discrete IO** tab. The panel shown in Figure 10-2 is displayed.
3. Select the fill control function to be triggered. Fill control functions are listed and defined in Table 10-3.

Figure 10-2 **Discrete IO panel**

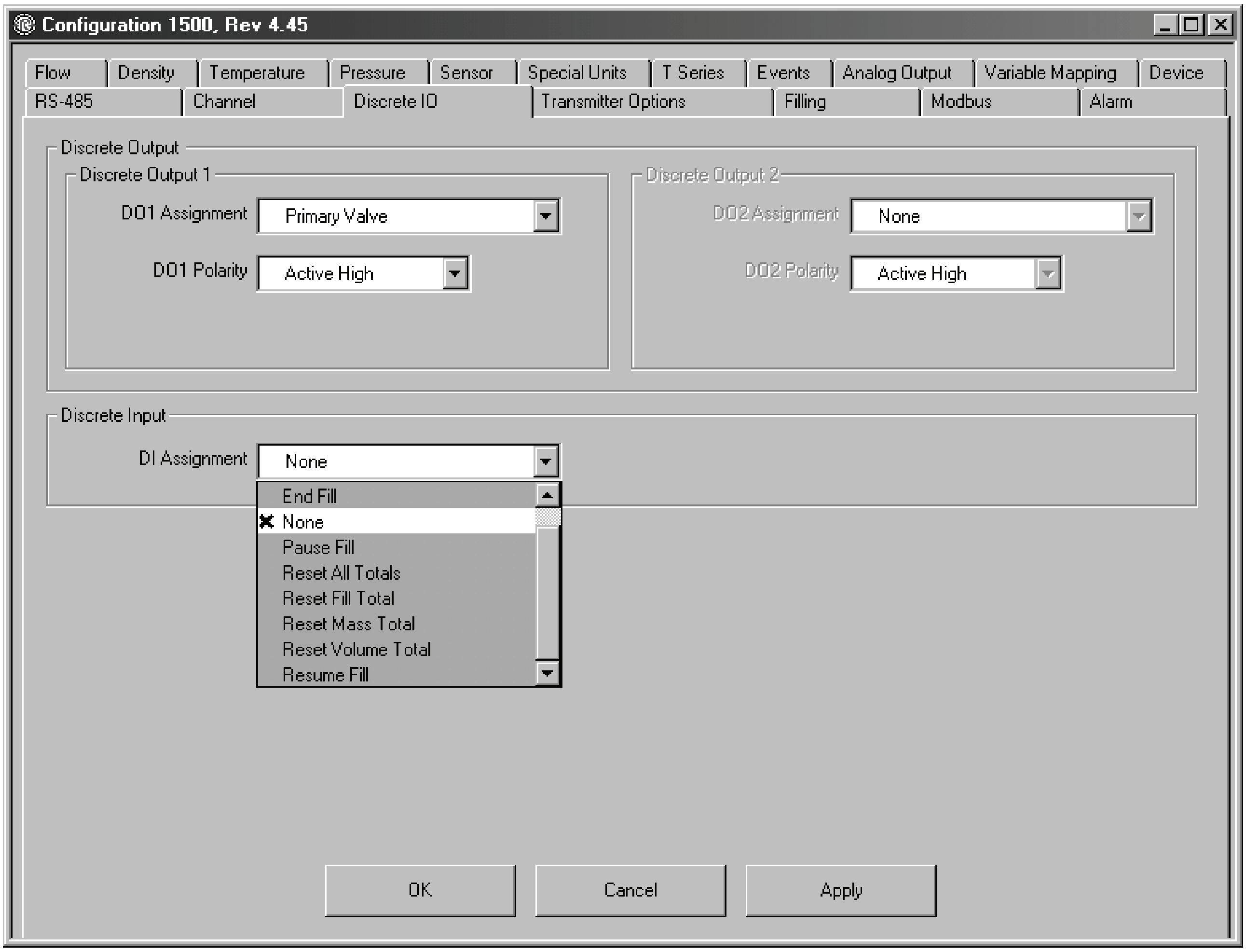


Table 10-3 **Fill control functions**

Function	ON state actions
Begin fill	• Starts the fill. • The fill total is automatically reset before filling begins.
End fill	• Permanently stops the fill. • The fill cannot be resumed.
Pause fill	• Temporarily stops the fill. • The fill can be resumed if the fill total is less than the fill target.
Resume fill	• Restarts a fill that has been paused. • Counting resumes from the point at which the fill was paused.
Reset fill total	• Resets fill total to zero. • Reset cannot be performed while a fill is running or while a fill is paused. Before a fill can be reset, the fill target must be reached or the fill must be ended.

Note: The Reset All Totals function (see Section 7.6) includes resetting the fill total.

10.3.3 Fill sequences with PAUSE and RESUME

This section provides illustrations of fill sequences when the fill is paused and resumed at different points in the process.

Figure 10-3 Fill sequences: Two-stage discrete fill, Open Primary at 0%, Close Primary First

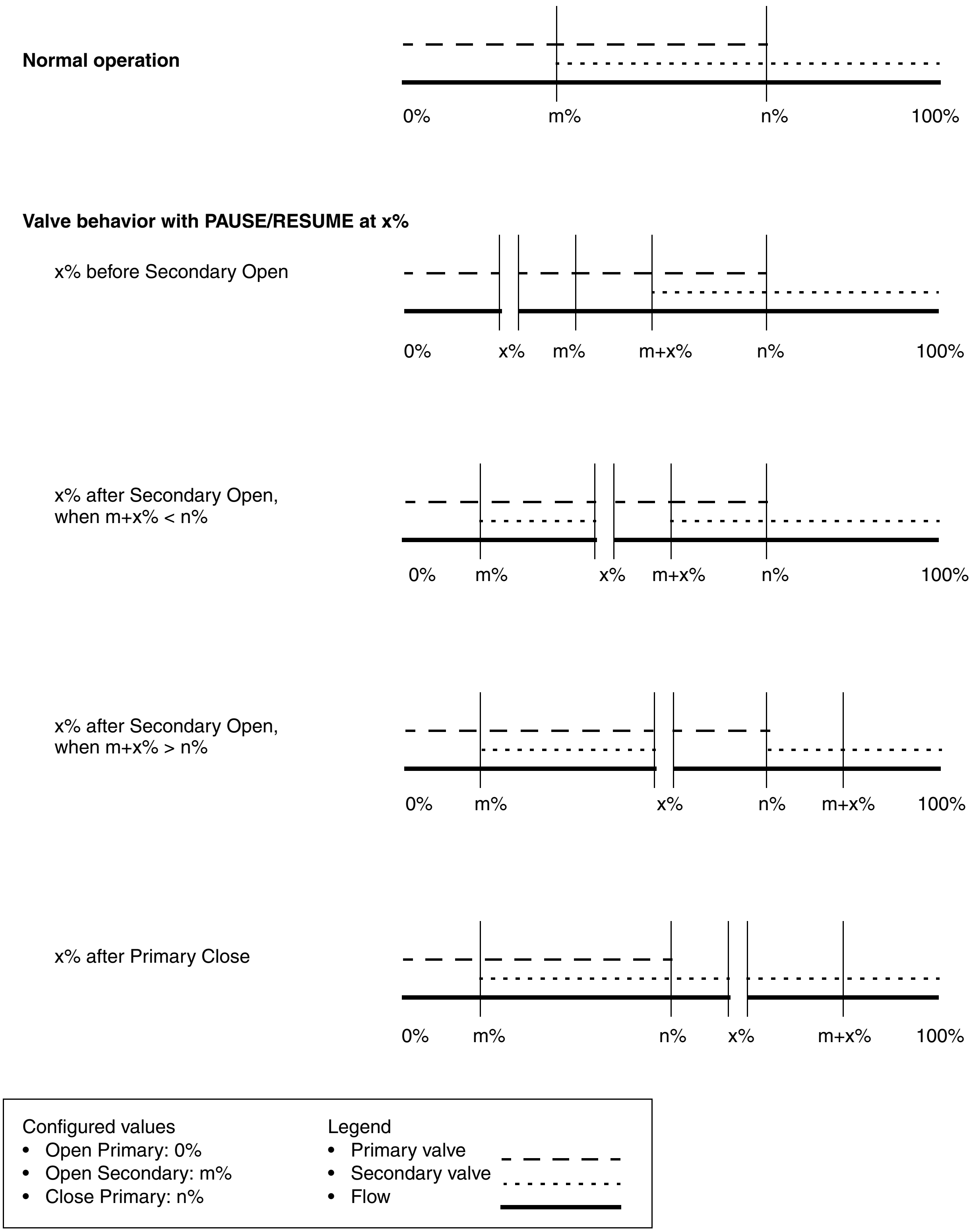


Figure 10-4 **Fill sequences: Two-stage discrete fill, Open Primary at 0%, Close Secondary first**

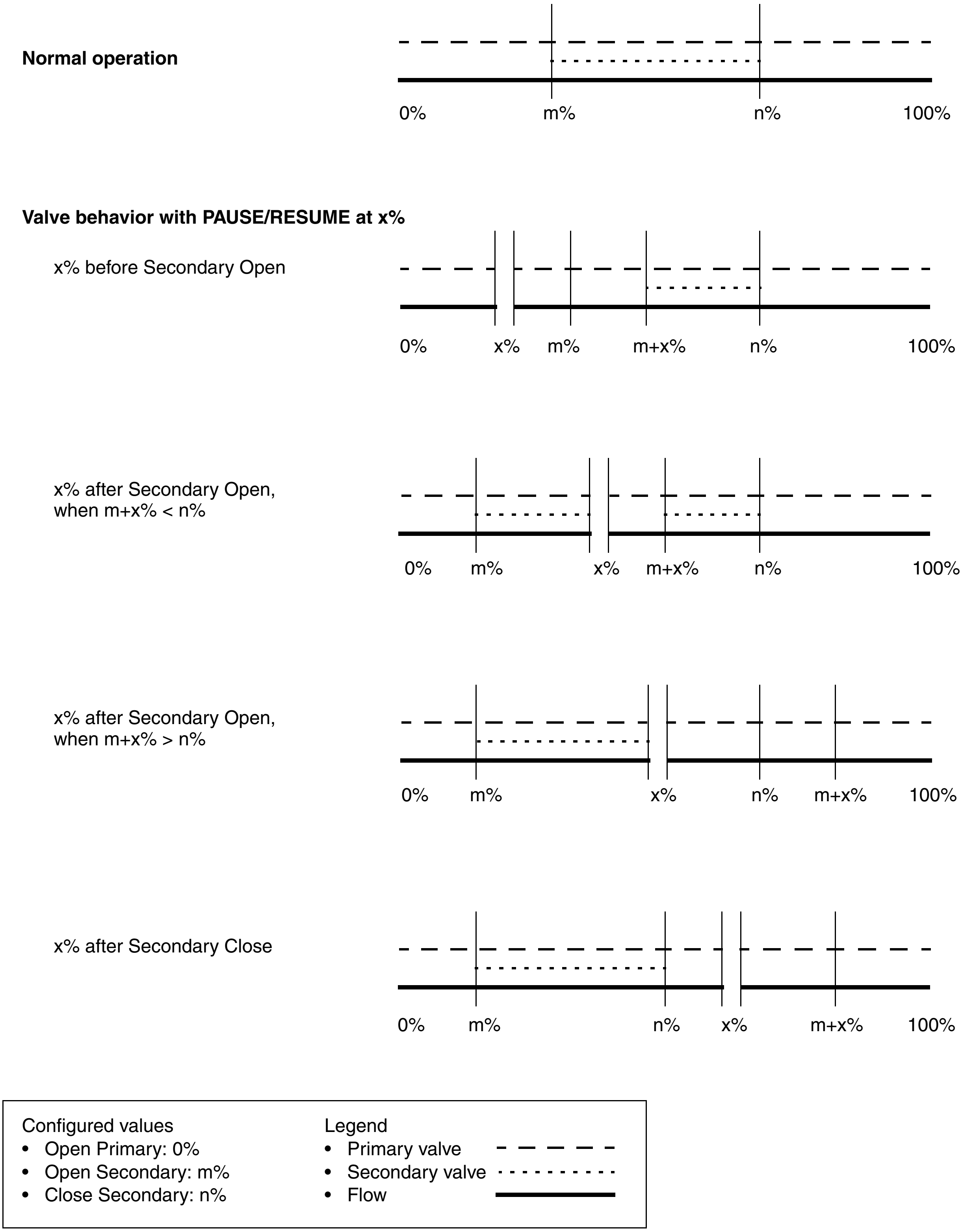


Figure 10-5 Fill sequences: Two-stage discrete fill, Open Secondary at 0%, Close Primary First

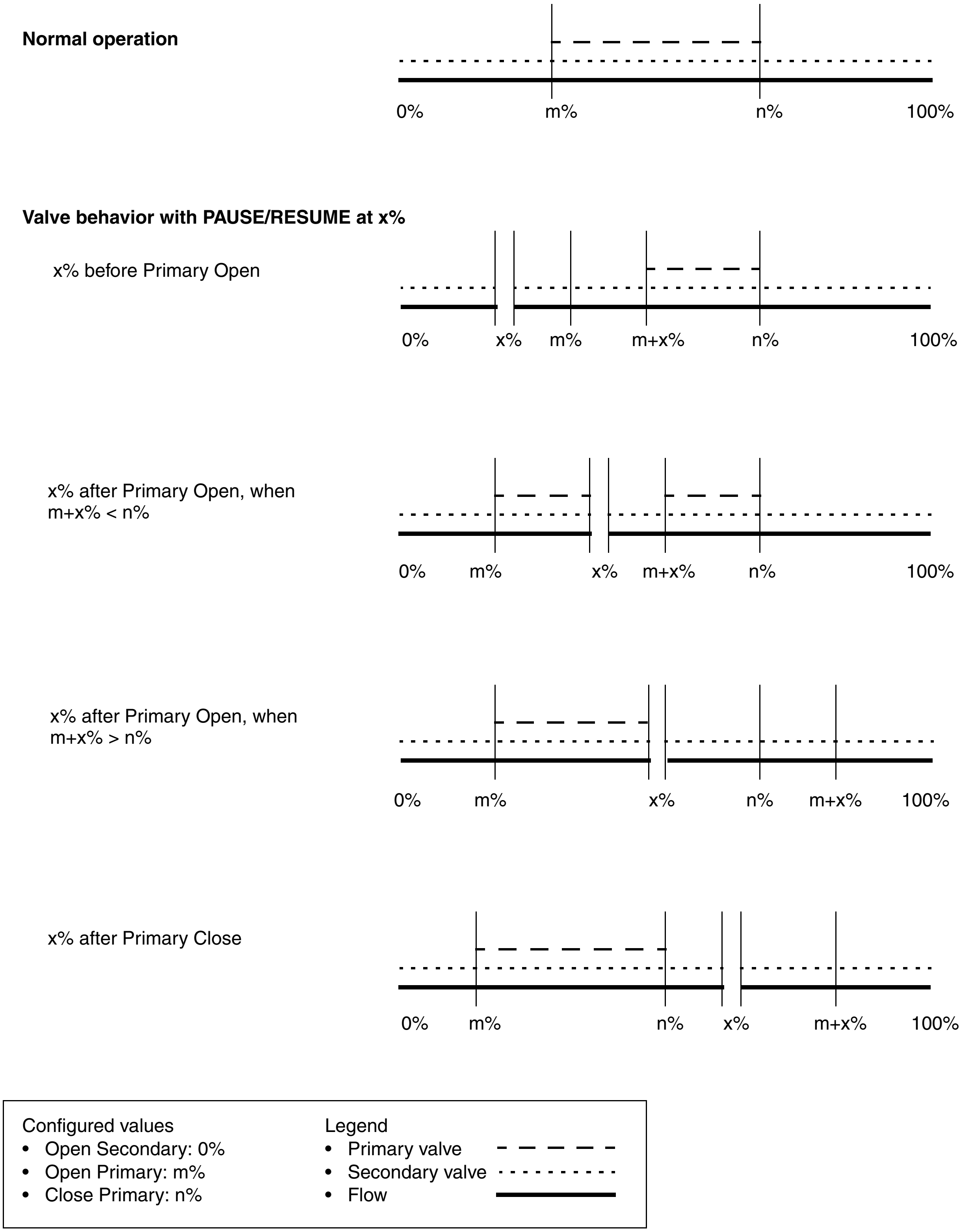


Figure 10-6 Fill sequences: Two-stage discrete fill, Open Secondary at 0%, Close Secondary First

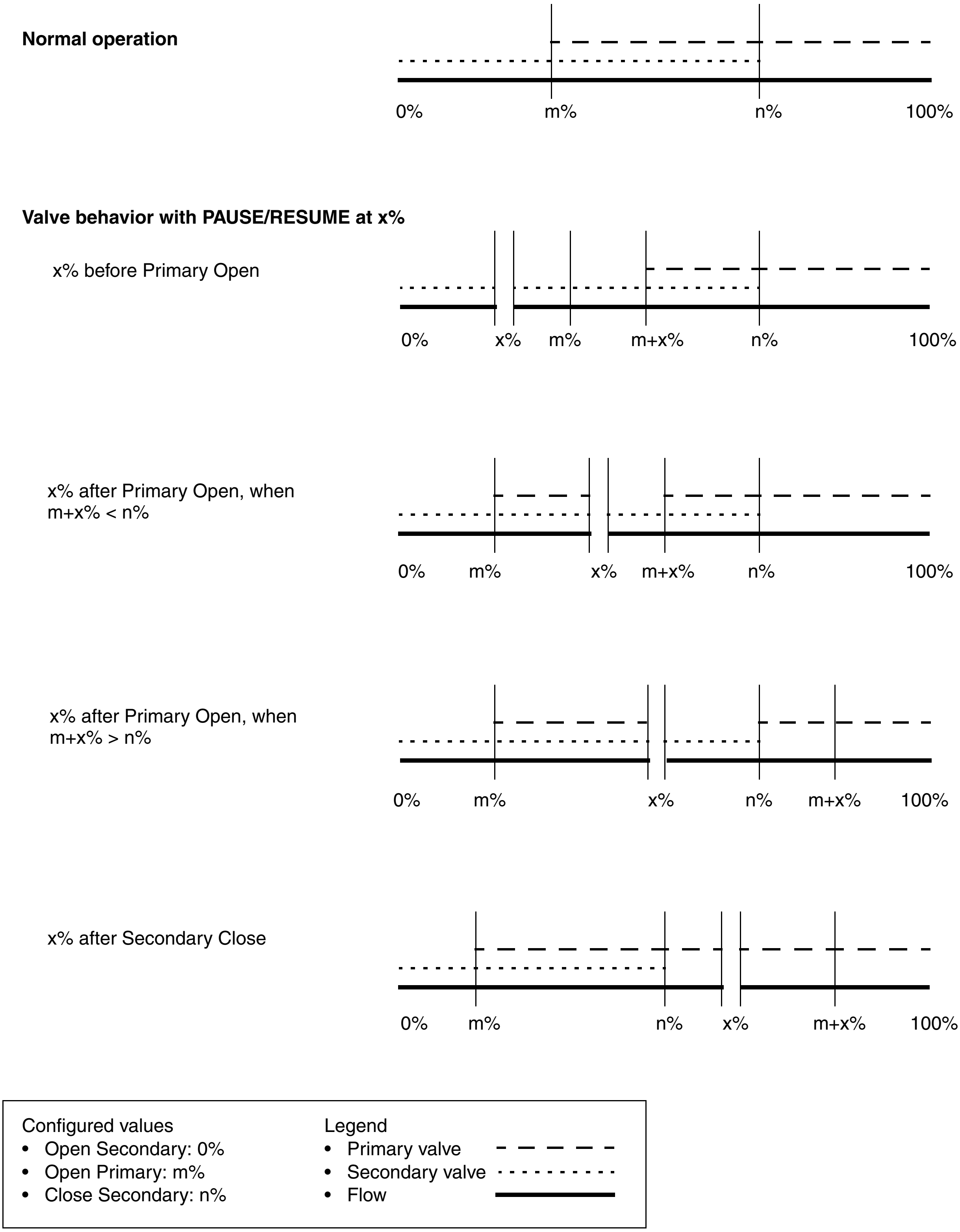
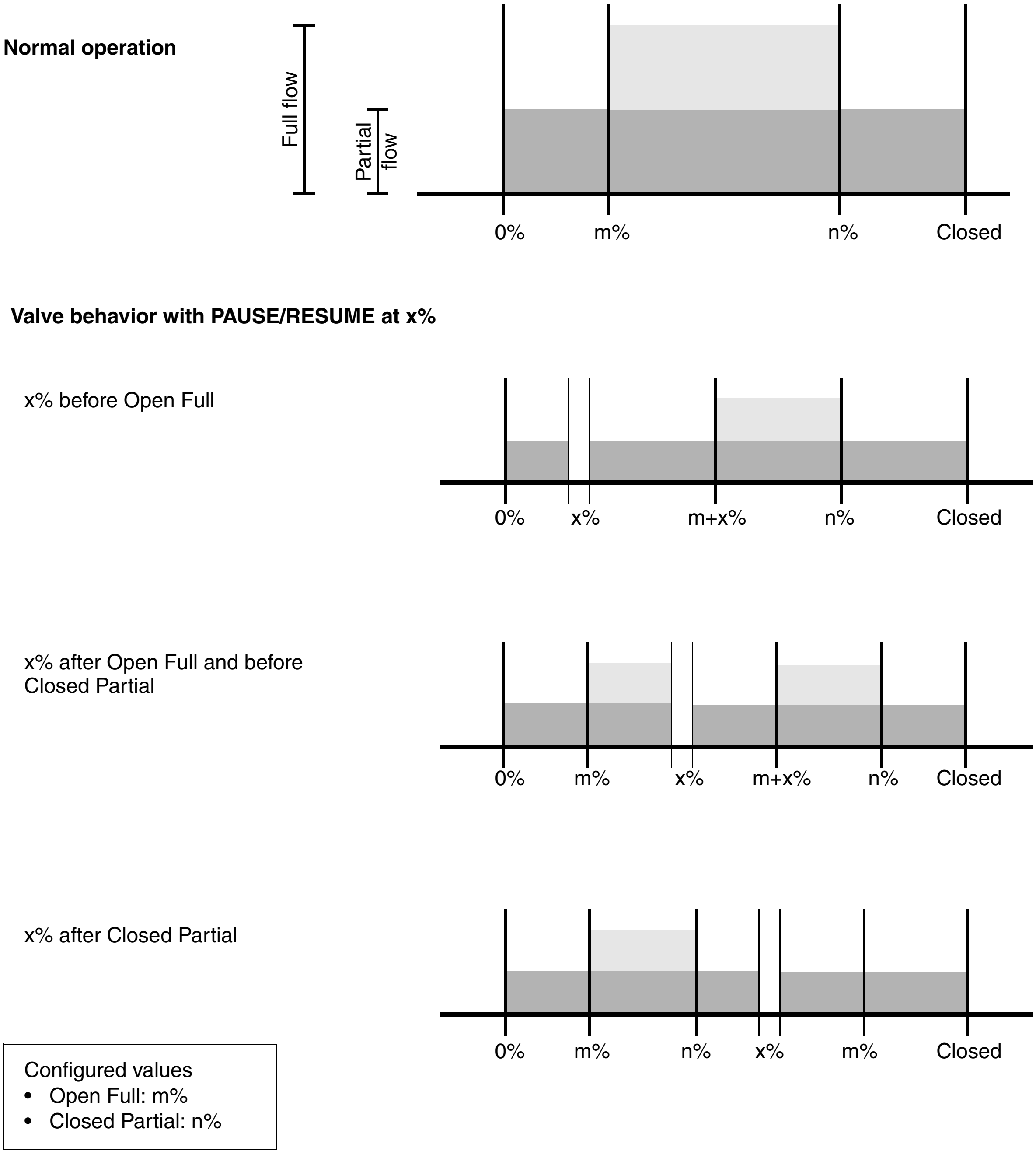


Figure 10-7 Fill sequences: Three-position analog valve



Chapter 11
Troubleshooting

11.1 Overview

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

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

Note: All ProLink II procedures provided in this section assume that your computer is already connected to the transmitter and you have established communication. All ProLink II procedures also assume that you are complying with all applicable safety requirements. See Chapter 3 for more information.

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.

11.2 Guide to troubleshooting topics

Refer to Table 11-1 for a list of troubleshooting topics discussed in this chapter.

Table 11-1 Troubleshooting topics and locations

Section	Topic
Section 11.4	*Transmitter does not operate*
Section 11.5	*Transmitter does not communicate*
Section 11.6	*Zero or calibration failure*
Section 11.7	*Fault conditions*
Section 11.8	*HART output problems*
Section 11.9	*Milliamp and frequency output problems*
Section 11.10	*Transmitter status LED*
Section 11.11	*Status alarms*
Section 11.12	*Checking process variables*
Section 11.13	*Diagnosing wiring problems*
Section 11.13.1	*Checking the power supply wiring*
Section 11.13.2	*Checking the sensor-to-transmitter wiring*

Table 11-1 Troubleshooting topics and locations *continued*

Section	Topic
Section 11.13.4	*Checking for RF interference*
Section 11.13.5	*Checking the HART communication loop*
Section 11.14	*Checking the communication device*
Section 11.15	*Checking the output wiring and receiving device*
Section 11.16	*Checking slug flow*
Section 11.17	*Checking output saturation*
Section 11.18	*Setting the HART polling address to zero*
Section 11.19	*Checking the flow measurement unit*
Section 11.20	*Checking the upper and lower range values*
Section 11.21	*Checking the frequency output scale and method*
Section 11.22	*Checking the calibration*
Section 11.23	*Checking the test points*
Section 11.24	*Checking the sensor*

11.3 Micro Motion customer service

To speak to a customer service representative, contact the Micro Motion Customer Service Department.

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.

11.4 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 11.13.

If the procedures do not indicate a problem with the electrical connections, contact the Micro Motion Customer Service Department.

11.5 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 11.13.5.

11.6 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 11.11 for specific remedies for status alarms indicating calibration failure.

11.7 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 11.11.

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

(LF-Series field-mount 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 7.5.

11.8 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 11.3.

11.9 Milliamp and frequency output problems

If you are experiencing problems with the mA or frequency outputs, use Table 11-2 to identify an appropriate remedy.

Table 11-2 Milliamp and frequency output 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 11.13.1.
	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 6.4.4 to check the mA fault indicator, or Section 6.5.6 to check the frequency fault indicator. If a fault condition is present, see Section 11.7.
	Channel not configured for desired output (CIO transmitters, Channel B or C only)	Verify channel configuration for associated output terminals.
mA output < 4 mA	Process condition below LRV	Verify process. Change the LRV. See Section 6.4.2.
	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 6.4.4. If a fault condition is present, see Section 11.7.
	Open in wiring	Verify all connections.
	Bad mA receiving device	Check the mA receiving device or try another mA receiving device. See Section 11.15.
	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.

Table 11-2 Milliamp and frequency output problems and remedies *continued*

Symptom	Possible cause	Possible remedy
No frequency output	Process condition below cutoff	Verify process. Change the cutoff. See Section 8.5.
	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 6.5.6. If a fault condition is present, see Section 11.7.
	Slug flow	See Section 11.16.
	Flow in reverse direction from configured flow direction parameter	Verify process. Check flow direction parameter. See Section 8.8. 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 11.15.
	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 Section 6.2).
	Incorrect pulse width configuration	Verify pulse width setting. See Section 6.5.3.
Constant mA output	Non-zero HART address (multi-drop communications) (primary mA output only)	Set HART address to zero. See Section 11.18.
	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 8.15.5.
	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 6.4.4. If a fault condition is present, see Section 11.7.
	LRV and URV not set correctly	Check the LRV and URV. See Section 11.20.
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 11.19.
	Incorrect process variable configured	Verify process variable assigned to mA output. See Section 6.4.1.
	LRV and URV not set correctly	Check the LRV and URV. See Section 11.20.
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).

Table 11-2 Milliamp and frequency output problems and remedies *continued*

Symptom	Possible cause	Possible remedy
Consistently incorrect frequency measurement	Output not scaled correctly	Check frequency output scale and method. See Section 11.21. 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 11.19.
Erratic frequency measurement	RF (radio frequency) interference from environment	See Section 11.13.4.
Cannot zero with Zero button (DIN transmitters only)	Not pressing Zero button for sufficient interval	Button must be depressed for .5 seconds to be recognized. Depress button until LED starts to flash yellow, then release button.
	Sensor in fault mode	Correct sensor faults and retry.
Cannot connect to terminals 33 & 34 in service port mode (DIN 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 DIN 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 (DIN 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.
FO phase on Channel C does not change with flow direction (CIO 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 (CIO transmitters only)	Possible internal/external power configuration error	Internal means that the transmitter will supply power to the terminals. External means that an external pull-up resistor and power source are required. Verify configuration setting is correct for desired application.
Cannot configure Channel B for DO1 operation (CIO 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 (CIO 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.

11.10 Transmitter status LED

All LF-Series DIN transmitters and LF-Series FM transmitters with displays have a status LED that shows transmitter status. LF-Series FM transmitters without displays do not have a status LED.

11.10.1 DIN rail mount transmitters

Table 11-3 shows the different transmitter states that can be indicated by the status LED.

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 11.11).
3. Correct the condition.

Table 11-3 DIN rail mount 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

11.10.2 Field-mount transmitters with displays

Table 11-4 shows the different transmitter states that can be indicated by the status LED.

If the status LED indicates an alarm condition:

1. View the alarm code using the procedures described in Section 7.4.
2. Identify the alarm (see Section 11.11).
3. Correct the condition.
4. If required, acknowledge the alarm using the procedures described in Section 7.5.

Table 11-4 FM 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 access to the alarm menu from the display has been disabled, it is not necessary to acknowledge alarms. In this case, the status LED will never flash. See Section 8.14.1 for information about enabling and disabling this display function.*

11.11 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 11-5.

Table 11-5 Status alarms and remedies

Alarm code	Communicator	ProLink II software	Possible remedy
A1	EEPROM Checksum—Core Processor	EEPROM Checksum	Cycle power to the flowmeter.
			The flowmeter might need service. Contact Micro Motion.
A2	RAM Error—Core Processor	RAM Error	Cycle power to the flowmeter.
			The flowmeter might need service. Contact Micro Motion.
A3	Sensor failure	Sensor Failure	Check the test points. See Section 11.23.
			Check wiring to sensor. See Section 11.13.2.
			Check for slug flow. See Section 11.16.
A4	Temperature out of range	Temperature Overrange	Check the test points. See Section 11.23.
			Check wiring to sensor. See Section 11.13.2.
			Verify that process temperature is within range of sensor and transmitter.
			Contact Micro Motion.
A5	Input over range	Input Overrange	Check the test points. See Section 11.23.
			Verify process.
			Make sure that the appropriate measurement unit is configured. See Section 11.19.
			Verify 4 mA and 20 mA values. See Section 11.20.
			Re-zero the transmitter.
A6	Field device not characterized	Not Configured	Contact Micro Motion.
A7	Real time interrupt failure	RTI Failure	Cycle power to the flowmeter.
			The flowmeter might need service. Contact Micro Motion.
A8	Density outside limits	Density Overrange	Check the test points. See Section 11.23.
			Verify process. Check for air in the flow tubes, tubes not filled, foreign material in tubes, or coating in tubes.
			Perform density calibration. See Section C.3.
A9	Field device warming up	Transmitter Initializing	Allow the flowmeter to warm up. The error should disappear once the flowmeter is ready for normal operation. If alarm does not clear, make sure that the sensor is completely full or completely empty. Verify sensor configuration and wiring to sensor.
A10	Calibration failed	Calibration Failure	If alarm appears during a transmitter zero, ensure that there is no flow through the sensor, then retry.
			Cycle power to the flowmeter, then retry.
A11	Excess calibration correction, zero too low	Zero too Low	Ensure that there is no flow through the sensor, then retry.
			Cycle power to the flowmeter, then retry.
A12	Excess calibration correction, zero too high	Zero too High	Ensure that there is no flow through the sensor, then retry.
			Cycle power to the flowmeter, then retry.

Table 11-5 **Status alarms and remedies** *continued*

Alarm code	Communicator	ProLink II software	Possible remedy
A13	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 flowmeter, then retry. See Section 11.22.
A14	Electronics failure	Transmitter Fail	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion.
A15	Data Loss Possible	Data Loss Possible	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion.
A16	Line RTD Overrange	Line Temp Out-of-range	Check the test points. See Section 11.23.
			Check wiring to sensor. See Section 11.13.2.
			Contact Micro Motion.
A17	Meter RTD Overrange	Meter Temp Out-of-Range	Check the test points. See Section 11.23.
			Contact Micro Motion.
A18	EEPROM Checksum—1000/2000	EEPROM Checksum	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion.
A19	RAM Error—1000/2000	RAM Error	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion.
A20	Calibration Factor Unentered (Flocal)	Cal Factor Unentered	Contact Micro Motion.
A21	Unrecognized/ Unentered Sensor Type (K1)	Incorrect Sensor Type	Contact Micro Motion.
A22	EEPROM Config Corrupt–Core Processor	Configuration Corrupt	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion.
A23	EEPROM Totals Corrupt–Core Processor	Totals Corrupt	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion.
A24	EEPROM Program Corrupt–Core Processor	CP Program Corrupt	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion.
A25	Core Processor Boot Sector Fault	Boot Sector Fault	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion.

Table 11-5 Status alarms and remedies *continued*

Alarm code	Communicator	ProLink II software	Possible remedy
A26	Sensor/Xmtr Communication Error	Sensor/Transmitter Comm Failure	Check the wiring between the transmitter and the sensor (see Section 11.13.2). The wires may be swapped. After swapping wires, cycle power to the flowmeter.
			Check for noise in wiring or transmitter environment.
			Check the sensor LED. See Section 11.24.
			Check that the sensor is receiving power. See Section 11.13.1.
			Perform the sensor resistance test. See Section 11.24.2.
A28	Xmtr Write Error	Core processor write failure	Cycle power to the flowmeter.
			The transmitter might need service or upgrading. Contact Micro Motion.
A100	Analog output 1 saturated	Analog 1 Saturated	See Section 11.17.
A101	Analog output 1 fixed	Analog 1 Fixed	Check the HART polling address. See Section 11.18.
			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	Drive Overrange	Excessive drive gain. See Section 11.23.3.
A103	Data loss possible	Data Loss Possible	Cycle power to the flowmeter.
			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.
A104	Calibration in progress	Calibration in Progress	Allow the flowmeter to complete calibration.
A105	Slug flow	Slug Flow	See Section 11.16.
A106	Burst mode enabled	Burst Mode	No action required.
A107	Power reset occurred	Power Reset	No action required.
A108	Event 1 triggered	Event 1 On	Be advised of alarm condition.
			If you believe the event has been triggered erroneously, verify the Event 1 settings. See Section 8.9.
A109	Event 2 triggered	Event 2 On	Be advised of alarm condition.
			If you believe the event has been triggered erroneously, verify the Event 2 settings. See Section 8.9.
A110	Frequency over range	Frequency Saturated	See Section 11.17.
A111	Freq output fixed	Frequency Output Fixed	Exit frequency output loop test.
A112	Series 1000/2000 software upgrade recommended	NA	Contact Micro Motion to get a transmitter software upgrade. Note that the device is still functional.
A113	Analog output 2 saturated	Analog 2 Saturated	See Section 11.17.

Table 11-5 Status alarms and remedies *continued*

Alarm code	Communicator	ProLink II software	Possible remedy
A114	Analog output 2 fixed	Analog 2 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.
A118	Discrete output 1 fixed	DO1 Fixed	Exit discrete output loop test. See Section 5.3.
A119	Discrete output 2 fixed	DO2 Fixed	Exit discrete output loop test. See Section 5.3.
A120	Bad fit data fault.	Bad fit data fault	Verify enhanced density configuration.
A121	Extrapolation warning	Extrapolation warning	Verify process temperature.
			Verify process density.
			Verify enhanced density configuration.
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 fluid is flowing in reverse direction.

11.12 Checking process variables

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

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

For troubleshooting, check the process variables under both normal flow and tubes-full no-flow conditions. Except for flow rate, you should see little or no change between flow and no-flow conditions. If you see a significant difference, record the values and contact the Micro Motion Customer Service Department for assistance. See Section 11.3.

Unusual values for process variables may indicate a variety of different problems. Table 11-6 lists several possible problems and remedies.

Table 11-6 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 flowmeter. See Section 5.5.
Erratic non-zero flow rate under no-flow conditions	RF interference	Check environment for RF interference. See Section 11.13.4.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact.
	Vibration in pipeline at rate close to sensor tube frequency	Check environment and remove source of vibration.
	Leaking valve or seal	Check pipeline.
	Inappropriate measurement unit	Check configuration. See Section 11.19.
	Inappropriate damping value	Check configuration. See Section 6.4.5 and Section 8.6.
	Slug flow	See Section 11.16.
	Mounting stress on sensor	Check sensor mounting. Ensure: • Sensor is not being used to support pipe. • Sensor is not being used to correct pipe misalignment. • Sensor is not too heavy for pipe.
	Sensor cross-talk	Check environment for sensor with similar (±0.5 Hz) tube frequency.
Erratic non-zero flow rate when flow is steady	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 11.19.
	Inappropriate damping value	Check configuration. See Section 6.4.5 and Section 8.6.
	Excessive or erratic drive gain	See Section 11.23.3 and Section 11.23.4.
	Slug flow	See Section 11.16.
	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes or replace sensor.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact.

Table 11-6 Process variables problems and possible remedies *continued*

Symptom	Cause	Possible remedy
Inaccurate flow rate or batch total	Inappropriate measurement unit	Check configuration. See Section 11.19.
	Bad sensor zero	Rezero the flowmeter. See Section 5.5.
	Bad density calibration factors	Contact Micro Motion.
	Bad flowmeter grounding	See Section 11.13.3.
	Slug flow	See Section 11.16.
	Problem with receiving device	See Section 11.15.
	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.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact.
	Bad flowmeter grounding	See Section 11.13.3.
	Slug flow	See Section 11.16.
	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 sensor.
Temperature reading significantly different from process temperature	RTD failure	Check for alarm conditions and follow troubleshooting procedure for indicated alarm.
	Incorrect temperature calibration factor	Verify that the temp cal factor is set to default value. See Table A-1.
Temperature reading slightly different from process temperature	Temperature calibration required	Perform temperature calibration. See Section C.4.
Unusually high density reading	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes or replace sensor.
	Incorrect K2 value	Contact Micro Motion.
Unusually low density reading	Slug flow	See Section 11.16.
	Incorrect K2 value	Contact Micro Motion.
Unusually high tube frequency	Sensor erosion	Contact Micro Motion.
Unusually low tube frequency	Plugged flow tube	Purge the flow tubes or replace sensor.
Unusually low pickoff voltages	Several possible causes	See Section 11.23.5.
Unusually high drive gain	Several possible causes	See Section 11.23.3.

11.13 Diagnosing wiring problems

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

Removing the wiring compartment covers in explosive atmospheres while the power is on can cause an explosion. Before removing the wiring compartment cover in explosive atmospheres, shut off the power and wait five minutes.

11.13.1 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. (Field-mount 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.

11.13.2 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.

11.13.3 Checking grounding

The sensor and the transmitter must be grounded. The transmitter is grounded via the shielded cable between the sensor and the transmitter. The sensor mounting plate must be grounded to earth. See the installation manual.

11.13.4 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.

11.13.5 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 ohm resistor across the primary mA 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.
- 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.

11.14 Checking the communication device

Ensure that your communication device is compatible with your transmitter.

Communicator

The 375 Field Communicator is required, and must contain the appropriate device description. The LF-Series transmitters use the Model 1500/1700/2500/2700 device descriptions. See Chapter 4 for more information.

ProLink II

ProLink II v2.0 or later is required for most LF-Series transmitters. Some LF-Series models require later versions of ProLink II.

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.

11.15 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.

11.16 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/cm³. 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 8.10).
- If desired, increase slug duration (see Section 8.10).

11.17 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 or replace sensor.
- For the mA outputs, change the mA URV and LRV (see Section 6.4.2).
- For the frequency output, change the scaling (see Section 6.5).

11.18 Setting the HART polling address to zero

If the transmitter's HART polling address is set to a nonzero number, the primary mA output is 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.

If the HART address is set to zero, the primary mA output will report the primary variable on a 4–20 mA scale.

See Section 8.15.2.

11.19 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 6.3.

11.20 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 6.4.2.

11.21 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 6.5.

11.22 Checking the calibration

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

Micro Motion calibrates every transmitter at the factory. Therefore, you should suspect improper calibration only if the transmitter has been calibrated after it was shipped from the factory.

The calibration procedures in this manual are designed for calibration to a regulatory standard. See Appendix C. To calibrate for true accuracy, always use a measurement source that is more accurate than the flowmeter. 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 flowmeter. For information on meter factors, see Section 8.13.

11.23 Checking the test points

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

11.23.1 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.

11.23.2 Evaluating the test points

Use the following guidelines to evaluate the test points:

- If the drive gain is unstable, refer to Section 11.23.3.
- The pickoff value for LF-Series sensors is 800 mV peak-to-peak.
  - If the value for the left or right pickoff does not match this value, refer to Section 11.23.5.
  - If the pickoff values match this value, record your troubleshooting data and contact the Micro Motion Customer Service Department for assistance.

11.23.3 Excessive drive gain

Excessive drive gain can be caused by several problems. See Table 11-7.

Table 11-7 Excessive drive gain causes and remedies

Cause	Possible remedy
Excessive slug flow	See Section 11.16.
Plugged flow tube	Purge the flow tubes or replace 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.
Mechanical binding at sensor	Ensure sensor is free to vibrate.
Open drive or left pickoff sensor coil	Contact Micro Motion.
Flow rate out of range	Ensure that flow rate is within sensor limits.

11.23.4 Erratic drive gain

Erratic drive gain can be caused by several problems. See Table 11-8.

Table 11-8 Erratic drive gain causes and remedies

Cause	Possible remedy
Polarity of pick-off reversed or polarity of drive reversed	Contact Micro Motion.
Slug flow	See Section 11.16.
Foreign material caught in flow tubes	Purge flow tubes or replace sensor.

11.23.5 Low pickoff voltage

Low pickoff voltage can be caused by several problems. See Table 11-9.

Table 11-9 Low pickoff voltage causes and remedies

Cause	Possible remedy
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 11.16.
No tube vibration in sensor	Check for plugging.
	Ensure sensor is free to vibrate (no mechanical binding).
	Verify wiring.
The sensor is damaged	Contact Micro Motion.

11.24 Checking the sensor

Two sensor procedures are available:

- You can check the sensor LED. The sensor has an LED that indicates different flowmeter conditions. See Table 11-10.
- You can perform the sensor resistance test to check for a damaged sensor.

11.24.1 Checking the sensor LED

To check the sensor LED:

1. Maintain power to the transmitter.
2. Check the sensor LED against the conditions described in Table 11-10. The sensor LED is on the top of the LF-Series device.

Table 11-10 Sensor LED behavior, flowmeter conditions, and remedies

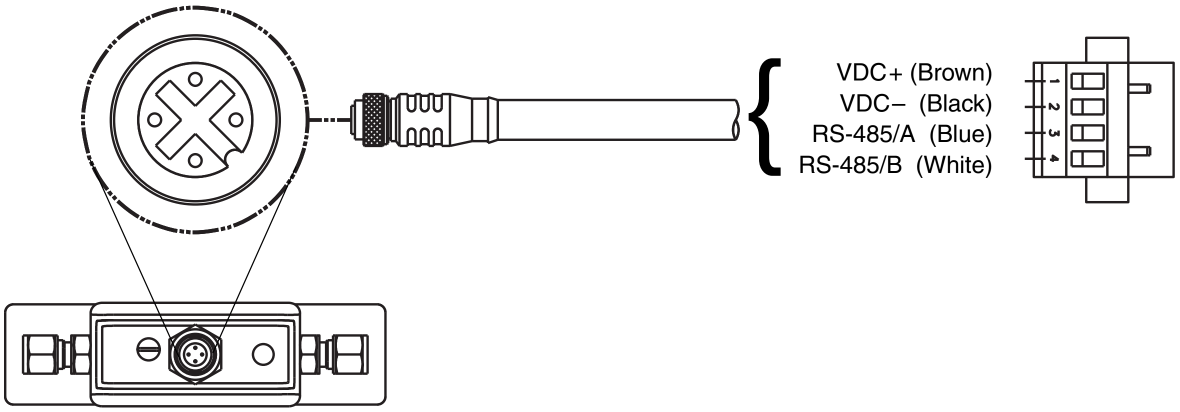
LED behavior	Condition	Possible remedy
1 flash per second (ON 25%, OFF 75%)	Normal operation	No action required.
1 flash per second (ON 75%, OFF 25%)	Slug flow	See Section 11.16.
Solid ON	Zero or calibration in progress	If calibration is in progress, no action required. If no calibration is in progress, contact Micro Motion.
	Sensor receiving between 11.5 and 5 volts	Check power supply to transmitter. See Section 11.13.1, and refer to Appendix B for diagrams.
4 flashes per second	Fault condition	Check alarm status.
OFF	Sensor receiving less than 5 volts	• Verify power supply wiring to sensor. 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 sensor. Normal reading is approximately 14 VDC. If reading is normal, internal sensor failure is possible. Contact Micro Motion. If reading is 0, internal transmitter failure is possible. Contact Micro Motion. If reading is less than 1 VDC, verify power supply wiring to sensor. Wires may be switched. See Section 11.13.1, and refer to Appendix B for diagrams. • If transmitter status LED is not lit, transmitter is not receiving power. Check power supply. See Section 11.13.1, and refer to Appendix B for diagrams. If power supply is operational, internal transmitter, display, or LED failure is possible. Contact Micro Motion.
	Sensor internal failure	Contact Micro Motion.

11.24.2 Sensor resistance test

To perform the sensor resistance test:

1. At the transmitter, disconnect the 4-wire sensor cable from the mating connector. See Figure 11-1.

Figure 11-1 Sensor resistance test and wire pairs



2. Measure the resistance between the following wire pairs:
   - Blue and white (RS-485/A and RS-485/B). Resistance should be 40 kΩ to 50 kΩ.
   - Black and blue (VDC– and RS-485/A). Resistance should be 20 kΩ to 25 kΩ.
   - Black and white (VDC– and RS-485/B). Resistance should be 20 kΩ to 25 kΩ.
3. If any resistance measurements are lower than specified, the sensor may not be able to communicate with a transmitter. Contact Micro Motion.
4. To return to normal operation, reconnect the 4-wire sensor cable to the mating connector.

Appendix A
Default Values and Ranges

A.1 Overview

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

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

A.2 Most frequently used defaults and ranges

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

Table A-1 Transmitter default values and ranges

Type	Setting	Default	Range	Comments
Flow	Flow direction	Forward		
	Flow damping	0.8 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 or higher.
	Flow calibration factor	1.00005.13		
	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 flowrate.
	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		
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		
Event 1	Variable	Density		
	Type	Low alarm		
	Setpoint	0.0		
	Setpoint units	g/cm^3		
Event 2	Variable	Density		
	Type	Low alarm		
	Setpoint	0.0		
	Setpoint units	g/cm^3		

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

Type	Setting	Default	Range	Comments
Variable mapping	Primary variable	Mass flow		
	Secondary variable	Mass flow • FM AN F • DIN AN Density • FM AN M • FM CIO • DIN CIO		
	Tertiary variable	Mass flow		
	Quaternary variable	Mass flow • FM AN F • DIN AN Volume flow • FM AN M • FM CIO • DIN CIO		
Update Rate	Update rate	Normal	Normal or Special	
Primary mA output	Primary variable	Mass flow		
	LRV	–200.00000 g/s		
	URV	200.00000 g/s		
	AO cutoff	0.00000 g/s		
	AO added damping	0.00000 sec		
	LSL	–200 g/s		Read-only
	USL	200 g/s		Read-only
	MinSpan	0.3 g/s		Read-only
	Fault action	Downscale		
	AO fault level – downscale	2.0 mA	1.0 – 3.6 mA	
	AO fault level – upscale	22 mA	21.0 – 24.0 mA	
	Last measured value timeout	0.00 sec		
Secondary mA output	Secondary variable	Density		
	LRV	0.00000 g/cm^3		
	URV	10.00000 g/cm^3		
	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
	MinSpan	0.05 g/cm^3		Read-only
	Fault action	Downscale		
	AO fault level – downscale	2.0 mA	1.0 – 3.6 mA	
	AO fault level – upscale	22 mA	21.0 – 24.0 mA	

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

Type	Setting	Default	Range	Comments
Frequency output	Tertiary variable	Mass flow		
	Frequency factor	1,000.00 Hz	.00091 – 10,000.00 Hz	
	Rate factor	16,666.66992 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	
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		
	Display totalizer reset	Disabled		
	Display auto scroll	Disabled		
	Display offline menu	Enabled		
	Display offline password	Disabled		
	Display alarm menu	Enabled		
	Display acknowledge all alarms	Enabled		
	Offline password	1234		
	Auto scroll rate	10 sec		
	Display totalizer start/stop	Disabled		

Appendix B
Flowmeter Illustrations

B.1 Overview

This appendix provides illustrations of different flowmeter installations and components, for:

- LF-Series field-mount transmitters
- LF-Series DIN rail mount transmitters

B.2 LF-Series field-mount transmitters

Figure B-1 shows the installation architecture for an LF-Series sensor with an LF-Series field-mount transmitter.

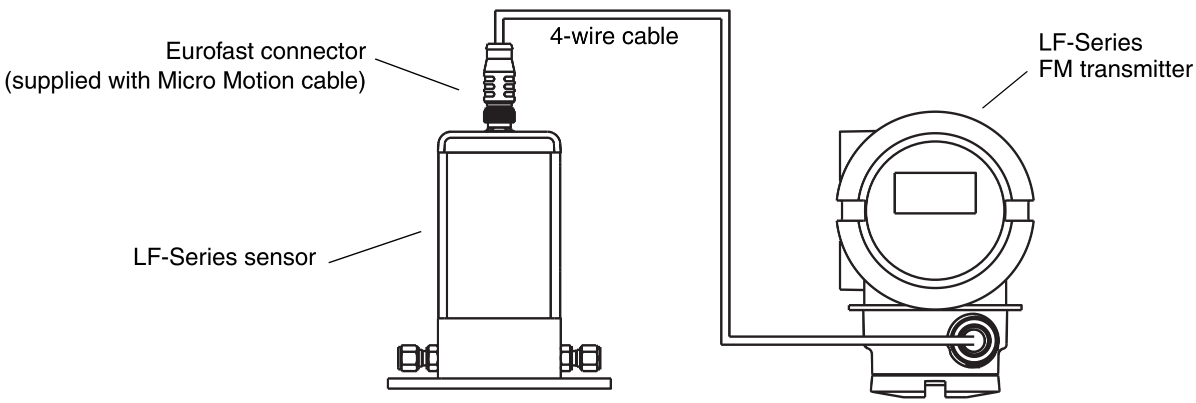
Figure B-2 shows the LF-Series field-mount transmitter components.

A 4-wire cable is used to connect the sensor to the transmitter's mating connector. See Figure B-3.

Figure B-4 shows the transmitter's power supply terminals.

Figure B-5 shows the output terminals for the LF-Series FM transmitter.

Figure B-1 Installation architecture – LF-Series field-mount transmitter



Illustrations
Calibration
Field-Mount AN
Field-Mount CIO

Figure B-2 **Transmitter components, junction end-cap removed**

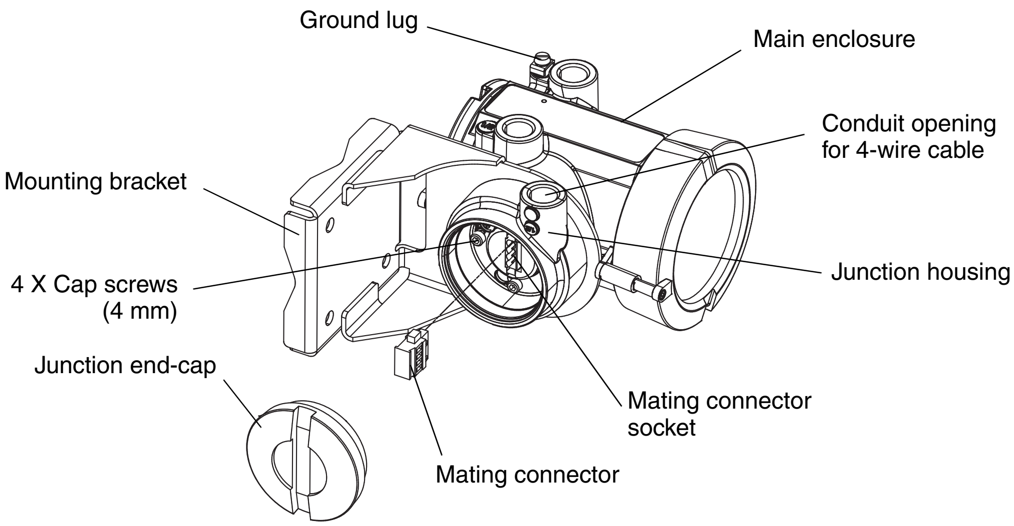
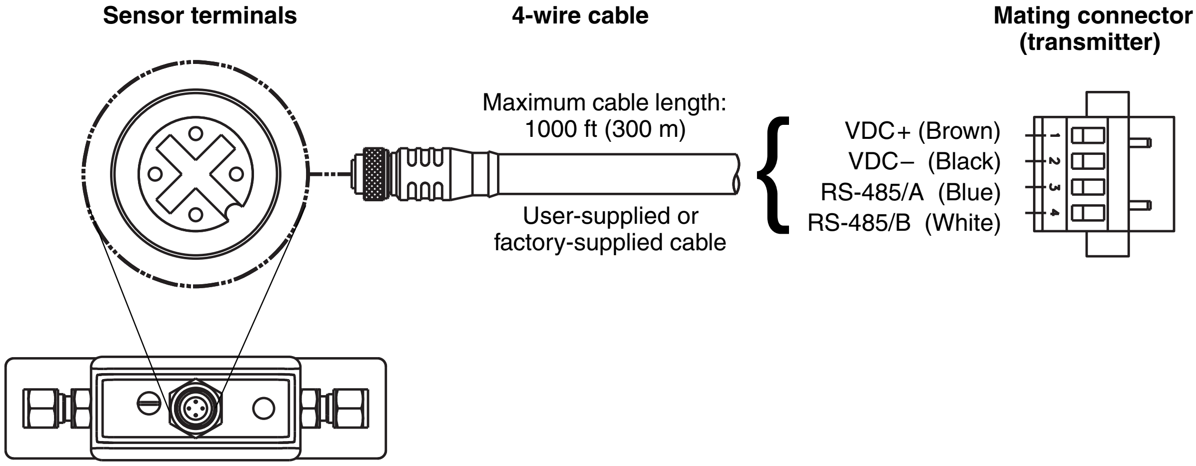


Figure B-3 **4-wire cable between the sensor and the FM transmitter mating connector**



Flowmeter Illustrations

Figure B-4 Power supply terminals – FM transmitter

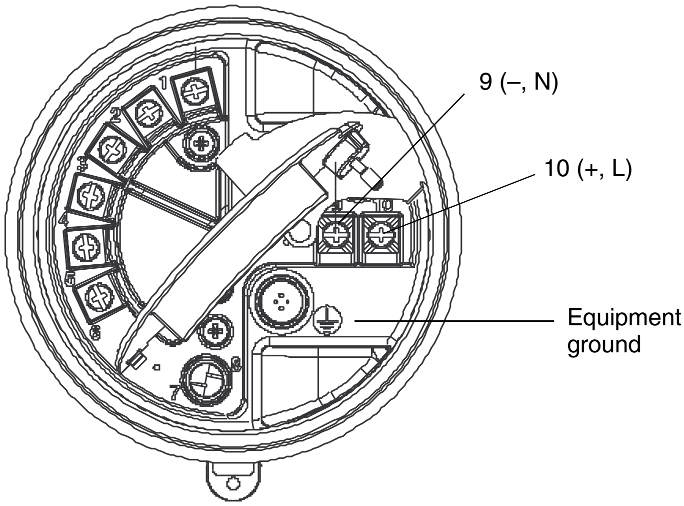
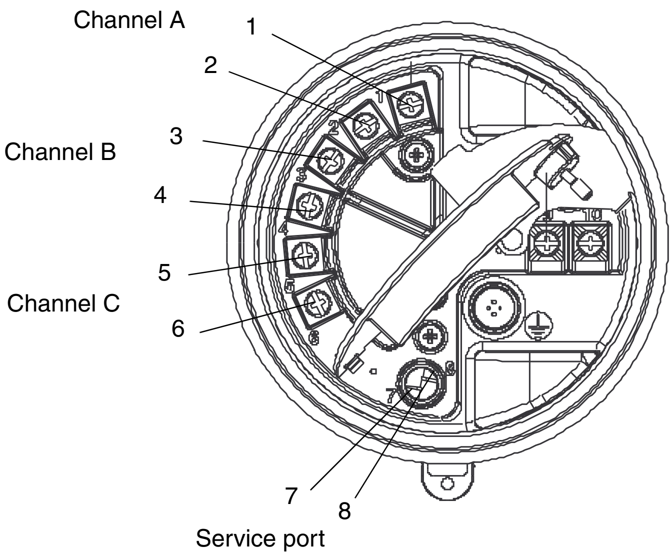


Figure B-5 Output terminals – FM transmitter



B.3 LF-Series DIN rail mount transmitters

Figure B-6 shows the installation architecture for an LF-Series sensor with an LF-Series DIN rail mount transmitter.

A 4-wire cable is used to connect the sensor to the transmitter. See Figure B-7.

Figure B-8 shows the transmitter's power supply terminals.

Figure B-9 shows the output terminals for the DIN AN transmitter.

Figure B-10 shows the output terminals for the DIN CIO transmitter.

Figure B-6 Installation architecture – LF-Series DIN rail mount transmitters

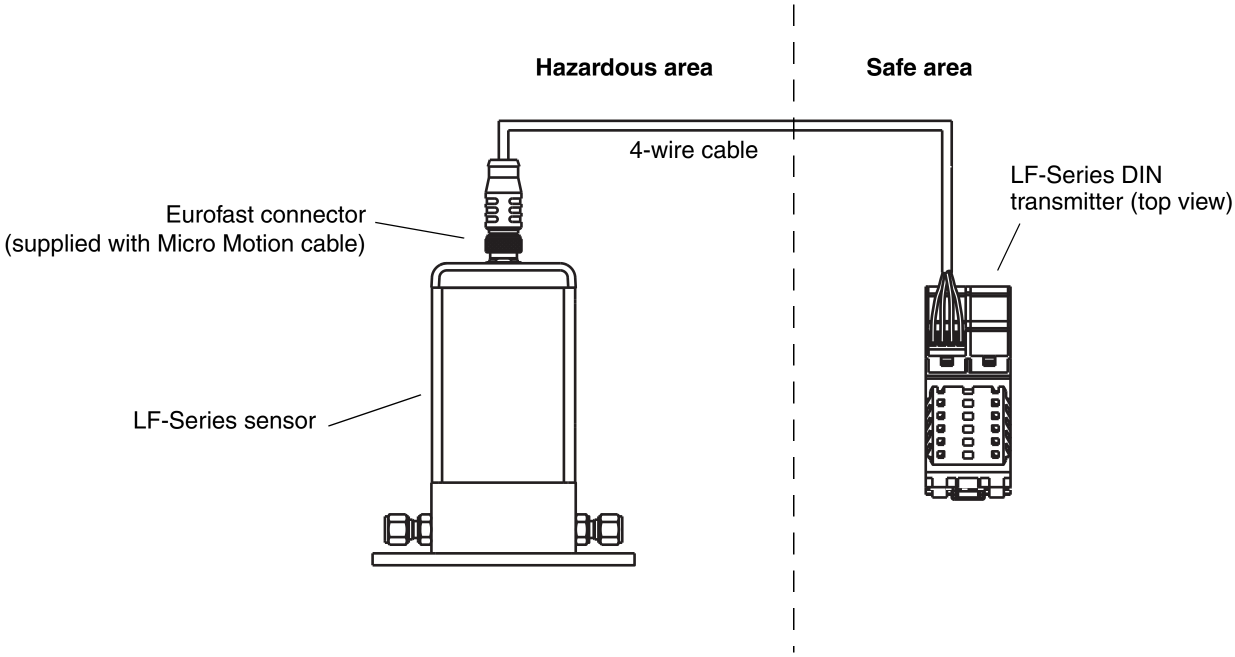


Figure B-7 4-wire cable between LF-Series sensor and LF-Series DIN rail mount transmitter

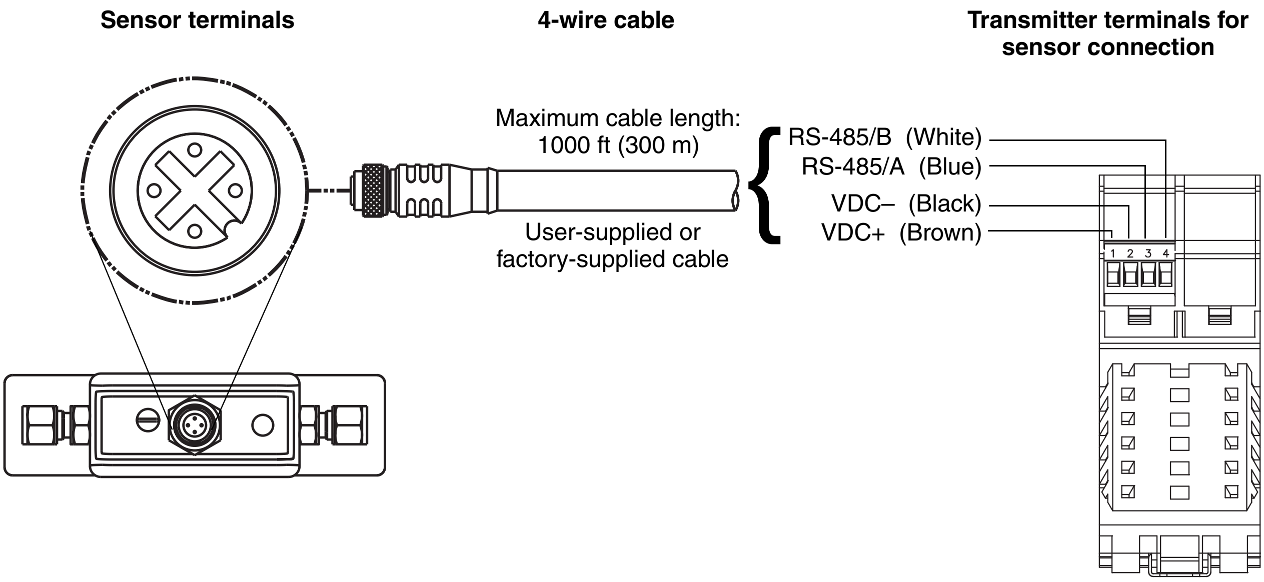


Figure B-8 Power supply terminals – LF-Series DIN rail mount transmitter

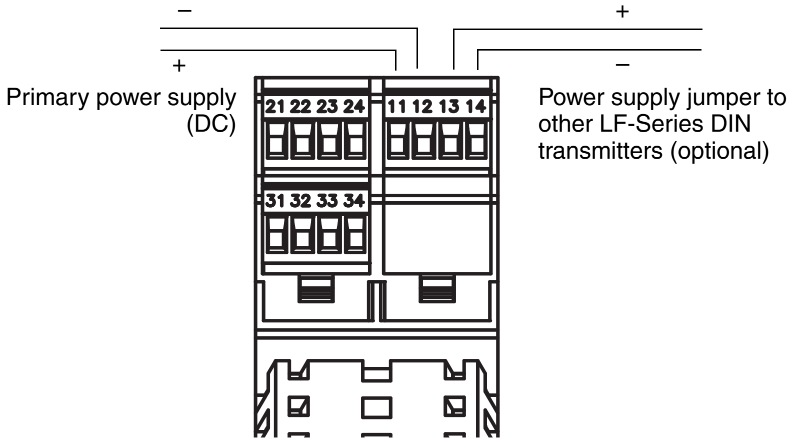
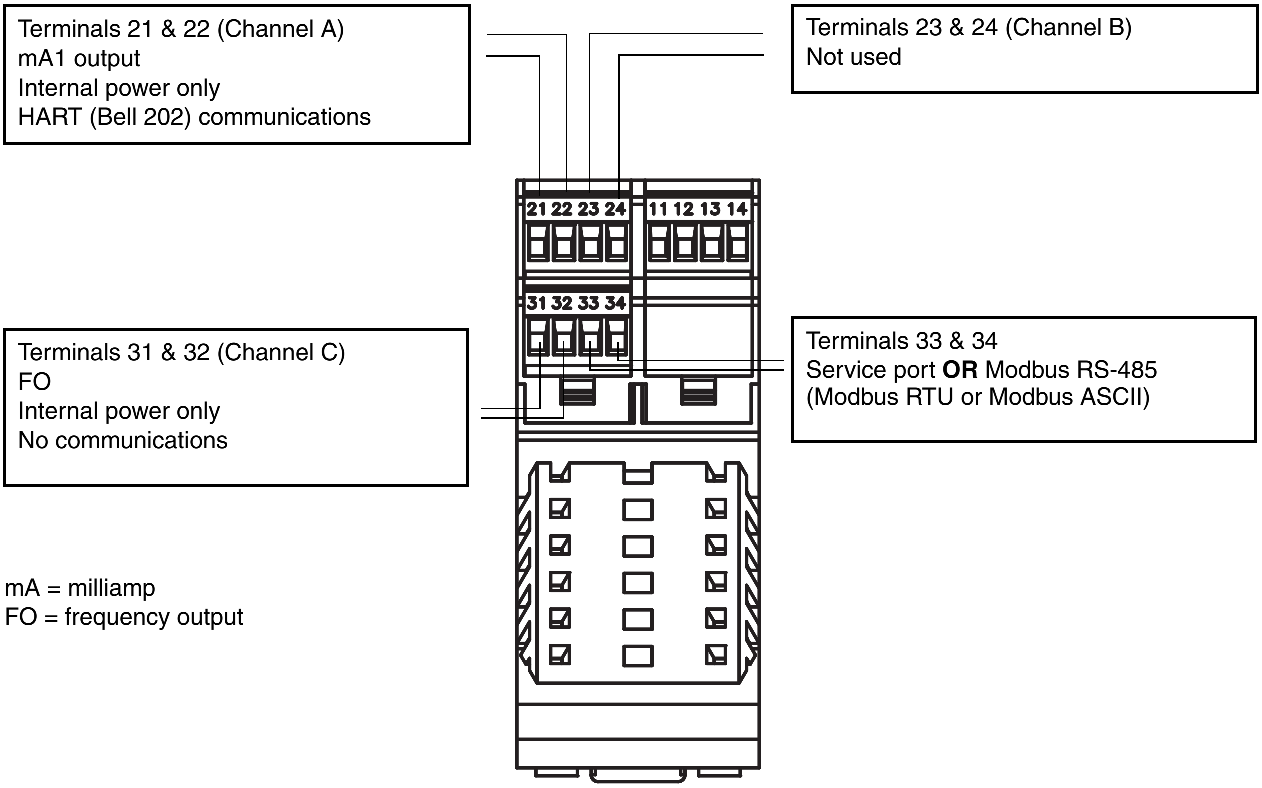
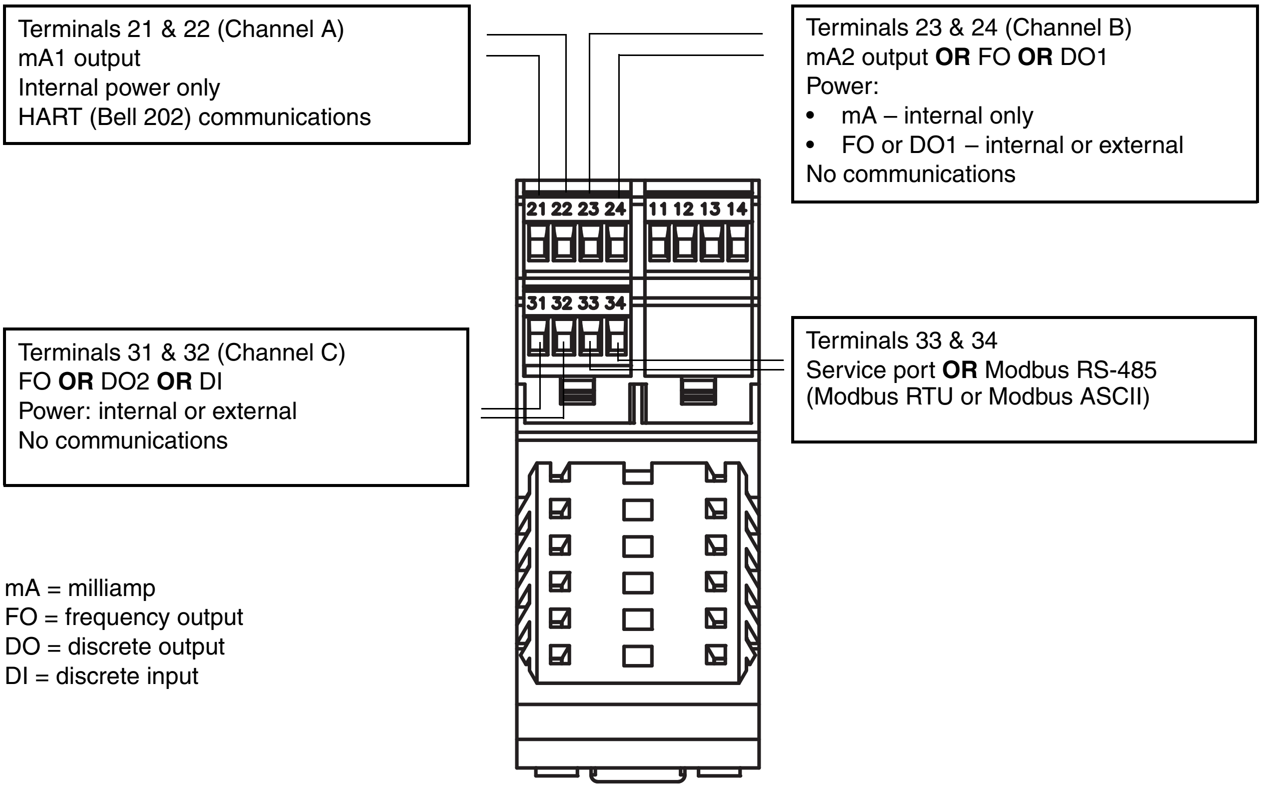


Figure B-9 Terminal configuration – LF-Series DIN AN transmitter



mA = milliamp
FO = frequency output

Figure B-10 Terminal configuration – LF-Series DIN CIO transmitter



Appendix C
Calibrating the Transmitter

C.1 Overview

This section describes transmitter calibration procedures. Using these procedures, you will be able to:

- Calibrate for density
- Calibrate for temperature

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

C.2 About calibration

The flowmeter measures process variables based on fixed points of reference. *Calibration* adjusts those points of reference.

The transmitter is factory calibrated and does not normally need to be calibrated in the field. Calibrate the transmitter only if you must do so to meet regulatory requirements.

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 flowmeter. For information on meter factors, see Section 8.13.

C.3 Density calibration

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

Density calibration includes the following calibration points:

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

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 software or a Communicator.

C.3.1 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.

C.3.2 Density calibration procedures

To perform a D1 and D2 density calibration

- With ProLink II, see Figure C-1.
- With a Communicator, see Figure C-2.

Figure C-1 **D1 and D2 density calibration – ProLink II**

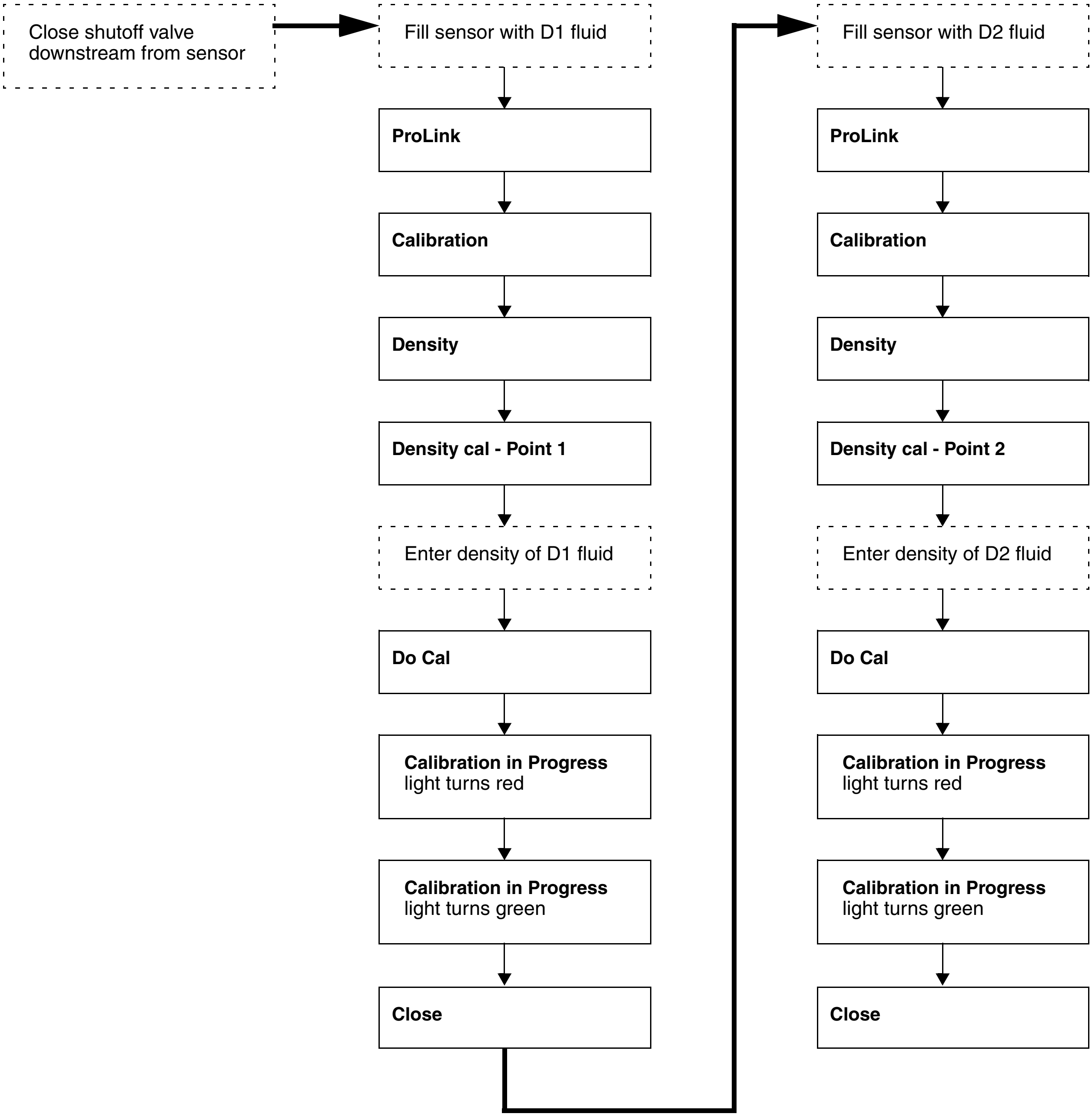
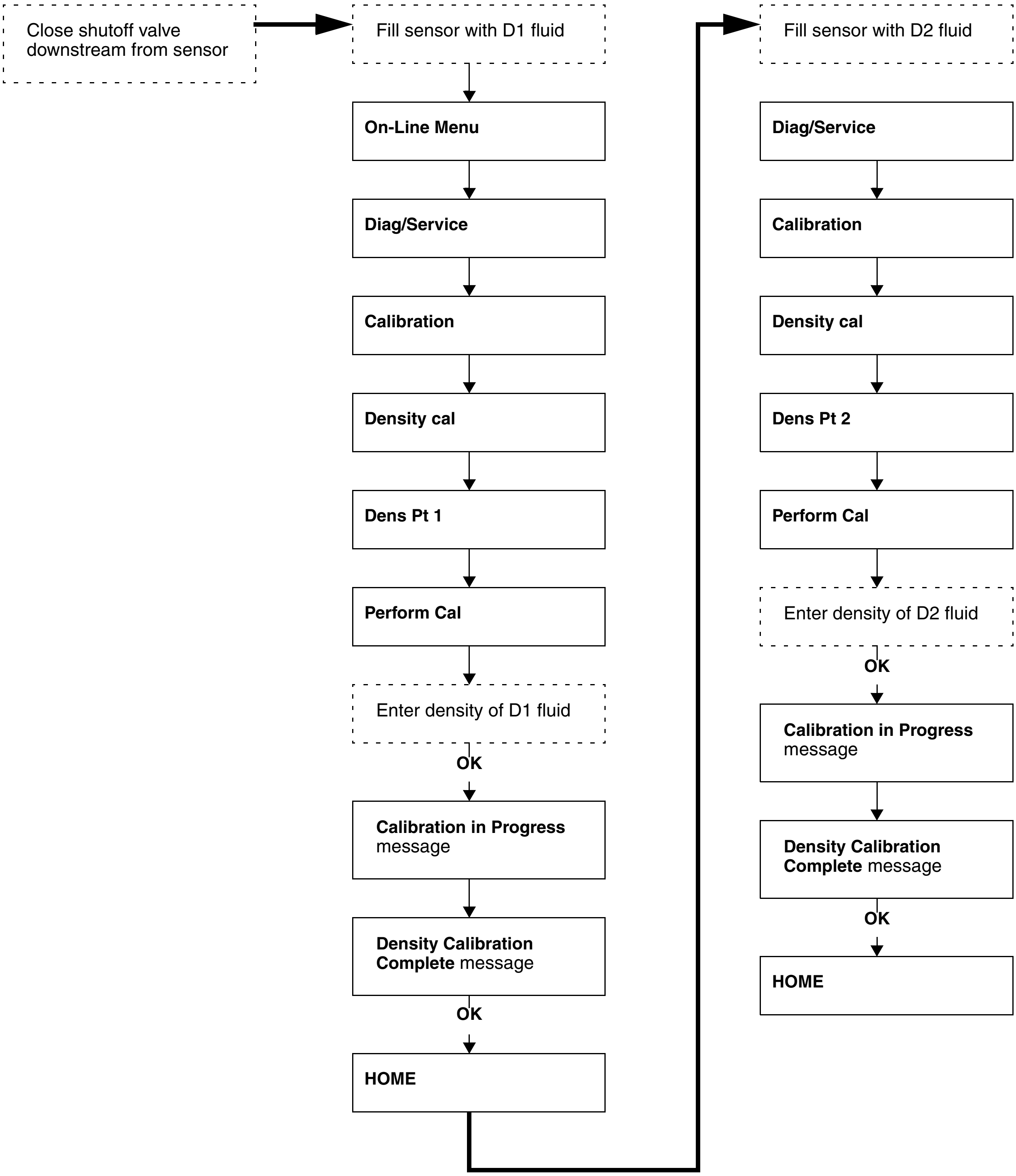


Figure C-2 D1 and D2 density calibration – Communicator



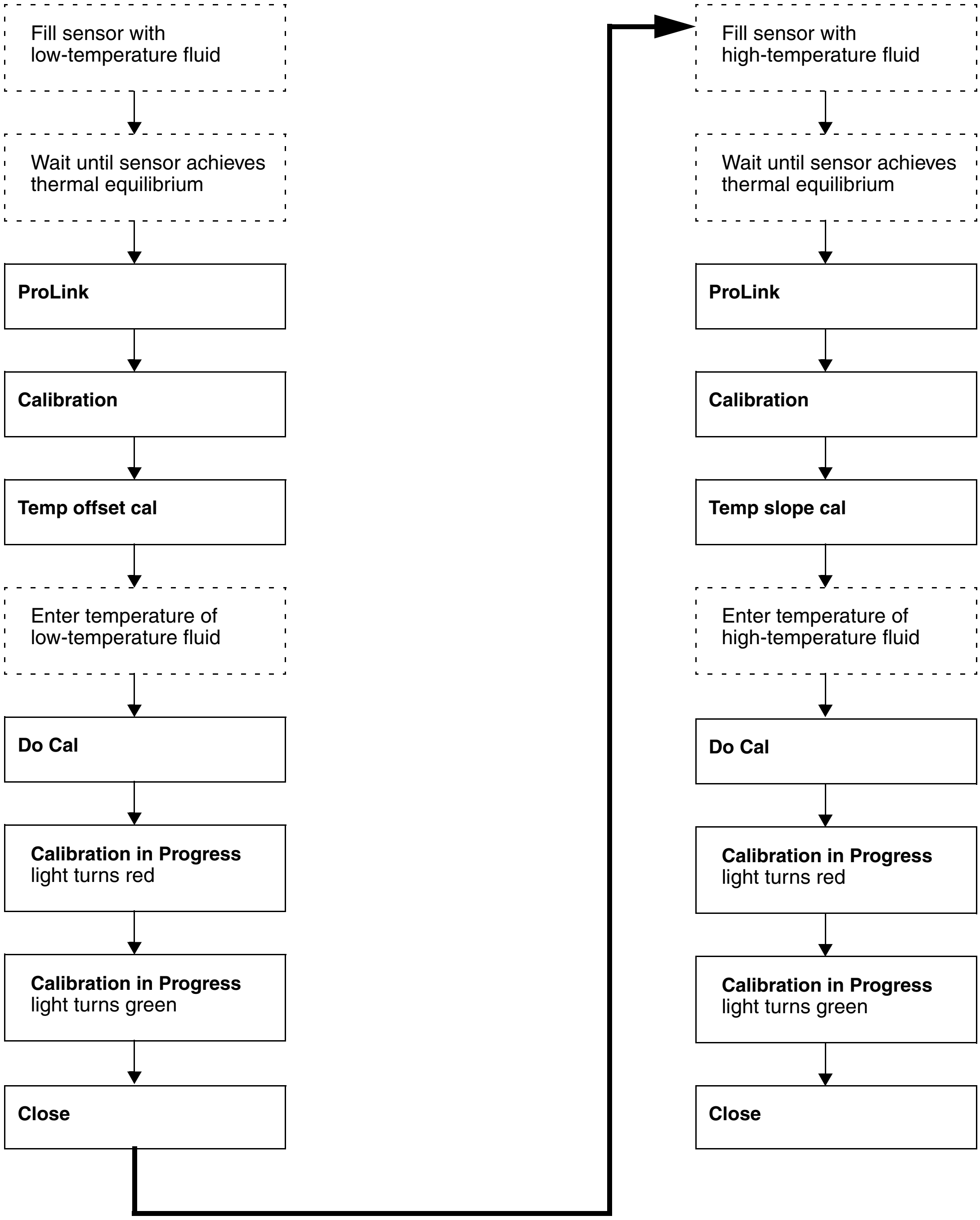
C.4 Temperature calibration

- FM AN F
- FM AN M
- FM CIO
- DIN AN
- DIN CIO
- DIN CIO FD

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 software. See Figure C-3.

Figure C-3 Temperature calibration – ProLink II



Appendix D
Menu Flowcharts – FM AN Transmitters

D.1 Overview

This appendix provides the following menu flowcharts for the LF-Series FM AN transmitter:

- ProLink II menus
  - Configuration menu – see Figures D-1 and D-2
  - Operating menus – see Figure D-3
- Communicator menus – see Figures D-4 through D-8
- Display menus
  - Managing totalizers and inventories – see Figure D-9
  - Off-line maintenance menu: Version information – see Figure D-10
  - Off-line maintenance menu: Configuration – see Figures D-11 and D-12
  - Off-line maintenance menu: Simulation (loop testing) – see Figure D-13
  - Off-line maintenance menu: Zero – see Figure D-14

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

For flowmeter zero, loop testing, and mA output trim procedures, see Chapter 5.

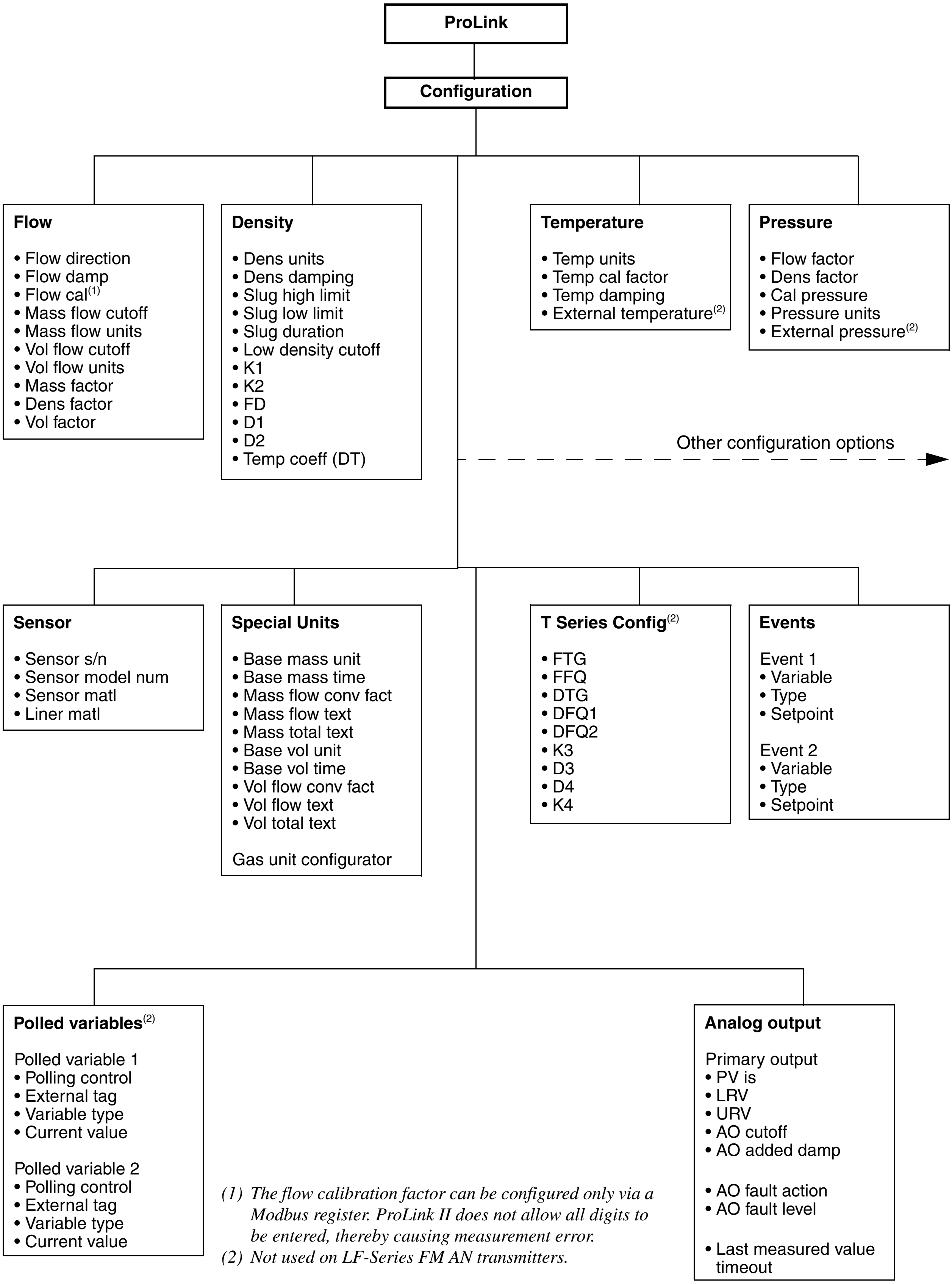
D.2 Version information

These menu flowcharts are based on:

- Transmitter software v3.7
- Sensor software v2.1
- ProLink II v2.1
- 275 HART Communicator device rev3, DD rev1

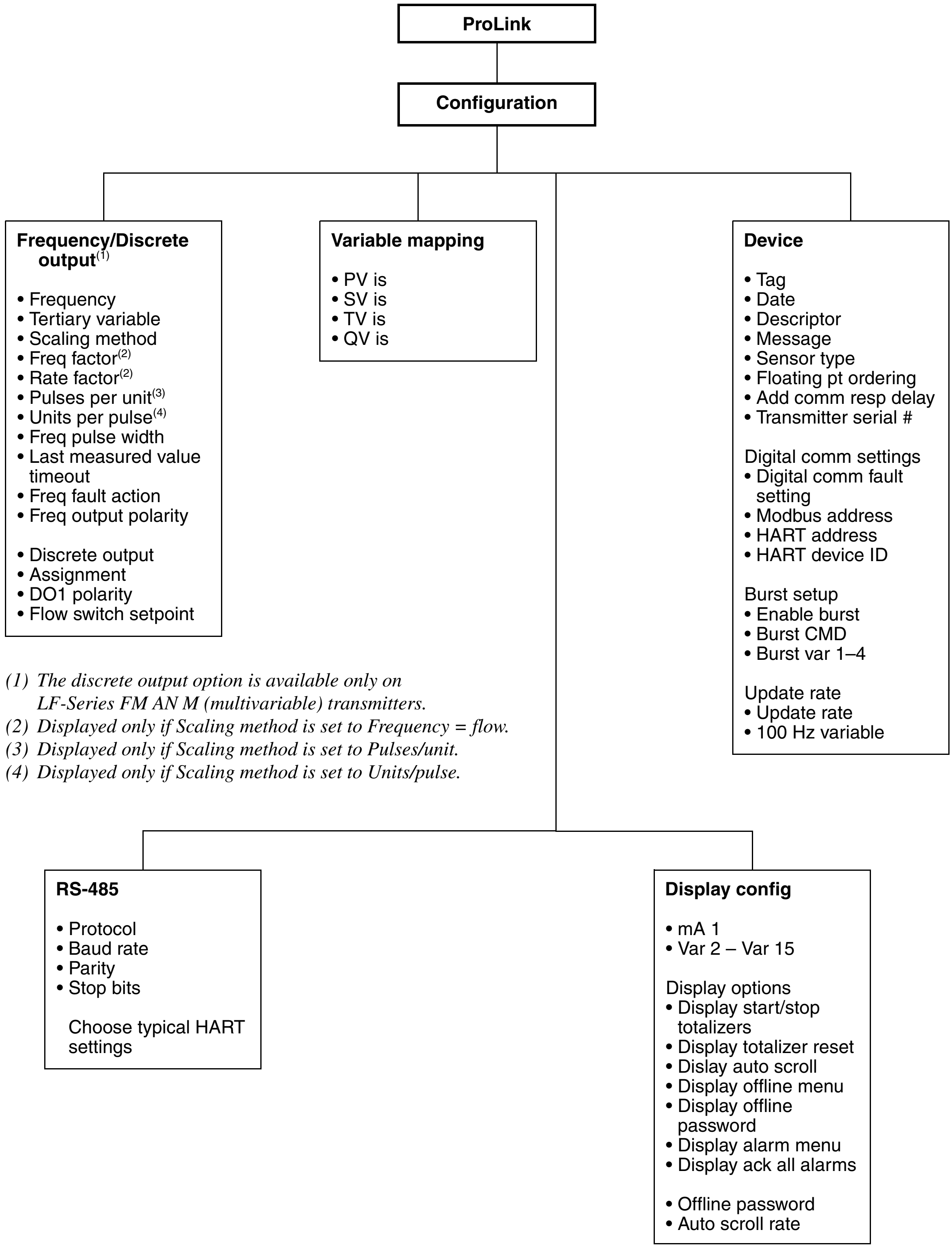
Menus may vary slightly for different versions of these components.

Figure D-1 ProLink II configuration menu



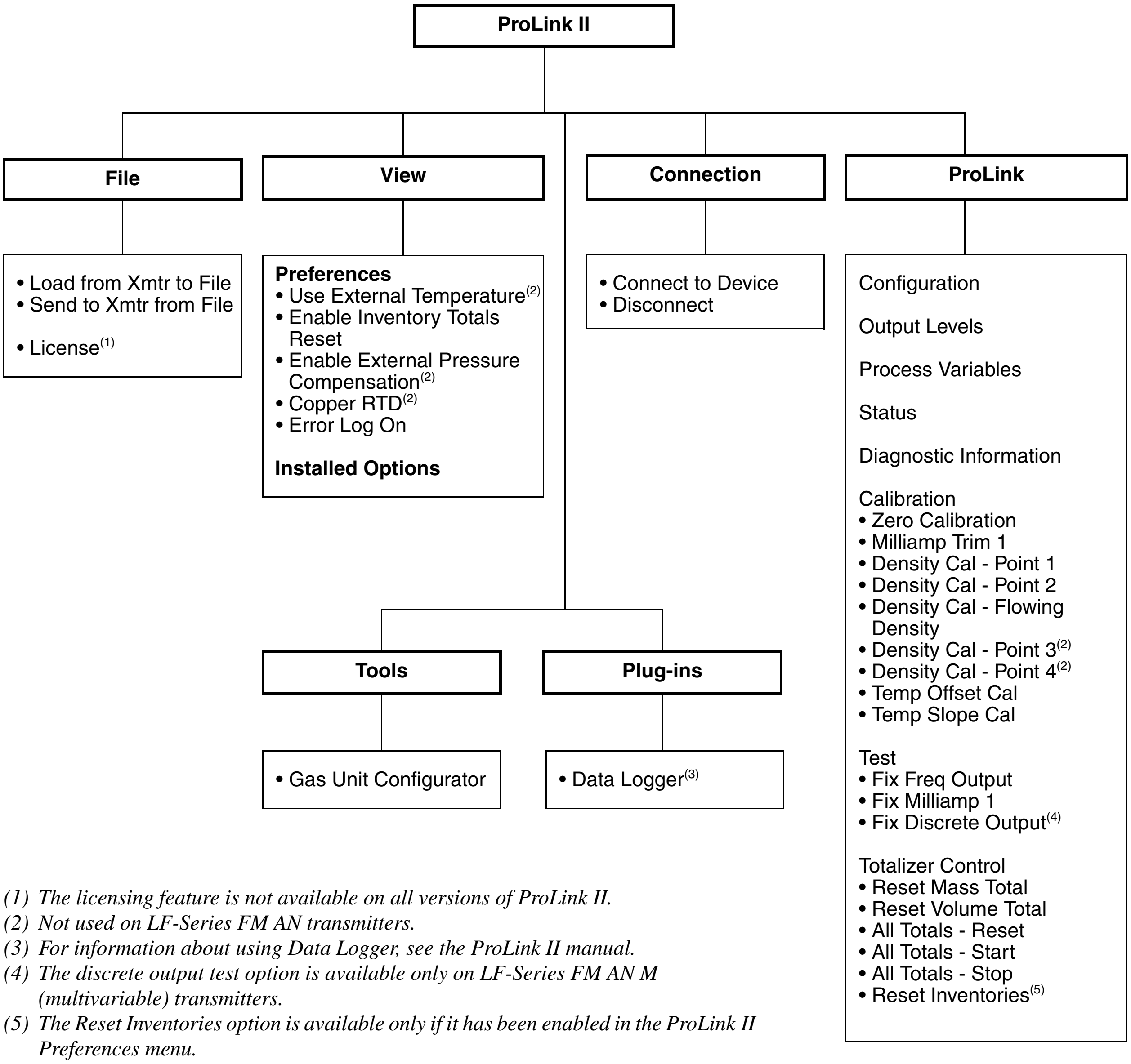
(1) The flow calibration factor can be configured only via a Modbus register. ProLink II does not allow all digits to be entered, thereby causing measurement error.
(2) Not used on LF-Series FM AN transmitters.

Figure D-2 ProLink II configuration menu *continued*



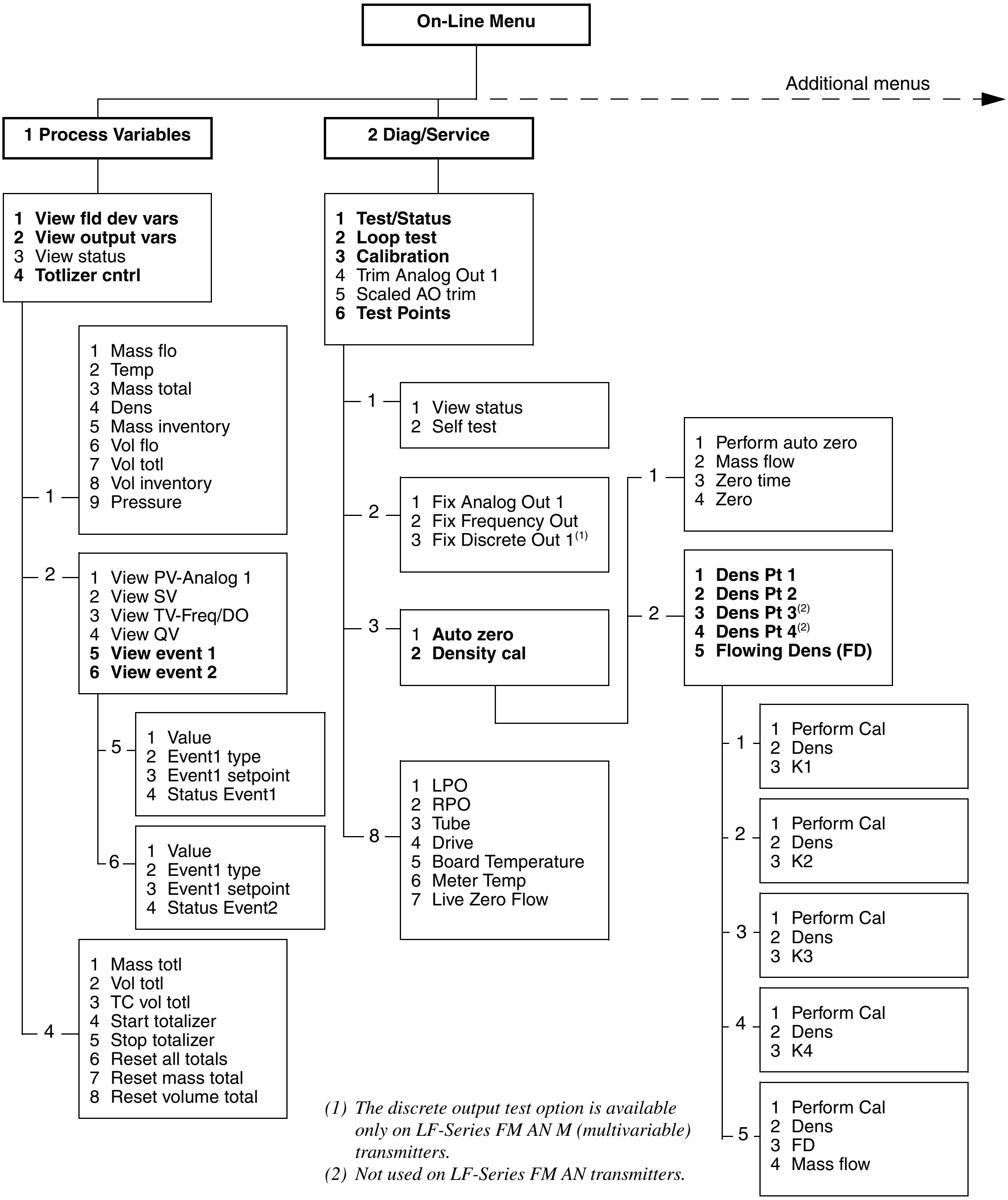
(1) The discrete output option is available only on LF-Series FM AN M (multivariable) transmitters.
(2) Displayed only if Scaling method is set to Frequency = flow.
(3) Displayed only if Scaling method is set to Pulses/unit.
(4) Displayed only if Scaling method is set to Units/pulse.

Figure D-3 ProLink II operating menus



(1) The licensing feature is not available on all versions of ProLink II.
(2) Not used on LF-Series FM AN transmitters.
(3) For information about using Data Logger, see the ProLink II manual.
(4) The discrete output test option is available only on LF-Series FM AN M (multivariable) transmitters.
(5) The Reset Inventories option is available only if it has been enabled in the ProLink II Preferences menu.

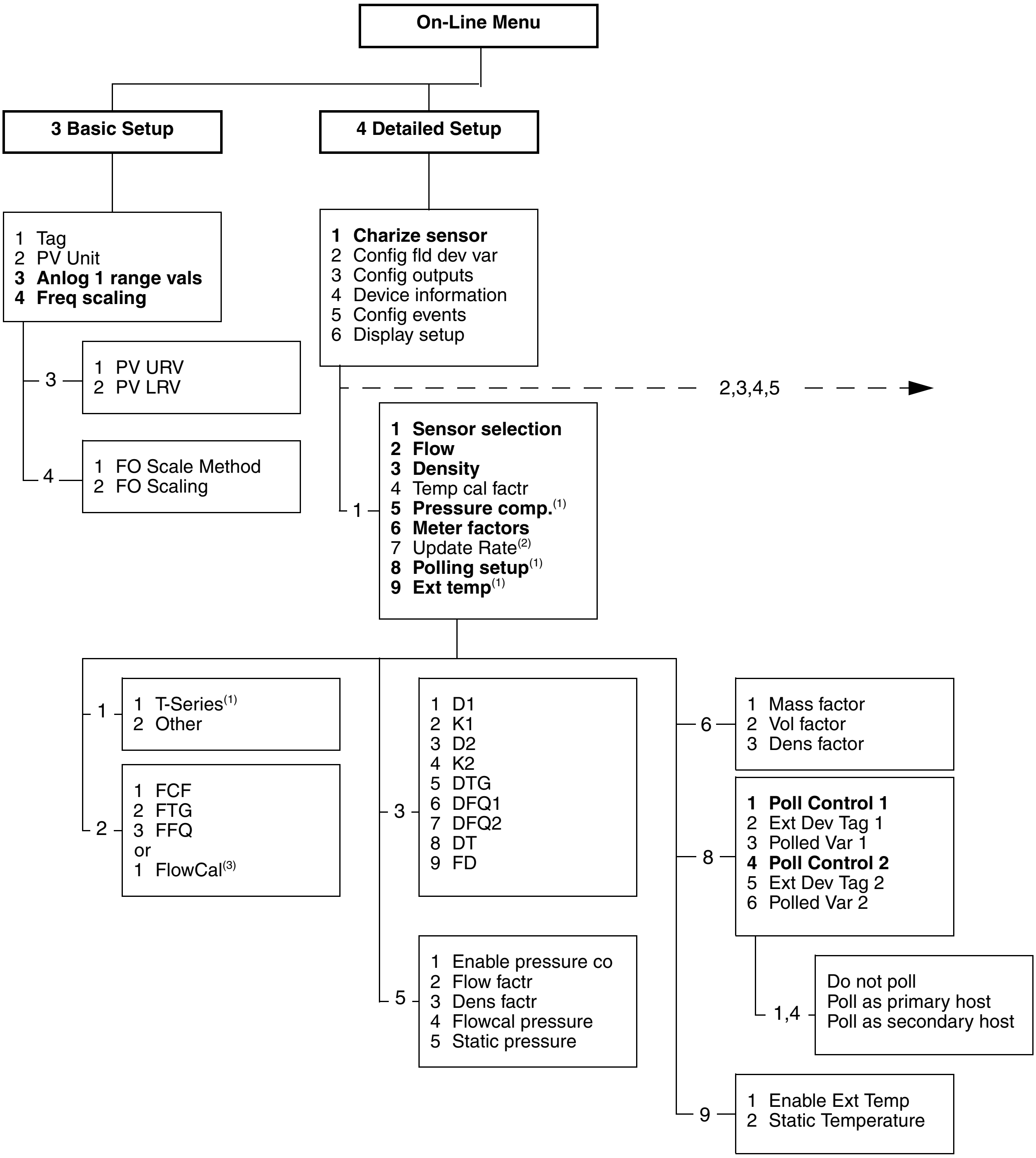
Figure D-4 Communicator menus



(1) The discrete output test option is available only on LF-Series FM AN M (multivariable) transmitters.

(2) Not used on LF-Series FM AN transmitters.

Figure D-5 Communicator menus *continued*



(1) Not used for LF-Series FM AN transmitters.
(2) If Update Rate is set to Special, a parameter called Update Rate Var is listed directly beneath Update Rate. Menu numbers are adjusted accordingly.
(3) The flow calibration factor can be configured only via a Modbus register. The Communicator does not allow all digits to be entered, thereby causing measurement error.

Figure D-6 **Communicator menus** *continued*

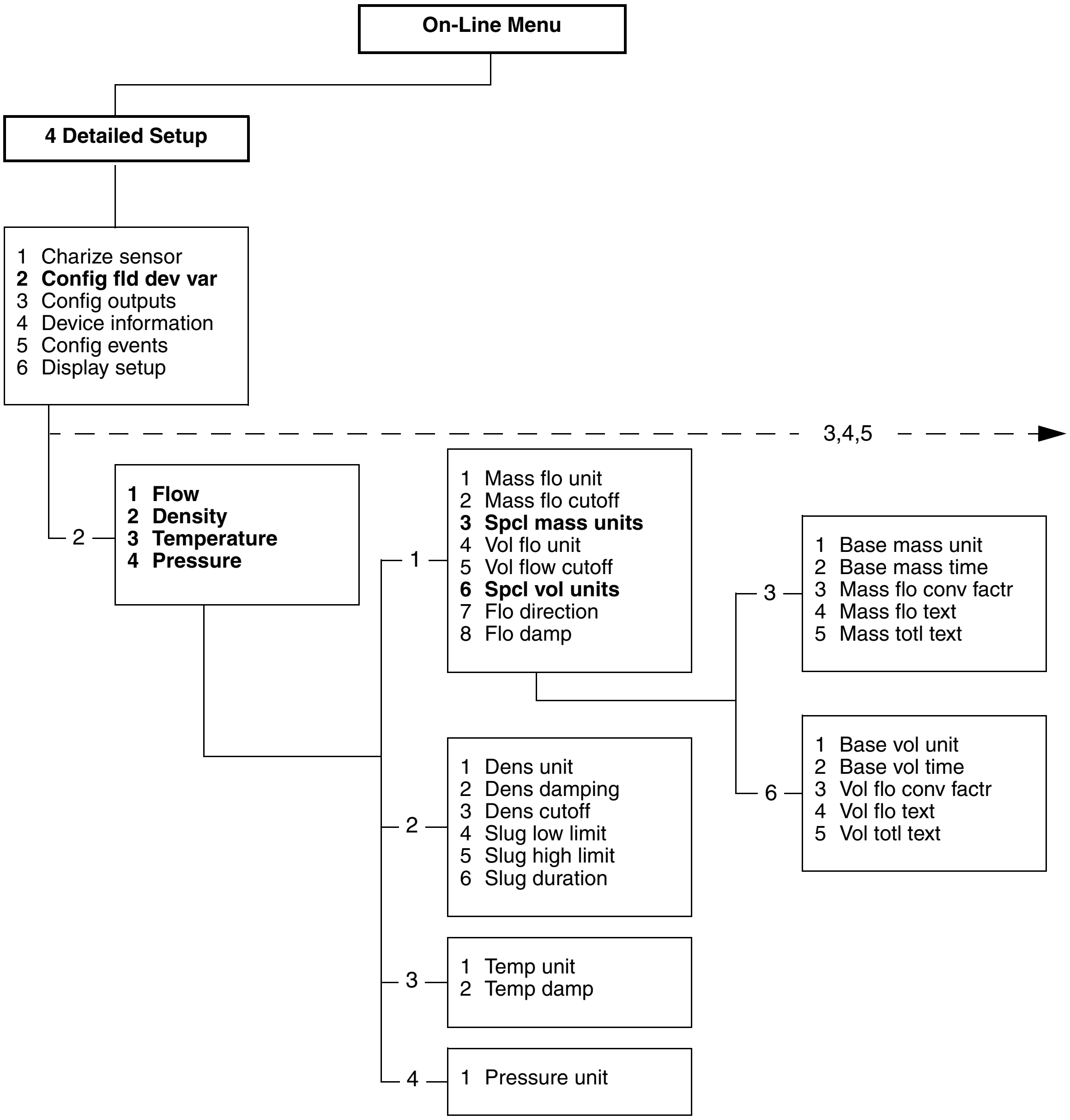
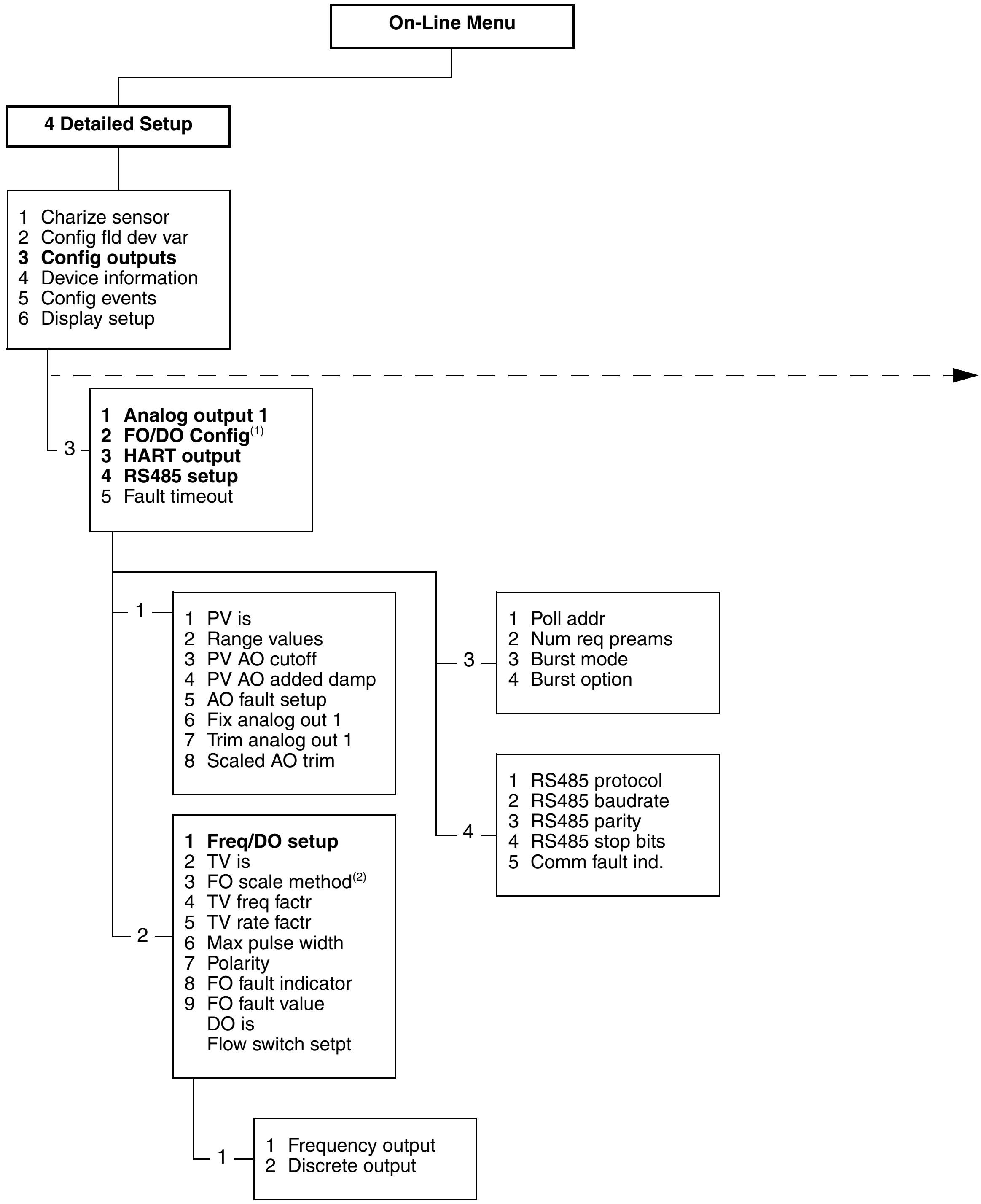


Figure D-7 Communicator menus *continued*



(1) The discrete output options are available only on LF-Series FM AN M (multivariable) transmitters.

(2) Different frequency output parameters are displayed depending on the scaling method selected.

Figure D-8 **Communicator menus** *continued*

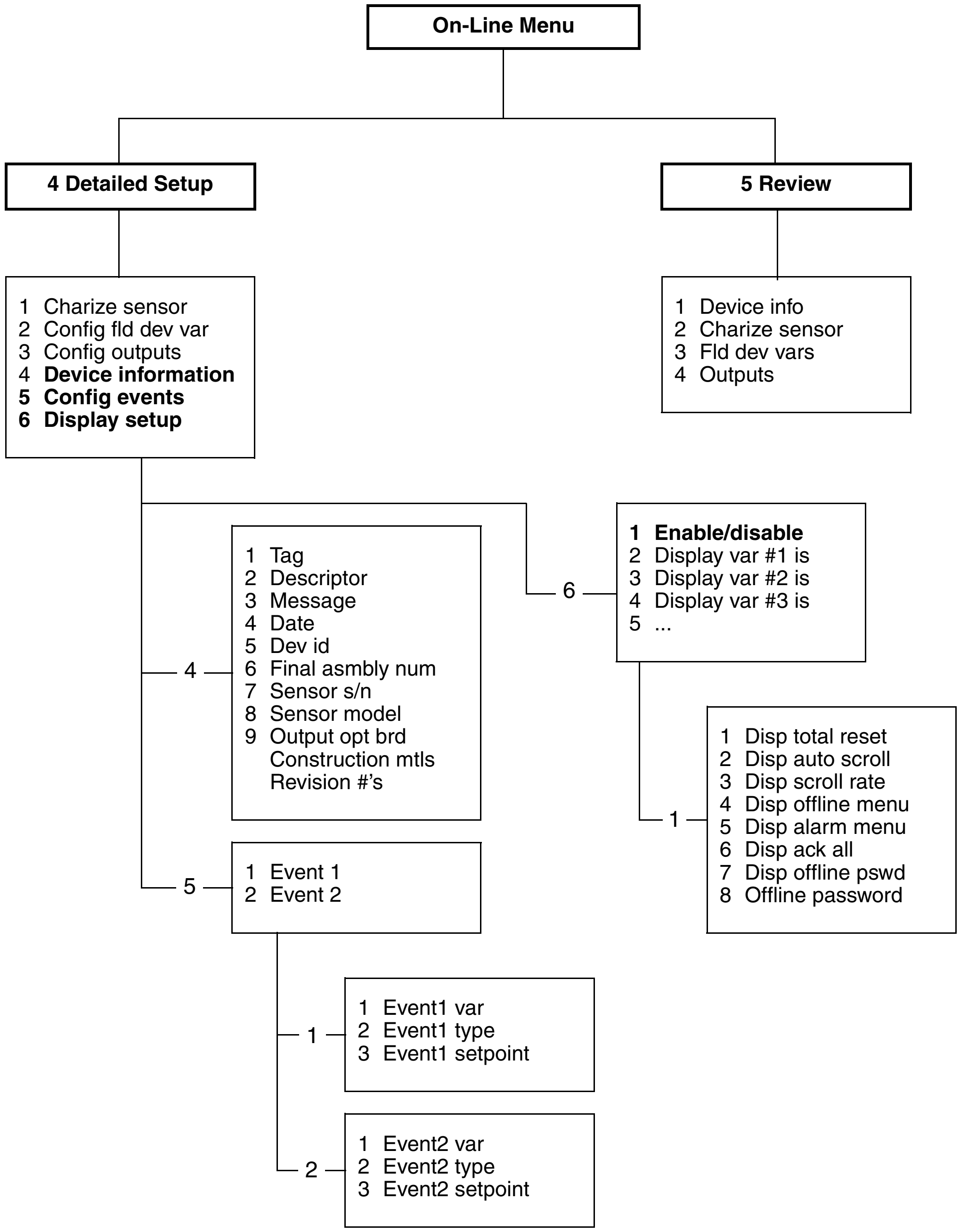
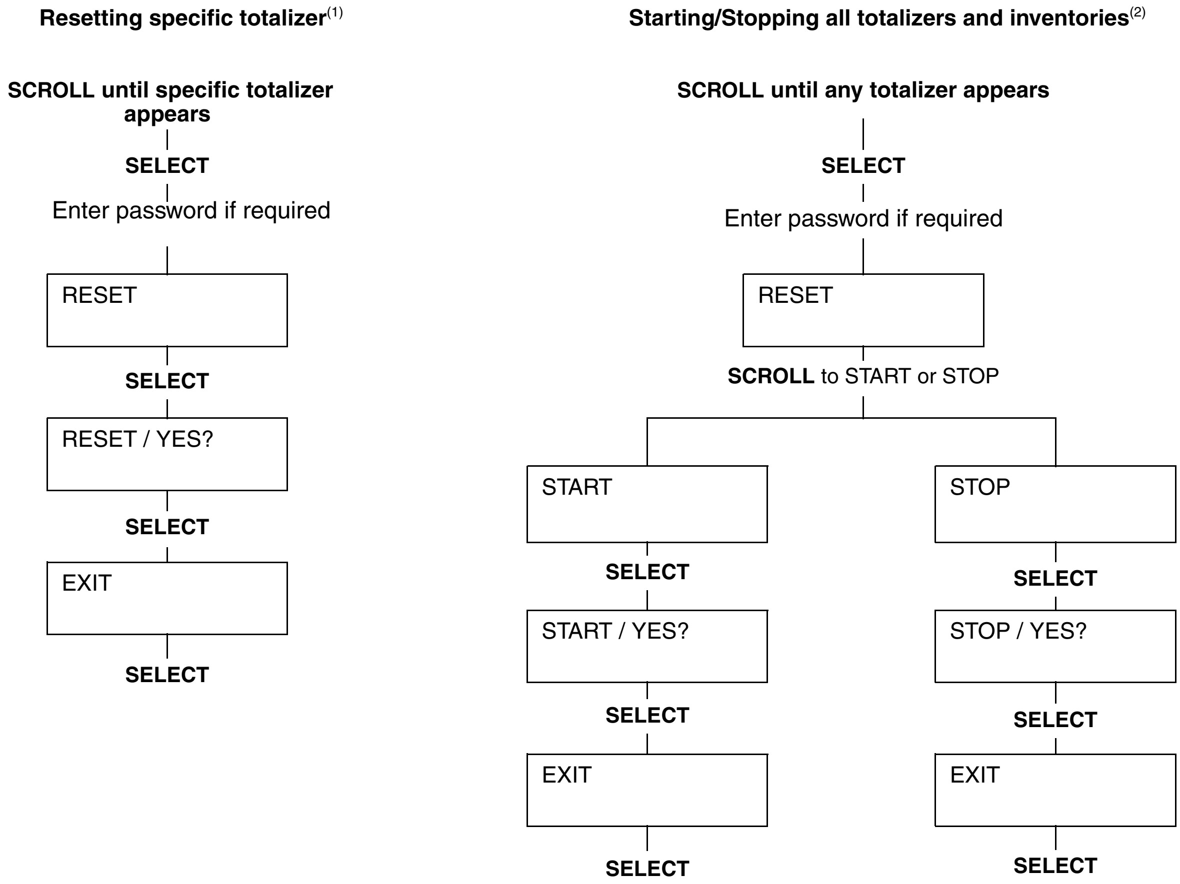


Figure D-9 Display menu – Managing totalizers and inventories



(1) Transmitter must be configured to allow resetting totalizers from display. See Section 8.14.1.
(2) Transmitter must be configured to allow starting and stopping totalizers from display. See Section 8.14.1.

Figure D-10 Display menu – Maintenance – Version information

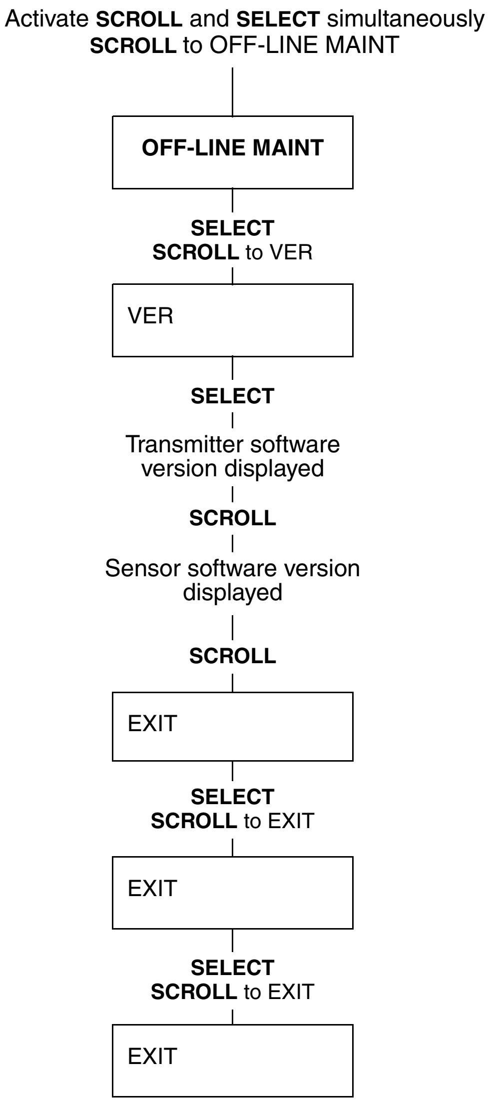
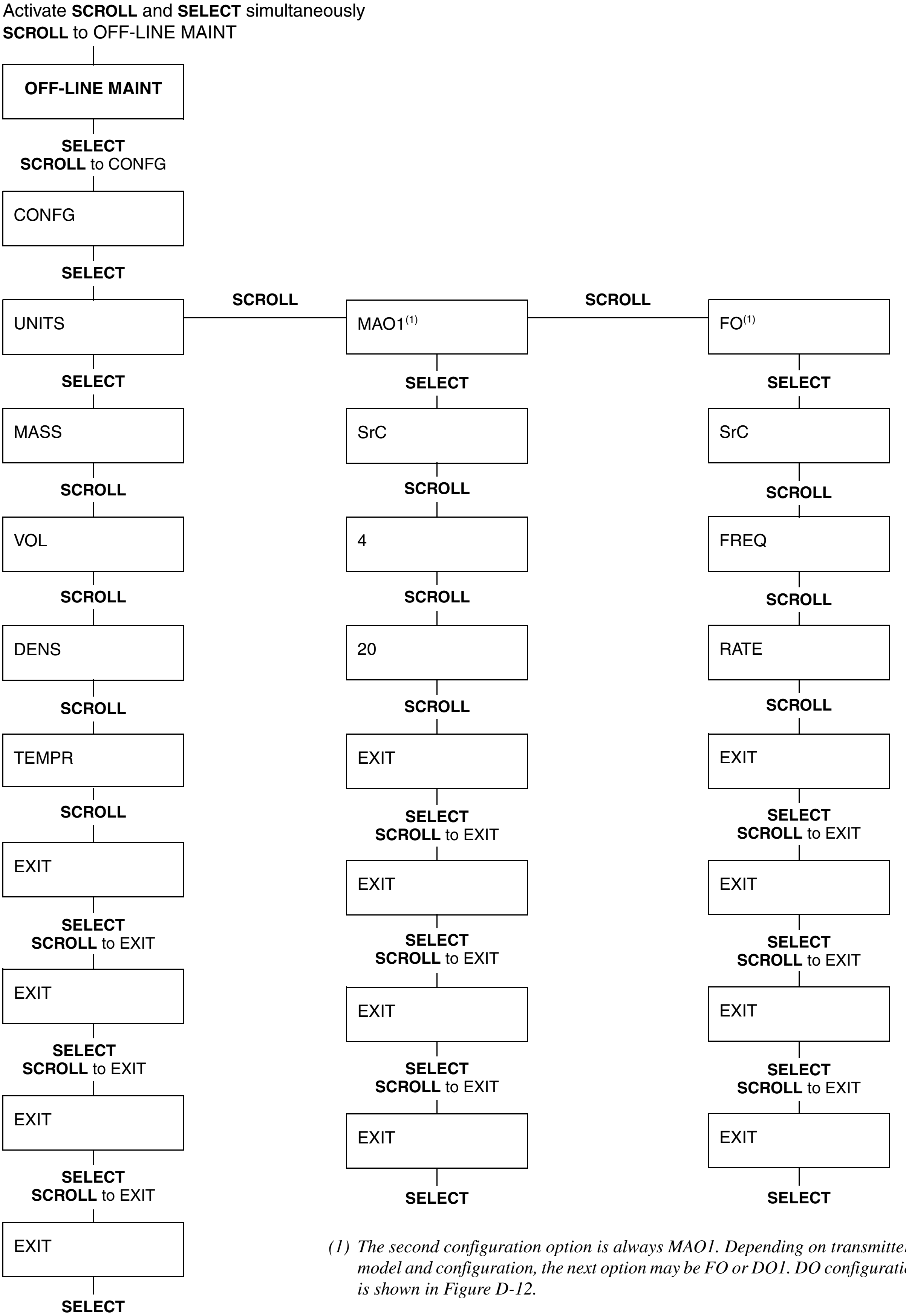
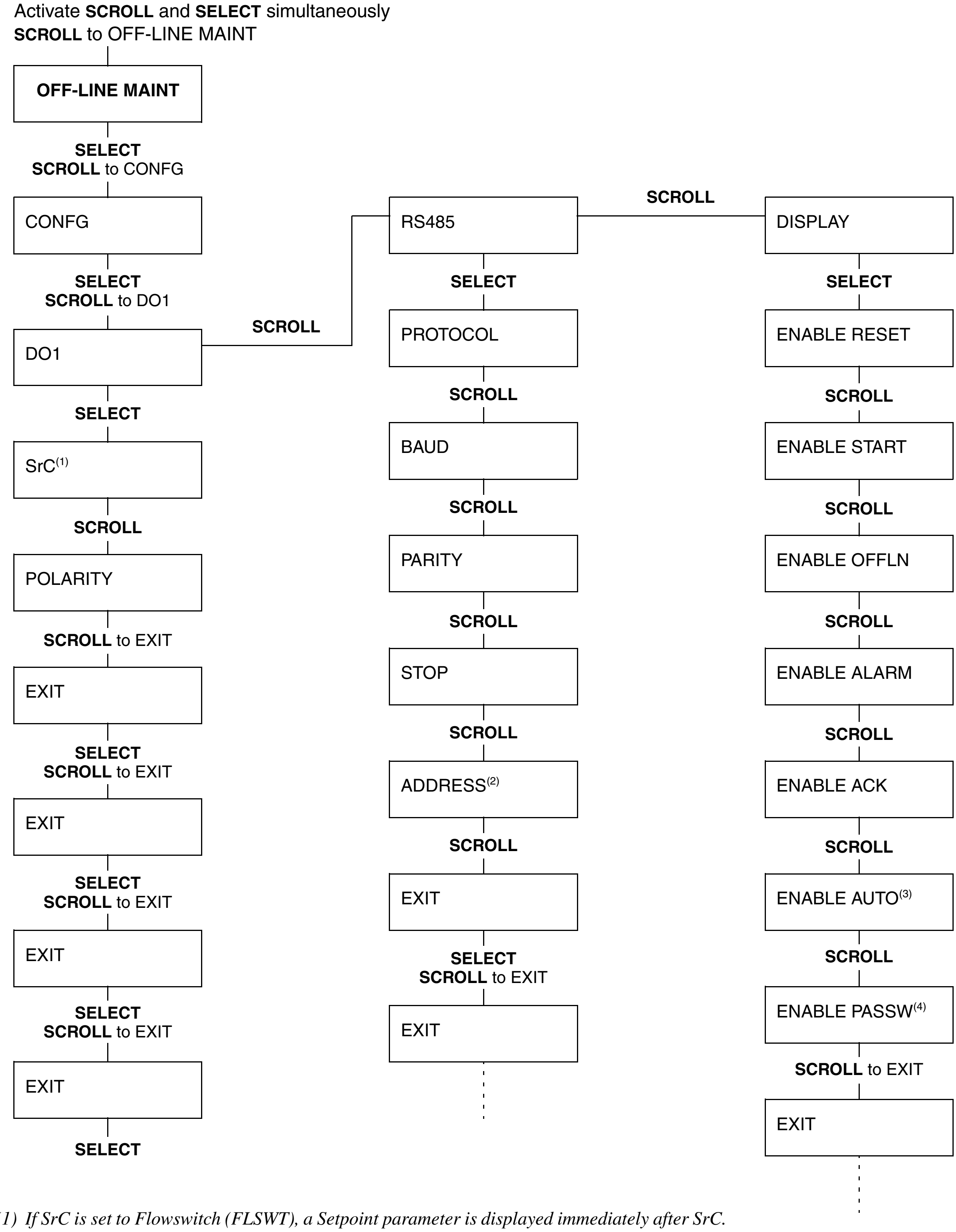


Figure D-11 Display menu – Maintenance – Configuration: Units, mA output, frequency output



(1) The second configuration option is always MAO1. Depending on transmitter model and configuration, the next option may be FO or DO1. DO configuration is shown in Figure D-12.

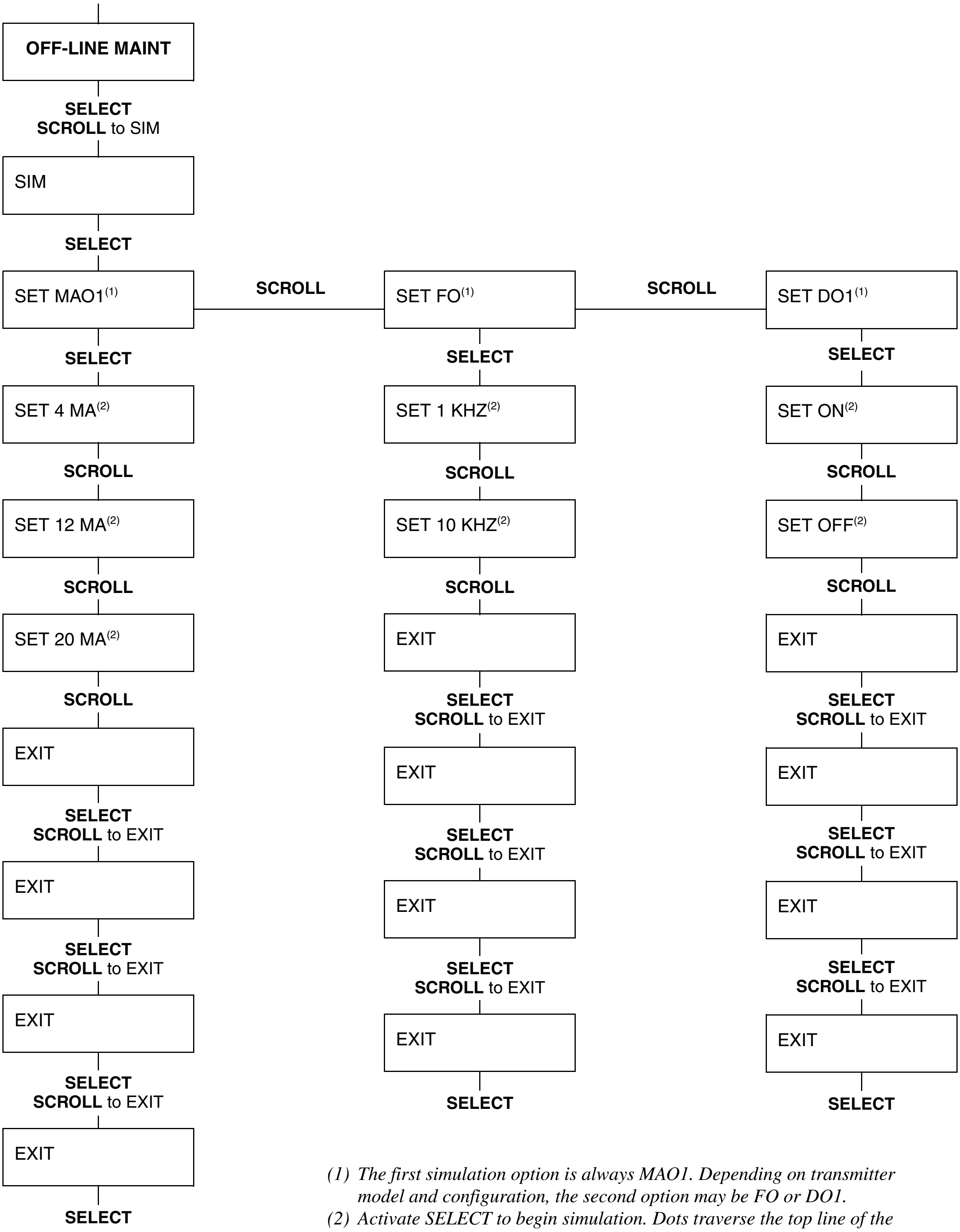
Figure D-12 Display menu – Maintenance – Configuration: Discrete output, RS-485 comm, display



(1) If SrC is set to Flowswitch (FLSWT), a Setpoint parameter is displayed immediately after SrC.
(2) May be HART address or Modbus address (MBUS), depending on protocol selection.
(3) If Autoscroll is enabled, a Scroll rate parameter is displayed immediately after Enable Auto.
(4) If Password is enabled, a Change Password parameter is displayed immediagely after Enable Passw.

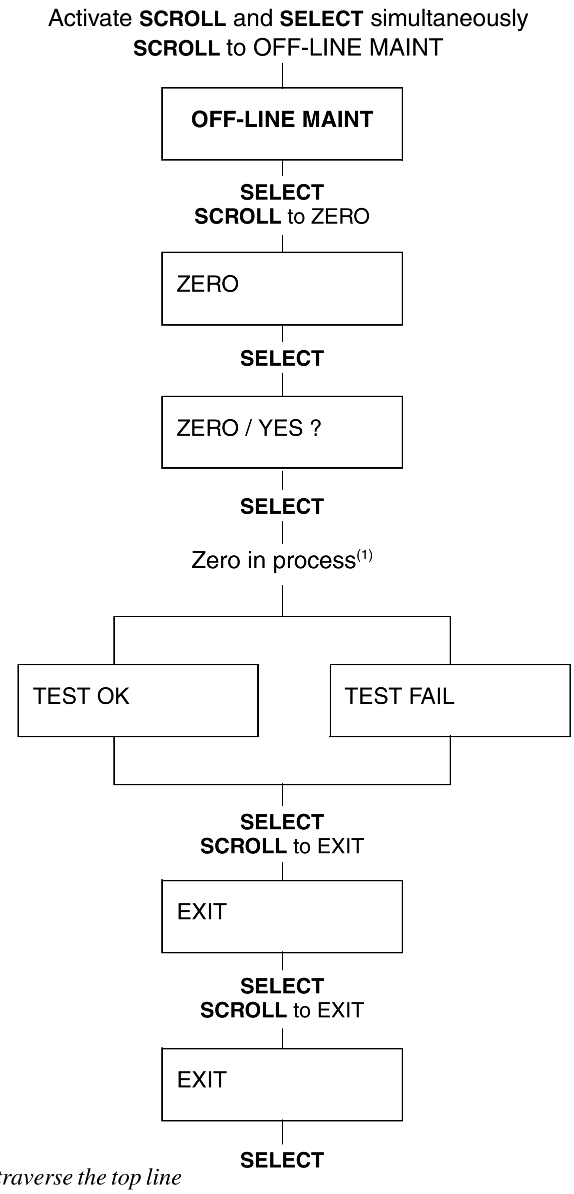
Figure D-13 Display menu – Simulation (loop testing)

Activate **SCROLL** and **SELECT** simultaneously
SCROLL to OFF-LINE MAINT



(1) The first simulation option is always MAO1. Depending on transmitter model and configuration, the second option may be FO or DO1.
(2) Activate SELECT to begin simulation. Dots traverse the top line of the display while simulation is in process. To end simulation, activate SELECT again.

Figure D-14 Display menu – Zero



(1) While zero is in process, dots traverse the top line of the display and the status LED flashes yellow.

Appendix E
Menu Flowcharts – FM CIO Transmitters

E.1 Overview

This appendix provides the following menu flowcharts for the LF-Series FM CIO transmitter:

- ProLink II menus
  - Configuration menu – see Figures E-1 and E-2
  - Operating menus – see Figure E-3
- Communicator menus – see Figures E-4 through E-8
- Display menus
  - Managing totalizers and inventories – see Figure E-9
  - Off-line maintenance menu: Version information – see Figure E-10
  - Off-line maintenance menu: Configuration – see Figures E-11 and E-12
  - Off-line maintenance menu: Simulation (loop testing) – see Figure E-13
  - Off-line maintenance menu: Zero – see Figure E-14

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

For flowmeter zero, loop testing, and mA output trim procedures, see Chapter 5.

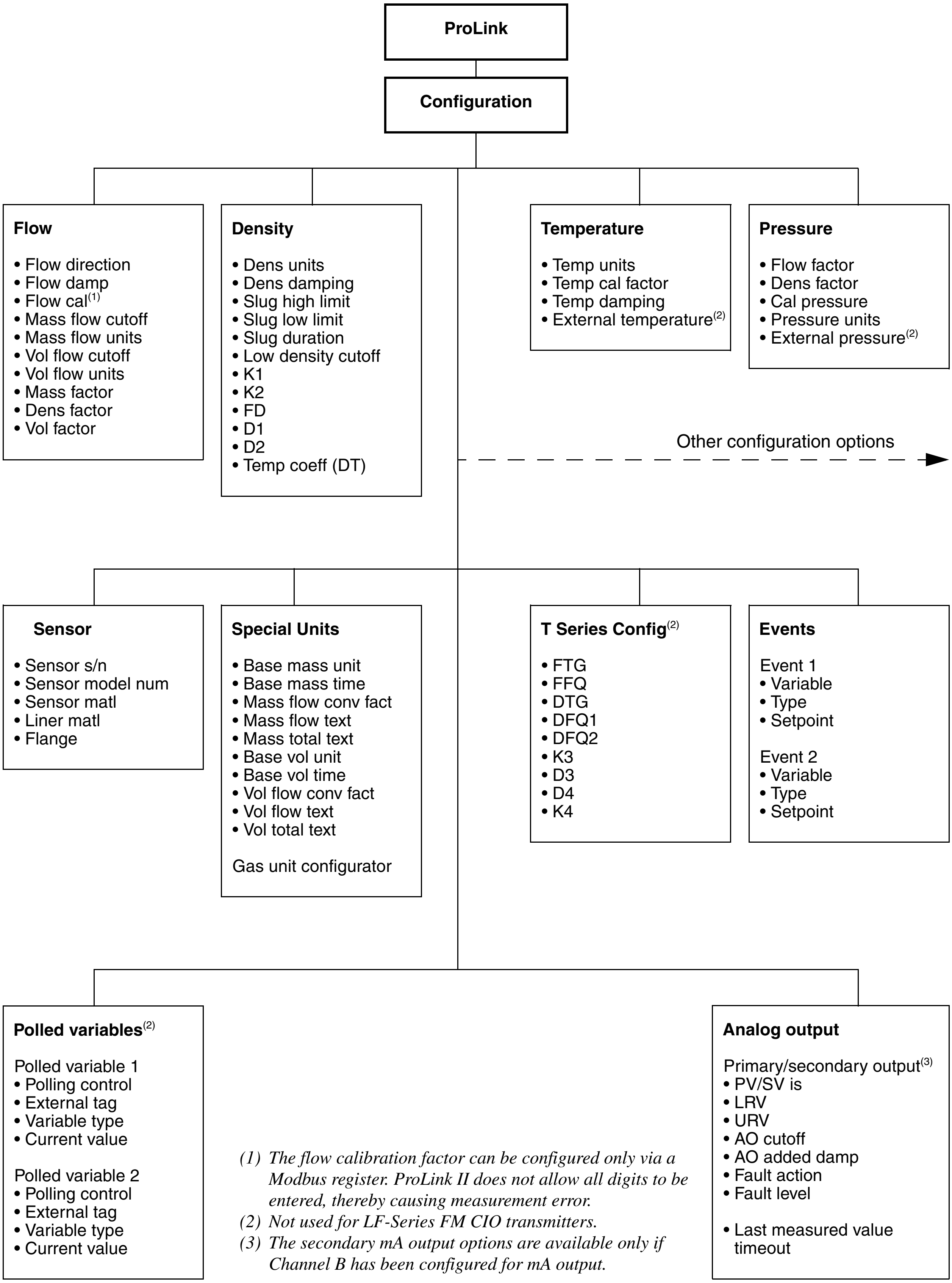
E.2 Version information

These menus flowcharts are based on:

- Transmitter software v4.0
- Sensor software v2.1
- ProLink II v2.1
- 275 HART Communicator device rev3, DD rev1

Menus may vary slightly for different versions of these components.

Figure E-1 ProLink II configuration menu



(1) The flow calibration factor can be configured only via a Modbus register. ProLink II does not allow all digits to be entered, thereby causing measurement error.
(2) Not used for LF-Series FM CIO transmitters.
(3) The secondary mA output options are available only if Channel B has been configured for mA output.

Figure E-2 ProLink II configuration menu *continued*

ProLink → **Configuration**

Frequency(1)
- Tertiary variable
- Pulse width
- Last measured value timeout
- Freq output mode
- Scaling method
- Freq factor(2)
- Rate factor(2)
- Pulses per unit(3)
- Units per pulse(4)
- Freq fault action
- Freq output polarity

(1) The frequency output options are available only if a channel has been configured for frequency output.
(2) Displayed only if Scaling method is set to Frequency = flow.
(3) Displayed only if Scaling method is set to Pulses/unit.
(4) Displayed only if Scaling method is set to Units/pulse.

Variable mapping
- PV is
- SV is
- TV is
- QV is

Device
- Tag
- Date
- Descriptor
- Message
- Sensor type
- Floating pt ordering
- Add comm resp delay
- Transmitter serial #

Digital comm settings
- Digital comm fault setting
- Modbus address
- HART address
- HART device ID

Burst setup
- Enable burst
- Burst CMD
- Burst var 1–4

Update rate
- Update rate
- 100 Hz variable

Display config
- mA 1
- Var 2 – Var 15

Display options
- Display start/stop totalizers
- Display totalizer reset
- Dislay auto scroll
- Display offline menu
- Display offline password
- Display alarm menu
- Display ack all alarms

- Offline password
- Auto scroll rate

Channel configuration

Channel B
- Type assignment
- Power type

Channel C
- Type assignment
- Power type

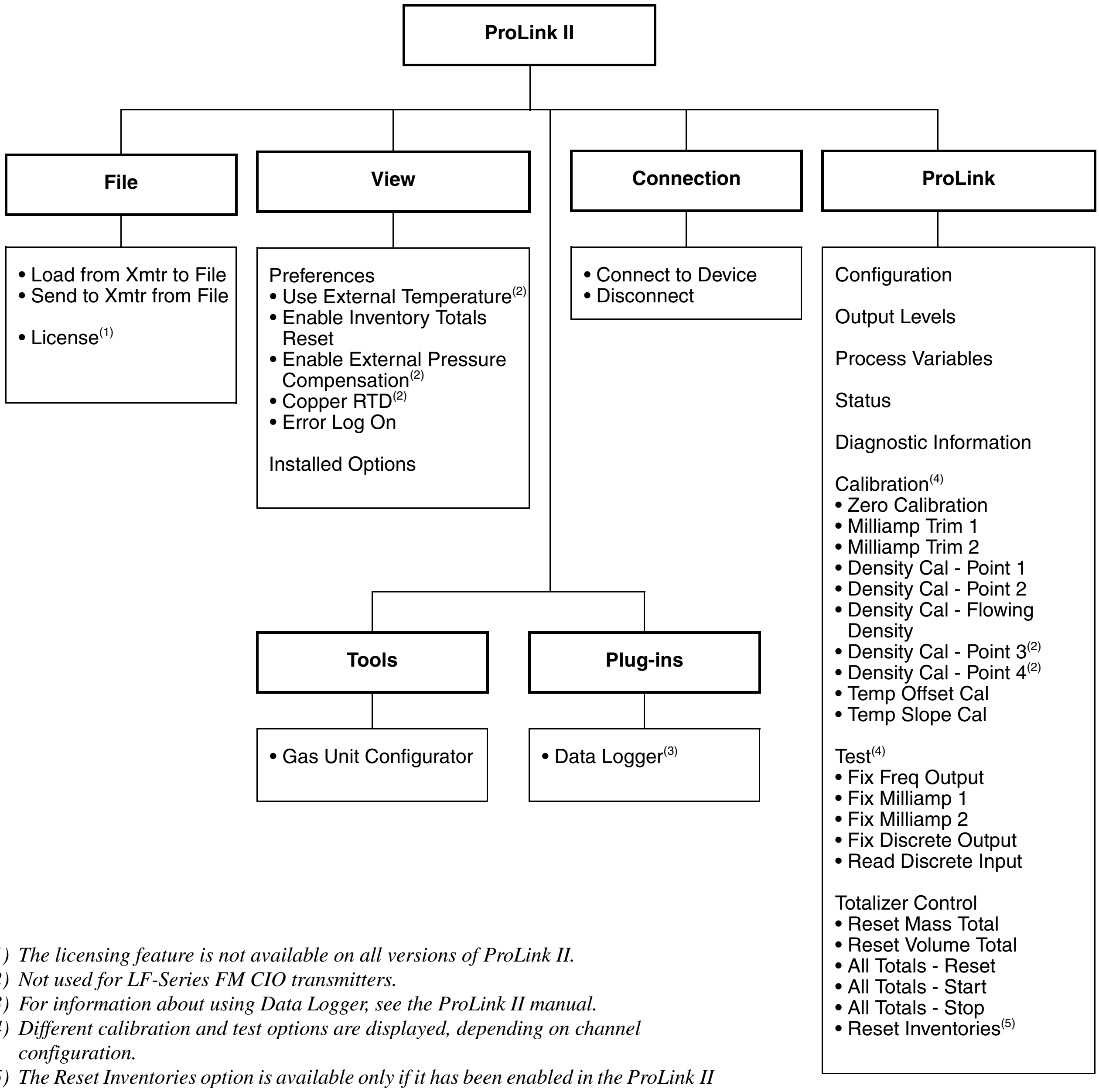
Discrete IO

Discrete output(1)
- DO1 assignment
- DO2 assignment
- DO1 polarity
- DO2 polarity
- Flow switch setpoint

Discrete input(2)
- DI assignment

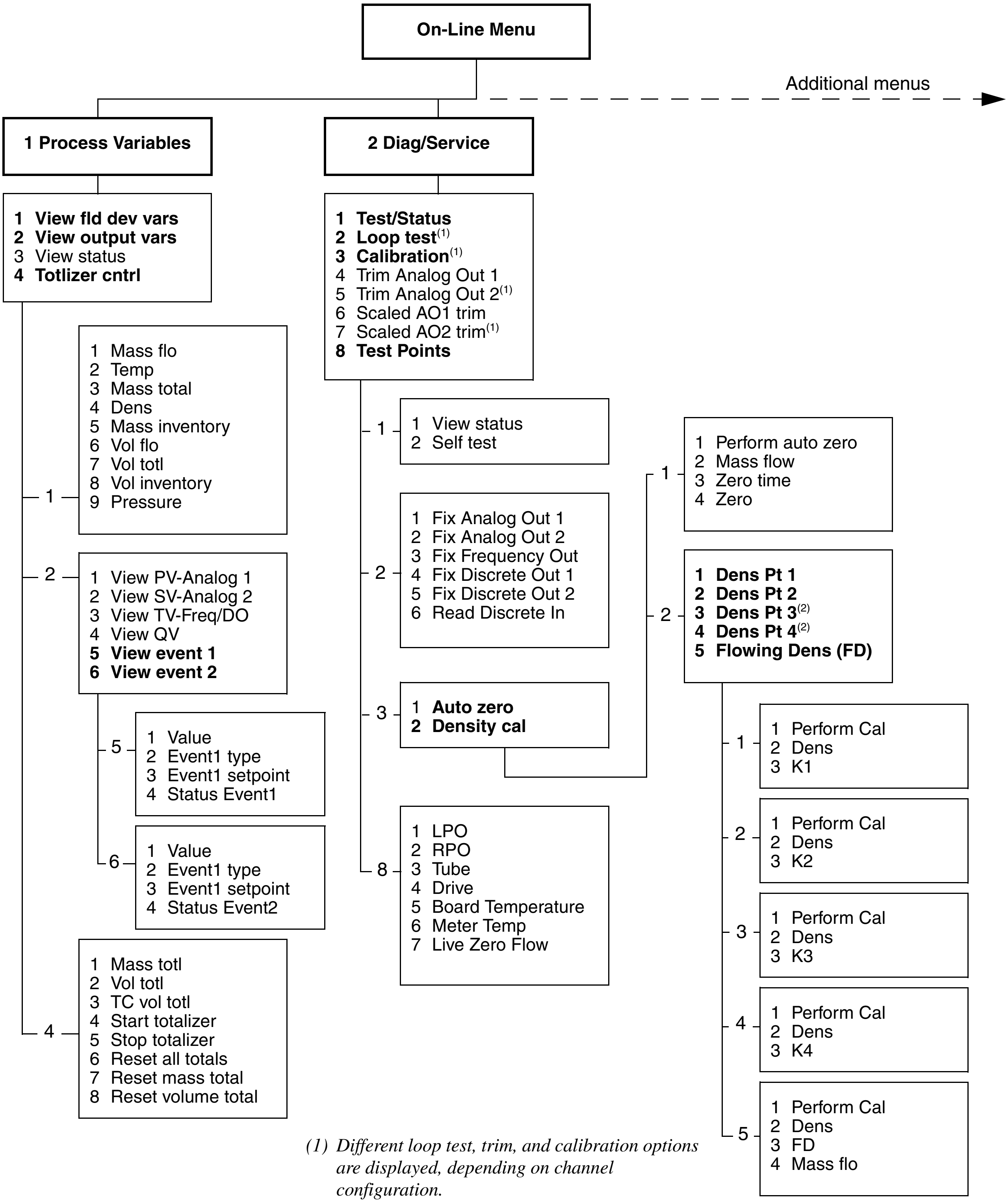
(1) The discrete output options are available only if a channel has been configured for discrete output.
(2) The discrete input options are available only if a channel has been configured for discrete input.

Figure E-3 ProLink II operating menus



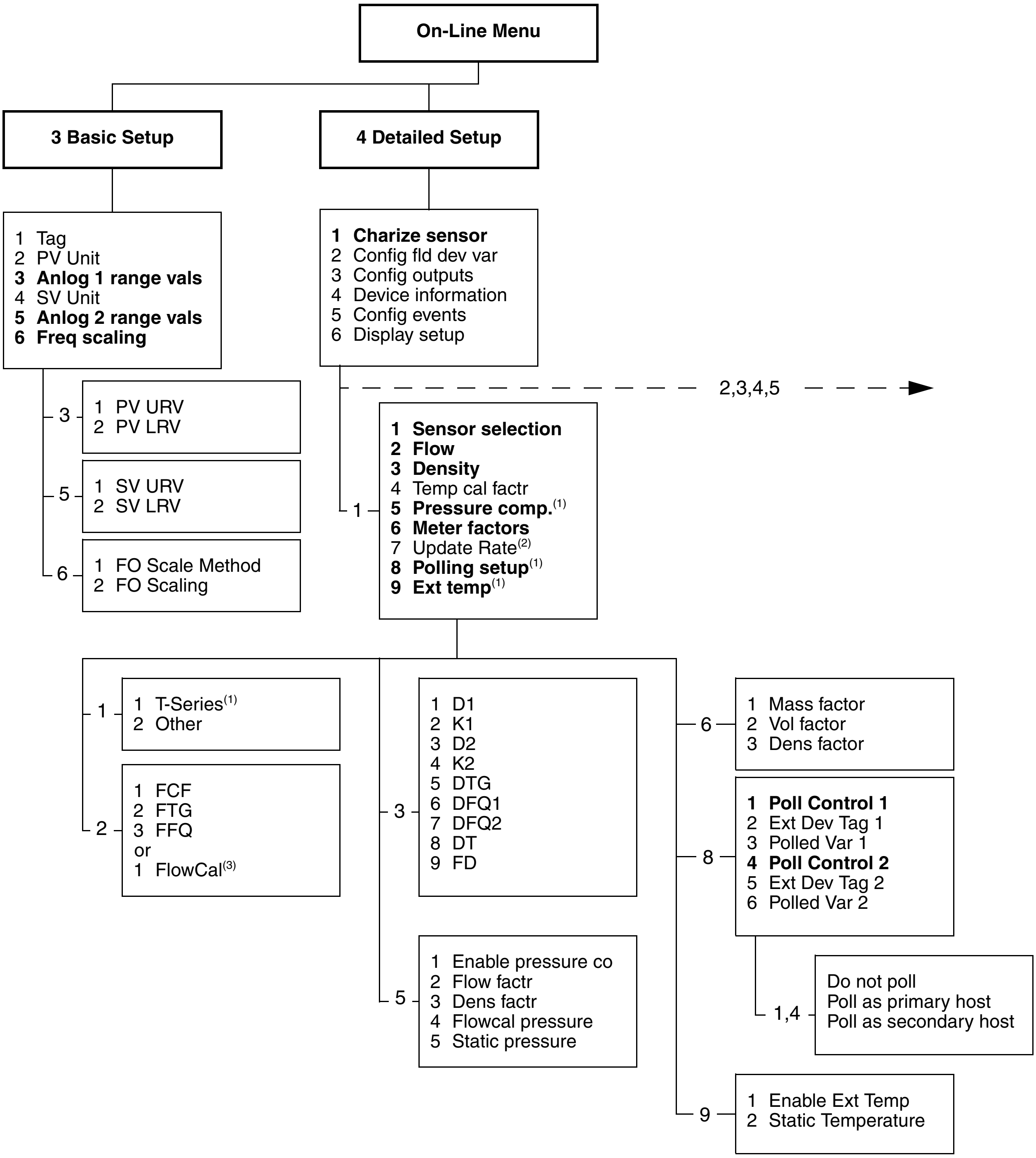
(1) The licensing feature is not available on all versions of ProLink II.
(2) Not used for LF-Series FM CIO transmitters.
(3) For information about using Data Logger, see the ProLink II manual.
(4) Different calibration and test options are displayed, depending on channel configuration.
(5) The Reset Inventories option is available only if it has been enabled in the ProLink II Preferences menu.

Figure E-4 Communicator menus



(1) Different loop test, trim, and calibration options are displayed, depending on channel configuration.
(2) Not used for LF-Series FM CIO transmitters.

Figure E-5 Communicator menus *continued*



(1) Not used for LF-Series FM CIO transmitters.
(2) If Update Rate is set to Special, a parameter called Update Rate Var is listed directly beneath Update Rate. Menu numbers are adjusted accordingly.
(3) The flow calibration factor can be configured only via a Modbus register. The Communicator does not allow all digits to be entered, thereby causing measurement error.

Figure E-6 **Communicator menus** *continued*

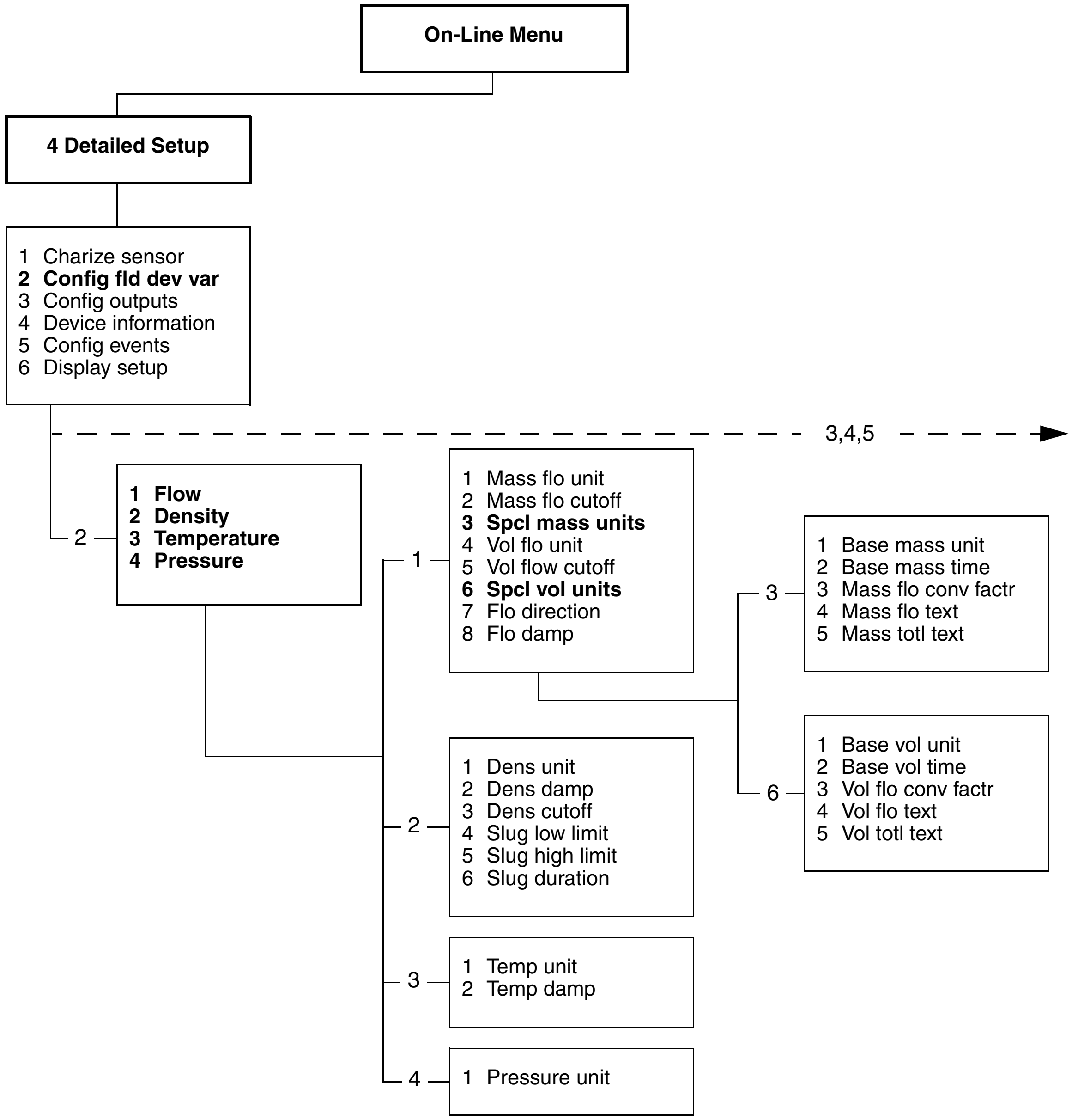
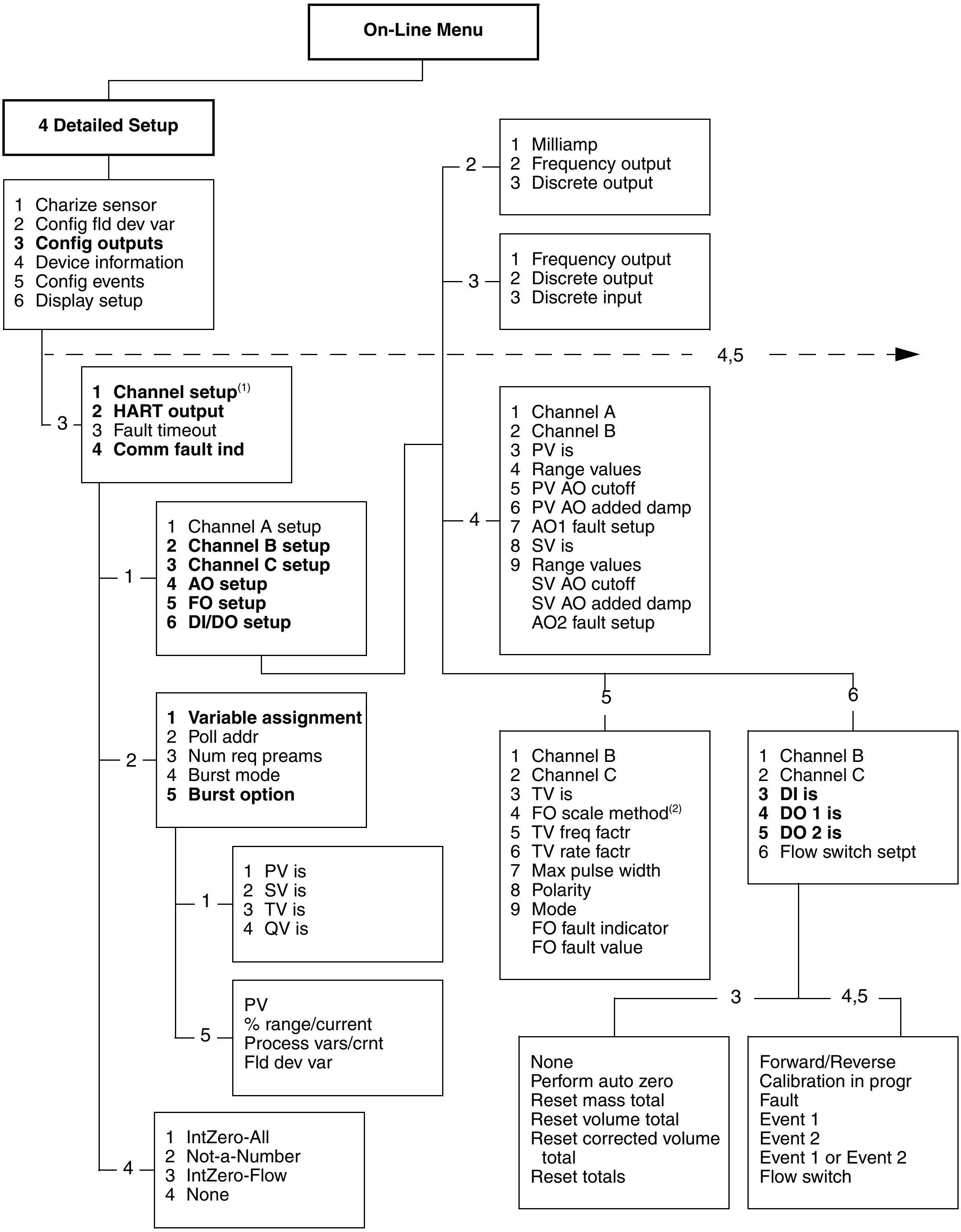


Figure E-7 Communicator menus *continued*



(1) As channel configuration options are selected, different options are displayed at lower levels of the menu. Menu numbers are adjusted accordingly. This menu does not show all configuration options.
(2) Different frequency output parameters are displayed depending on the scaling method selected.

Figure E-8 Communicator menus *continued*

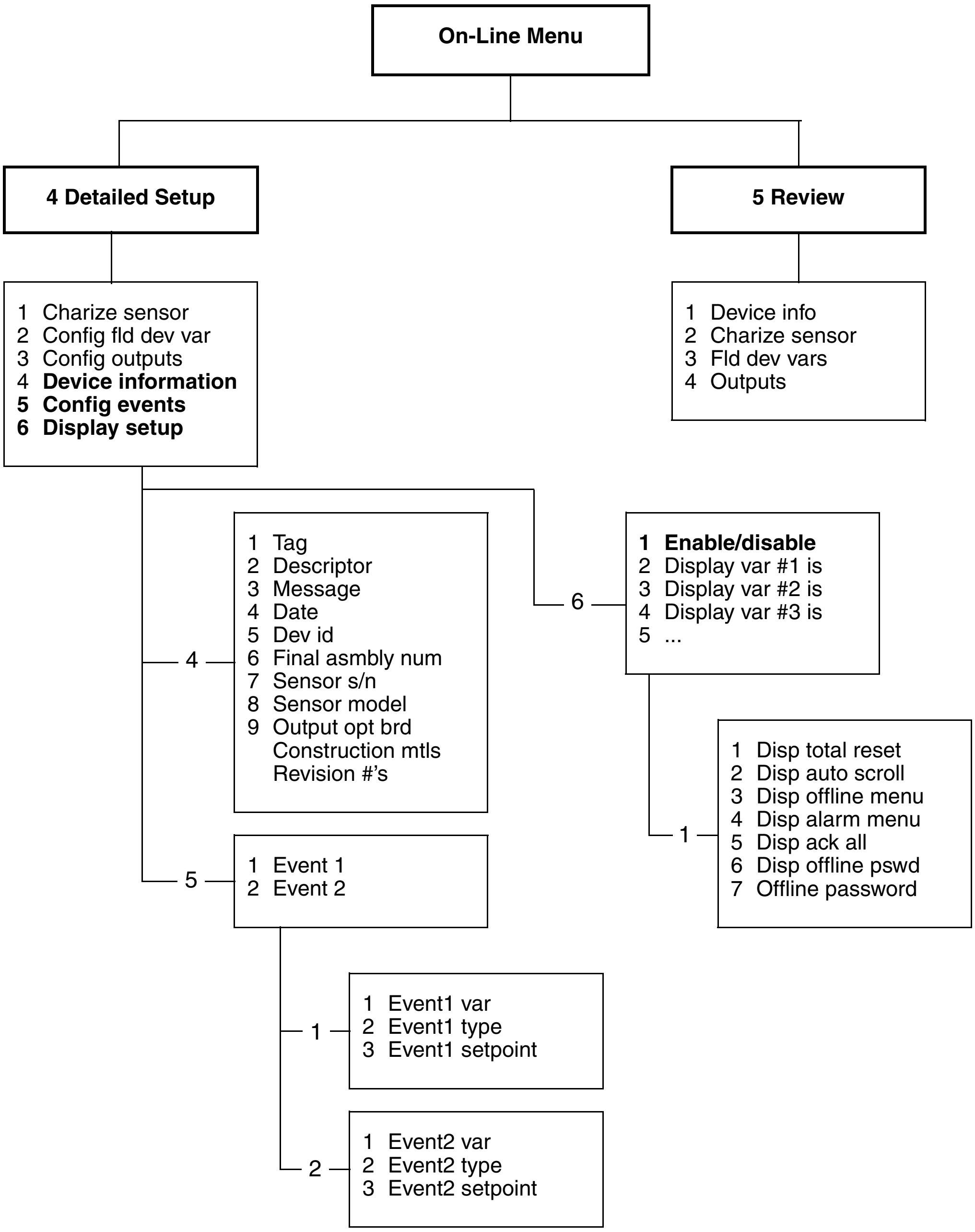
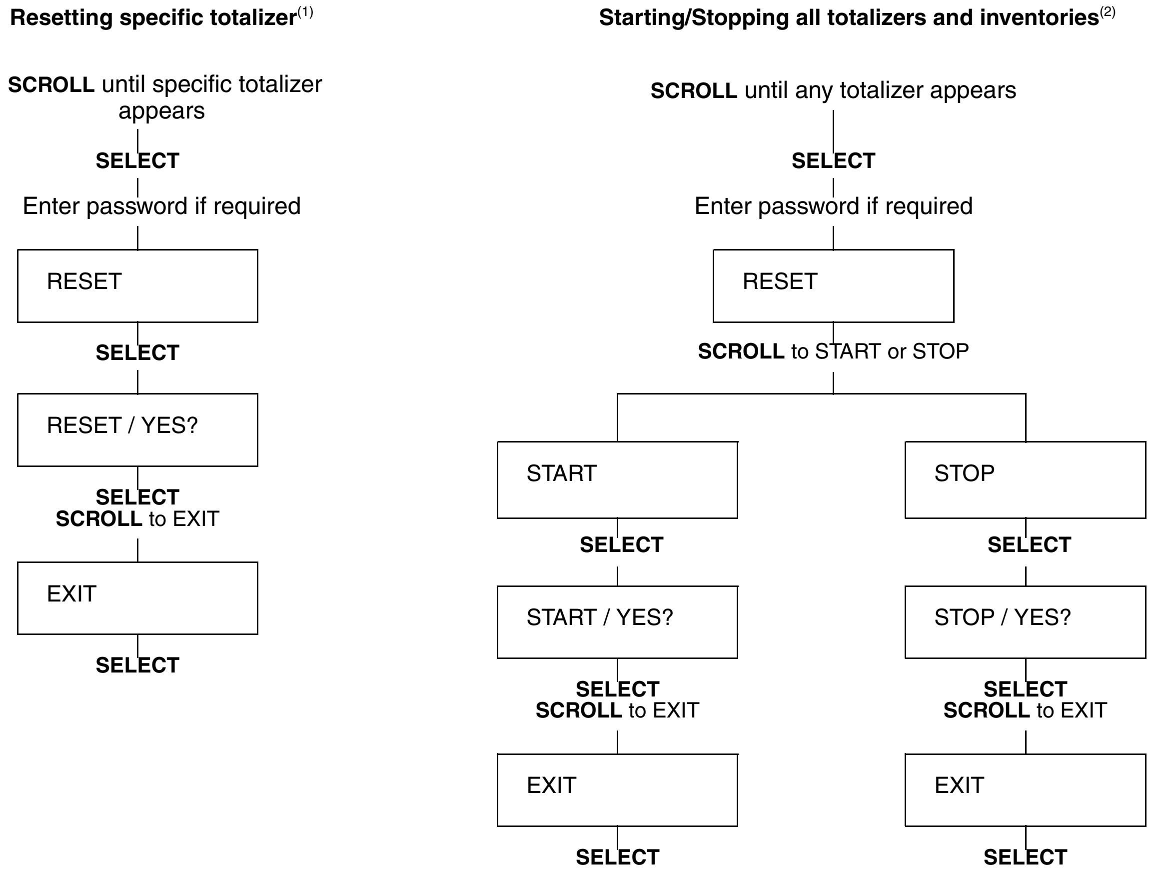


Figure E-9 Display menu – Managing totalizers and inventories



(1) Transmitter must be configured to allow resetting totalizers from display. See Section 8.14.1.
(2) Transmitter must be configured to allow starting and stopping totalizers from display. See Section 8.14.1.

Figure E-10 Display menu – Maintenance – Version information

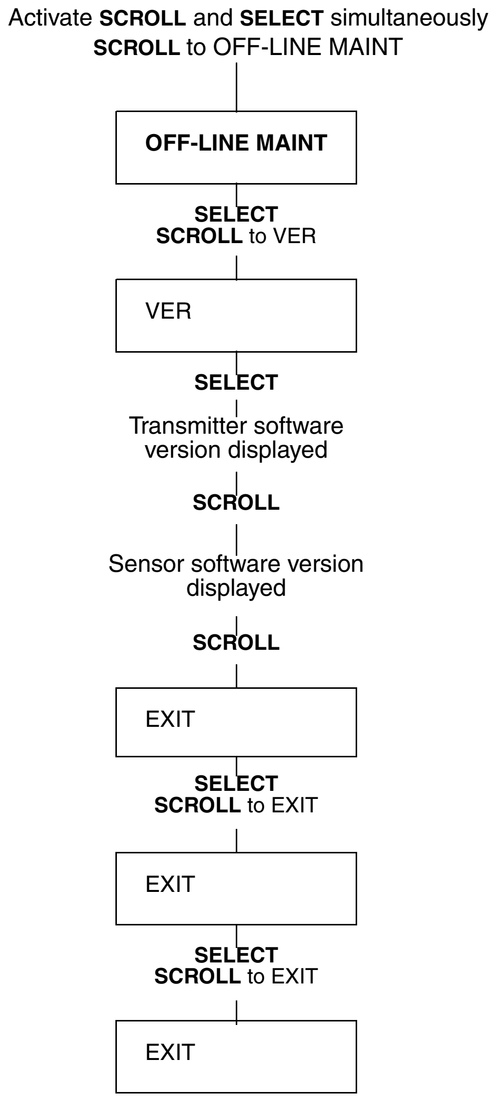
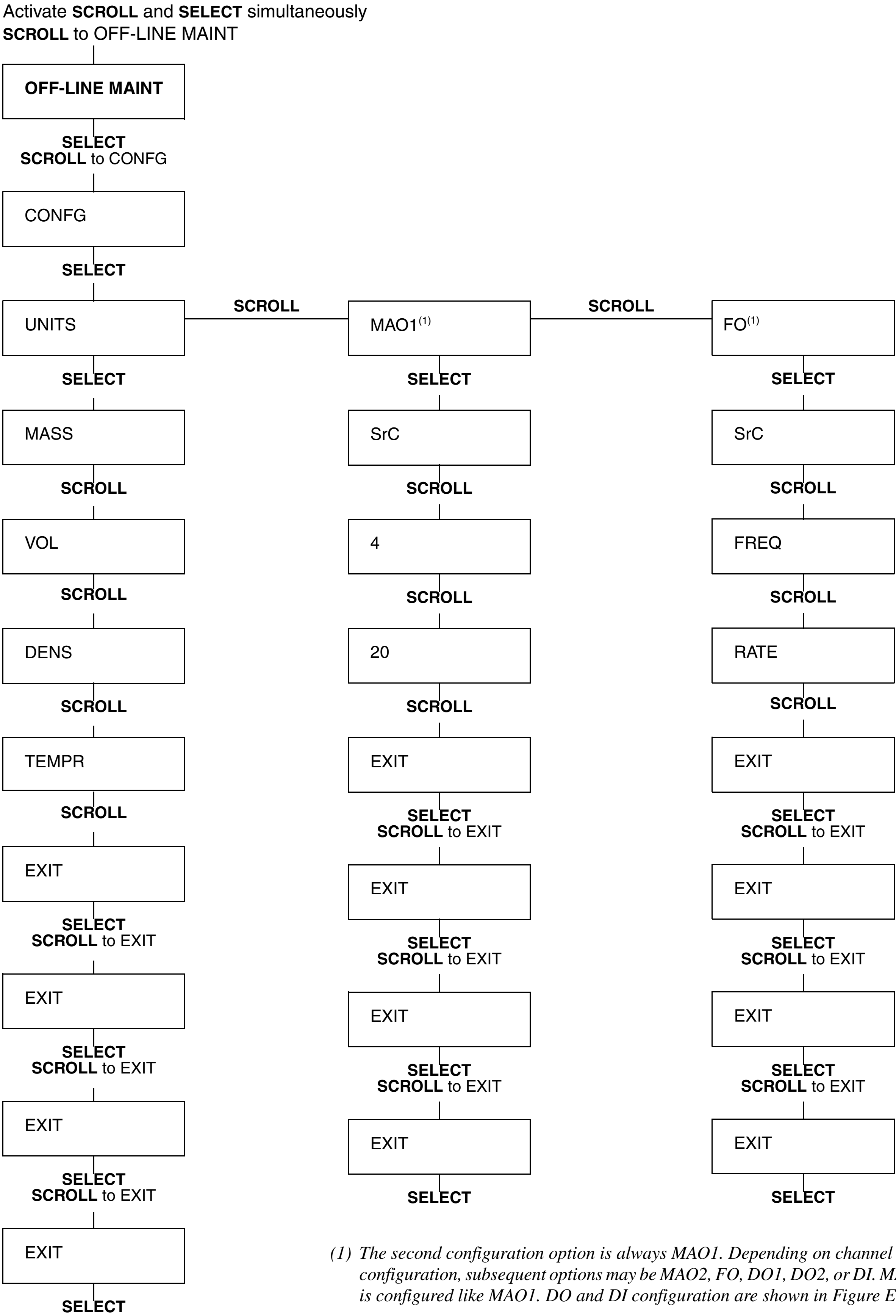
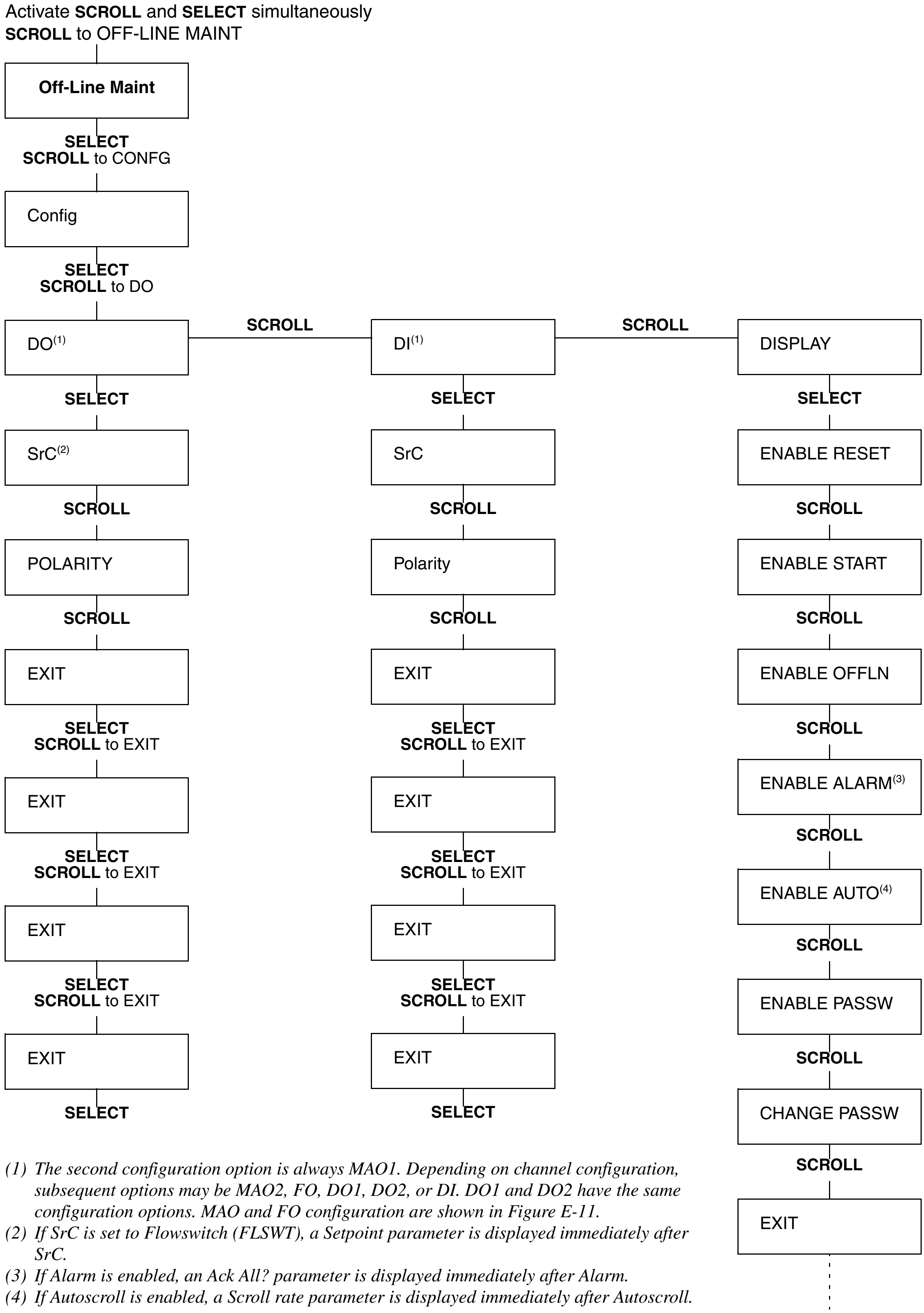


Figure E-11 Display menu – Maintenance – Configuration: Units, mA output(s), frequency output(s)



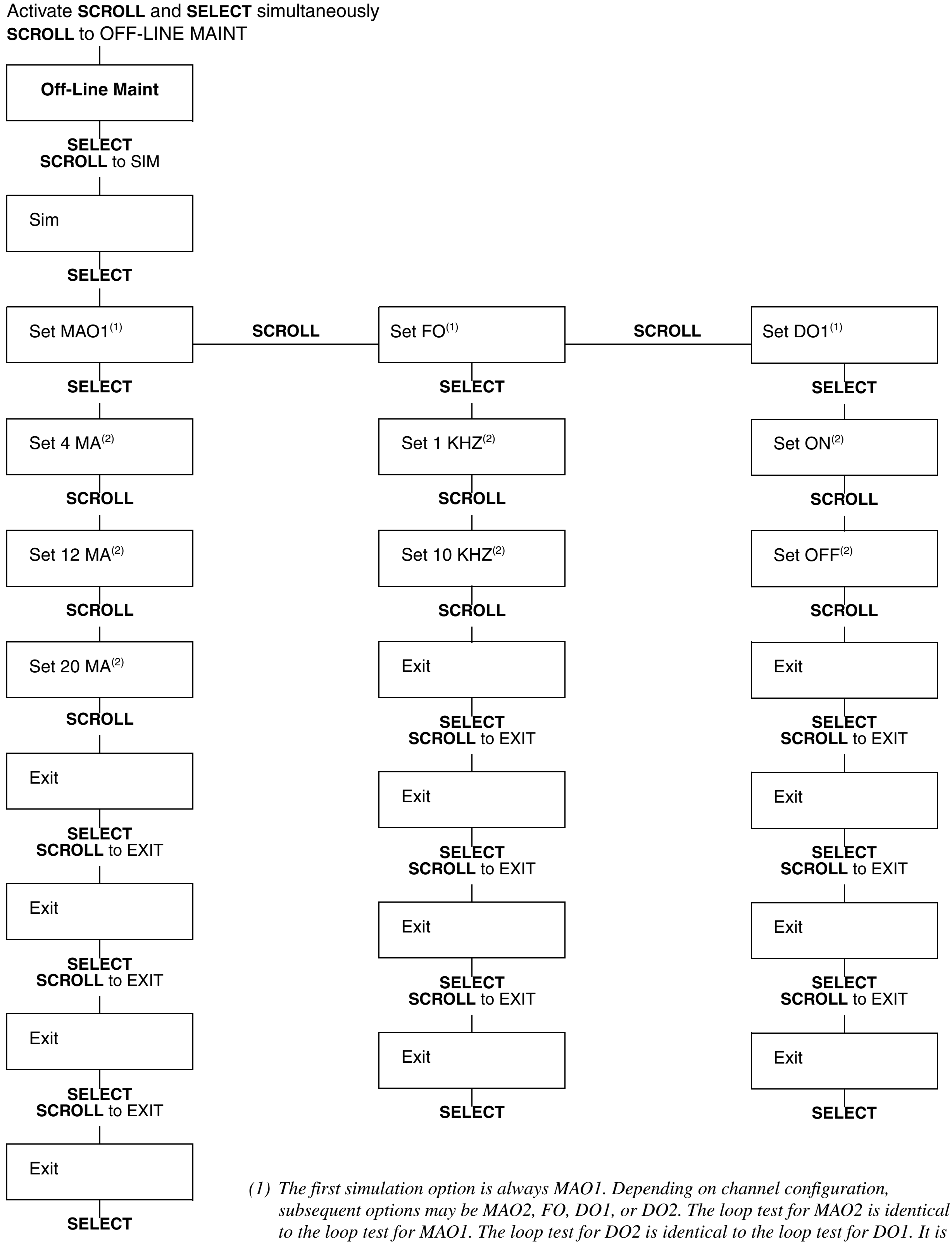
(1) The second configuration option is always MAO1. Depending on channel configuration, subsequent options may be MAO2, FO, DO1, DO2, or DI. MAO2 is configured like MAO1. DO and DI configuration are shown in Figure E-12.

Figure E-12 Display menu – Maintenance – Configuration: Discrete output(s), discrete input, display



(1) The second configuration option is always MAO1. Depending on channel configuration, subsequent options may be MAO2, FO, DO1, DO2, or DI. DO1 and DO2 have the same configuration options. MAO and FO configuration are shown in Figure E-11.
(2) If SrC is set to Flowswitch (FLSWT), a Setpoint parameter is displayed immediately after SrC.
(3) If Alarm is enabled, an Ack All? parameter is displayed immediately after Alarm.
(4) If Autoscroll is enabled, a Scroll rate parameter is displayed immediately after Autoscroll.

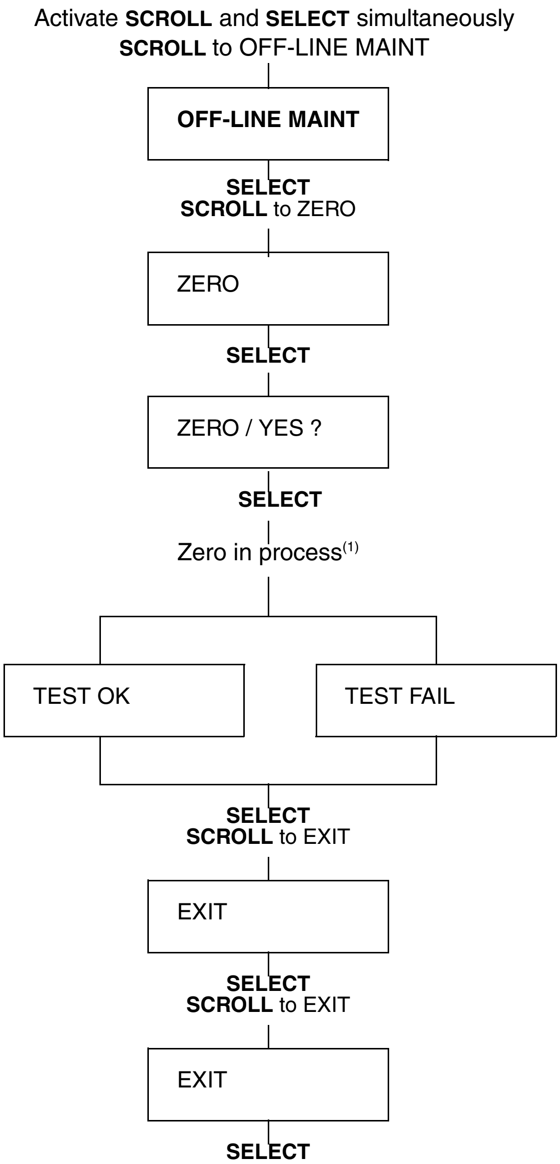
Figure E-13 Display menu – Simulation (loop testing)



(1) *The first simulation option is always MAO1. Depending on channel configuration, subsequent options may be MAO2, FO, DO1, or DO2. The loop test for MAO2 is identical to the loop test for MAO1. The loop test for DO2 is identical to the loop test for DO1. It is not possible to test the discrete input (DI) with the display.*

(2) *Activate SELECT to begin simulation. Dots traverse the top line of the display while simulation is in process. To end simulation, activate SELECT again.*

Figure E-14 Display menu – Zero



(1) While zero is in process, dots traverse the top line of the display and the status LED flashes yellow.

Appendix F
Menu Flowcharts – DIN AN Transmitters

F.1 Overview

This appendix provides the following menu flowcharts for the LF-Series DIN AN transmitter:

- ProLink II menus
  - Configuration menu – Figures F-1 and F-2
  - Operating menus – Figure F-3
- Communicator 375 menus – Figures F-4 through F-8

For flowmeter zero, loop testing, and mA output trim procedures, see Chapter 5.

F.2 Outputs option board

The LF-Series DIN AN 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.

F.3 Communication tool requirements

F.3.1 ProLink II

ProLink II v2.1 or higher is required for full support of the LF-Series DIN AN transmitter. If you use previous versions of ProLink II, you will not be able to perform all functions.

F.3.2 Communicator

When the 375 Field Communicator is first connected to the LF-Series DIN AN transmitter, a warning message may be displayed. Press **CONT** to continue using the 375 Field Communicator with the LF-Series DIN AN transmitter.

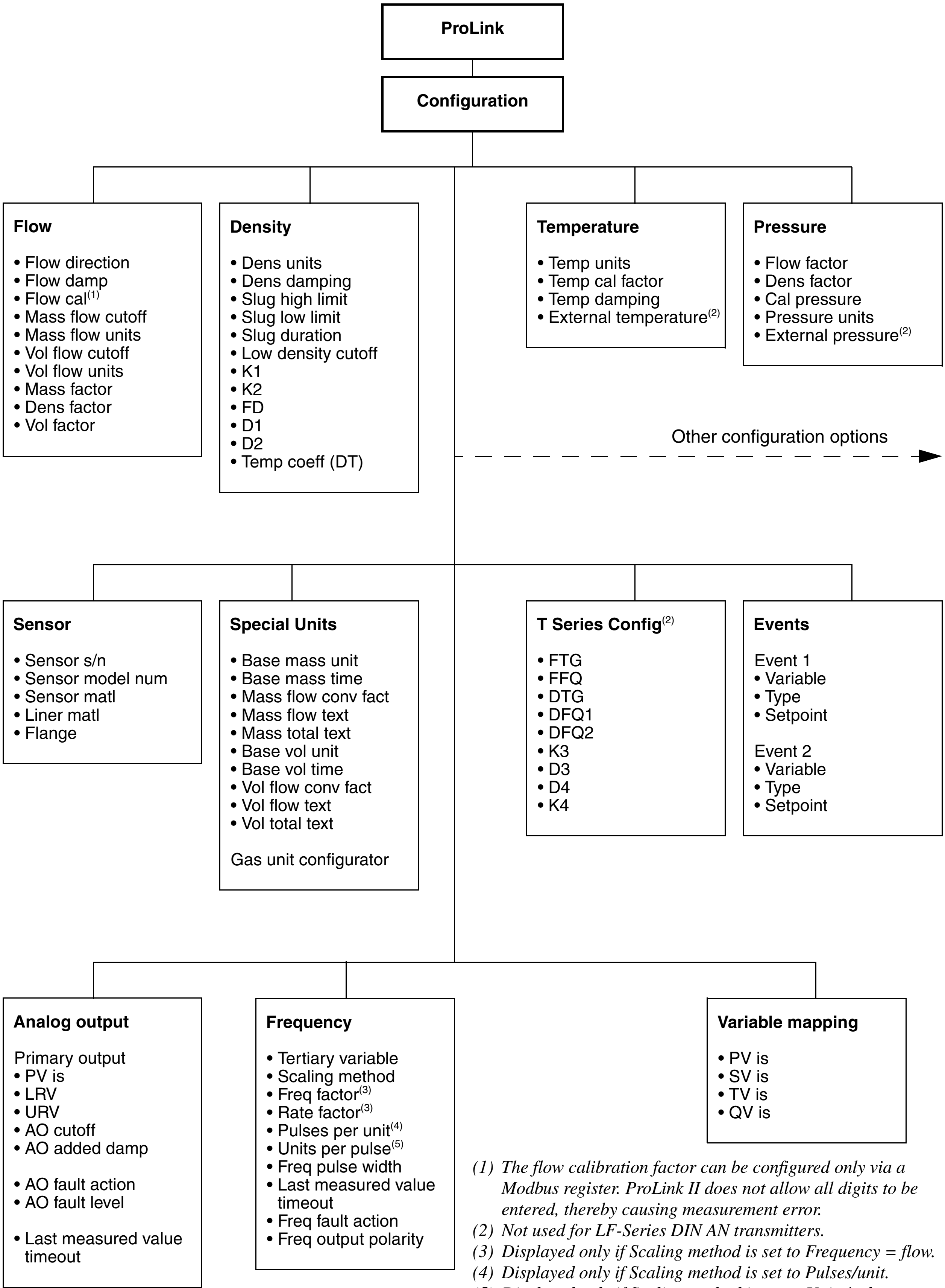
F.4 Version information

These menu flowcharts are based on:

- Transmitter software v4.1
- Sensor software v2.1
- ProLink II v2.1
- 375 Field Communicator device rev4, DD rev1

Menus may vary slightly for different versions of these components.

Figure F-1 ProLink II configuration menu



(1) The flow calibration factor can be configured only via a Modbus register. ProLink II does not allow all digits to be entered, thereby causing measurement error.

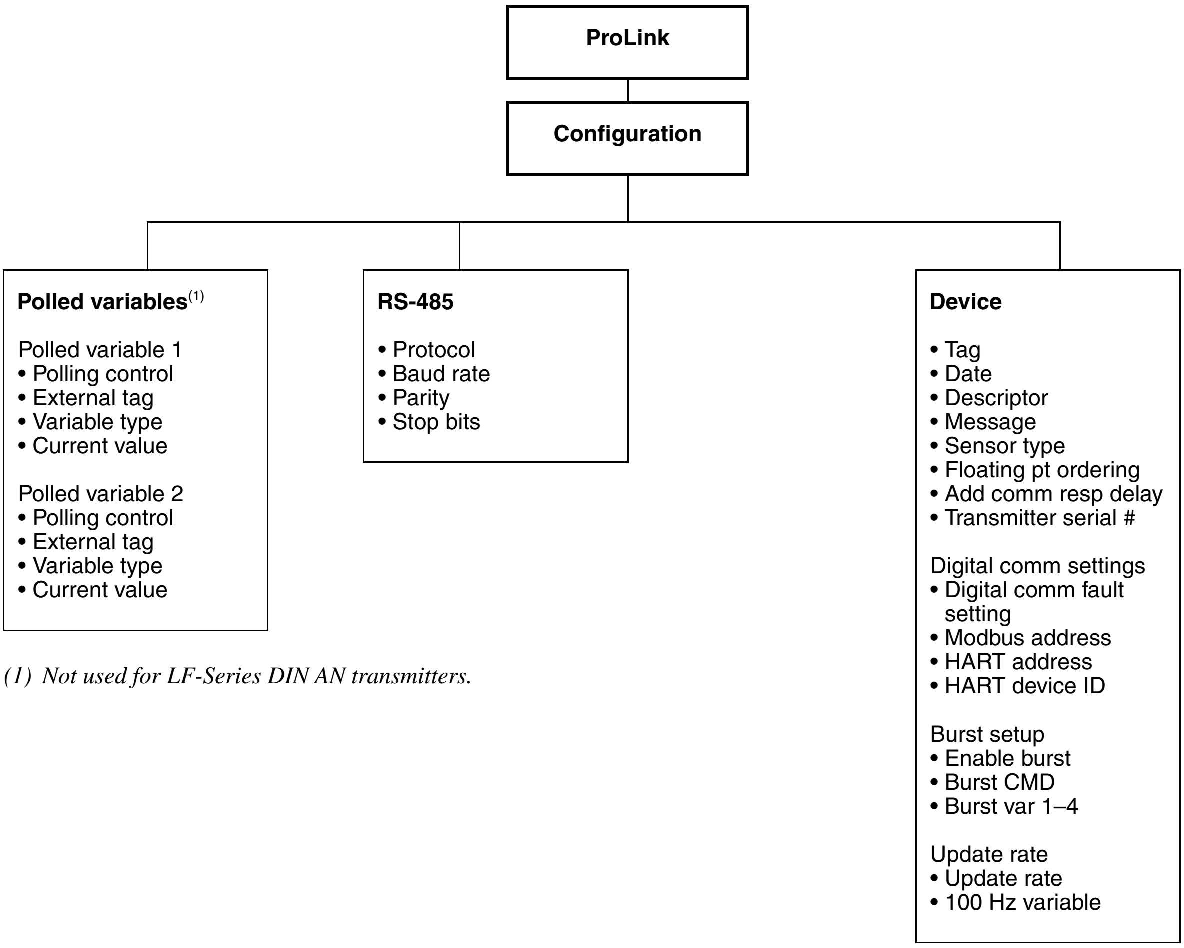
(2) Not used for LF-Series DIN AN transmitters.

(3) Displayed only if Scaling method is set to Frequency = flow.

(4) Displayed only if Scaling method is set to Pulses/unit.

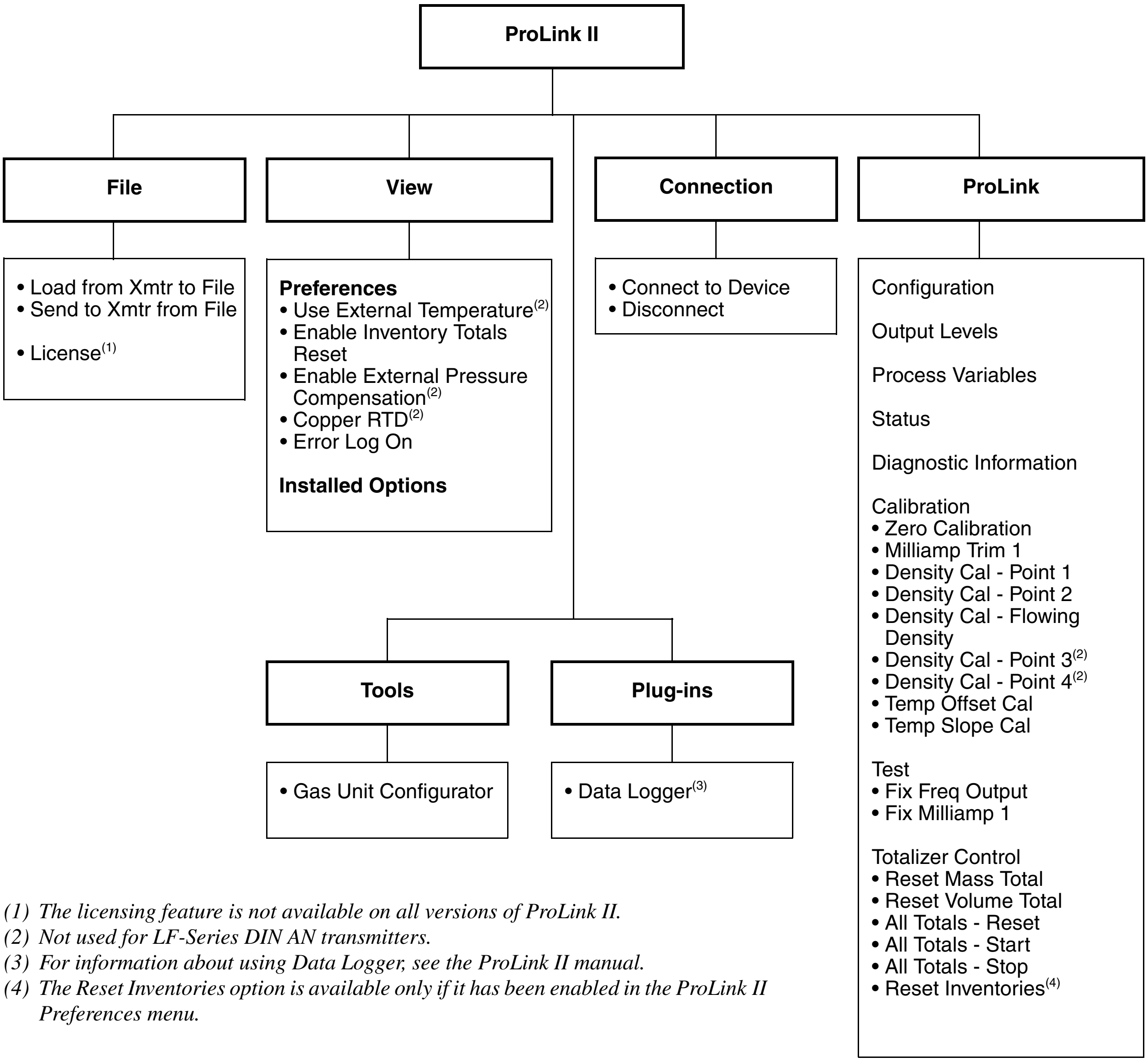
(5) Displayed only if Scaling method is set to Units/pulse.

Figure F-2 ProLink II configuration menu *continued*



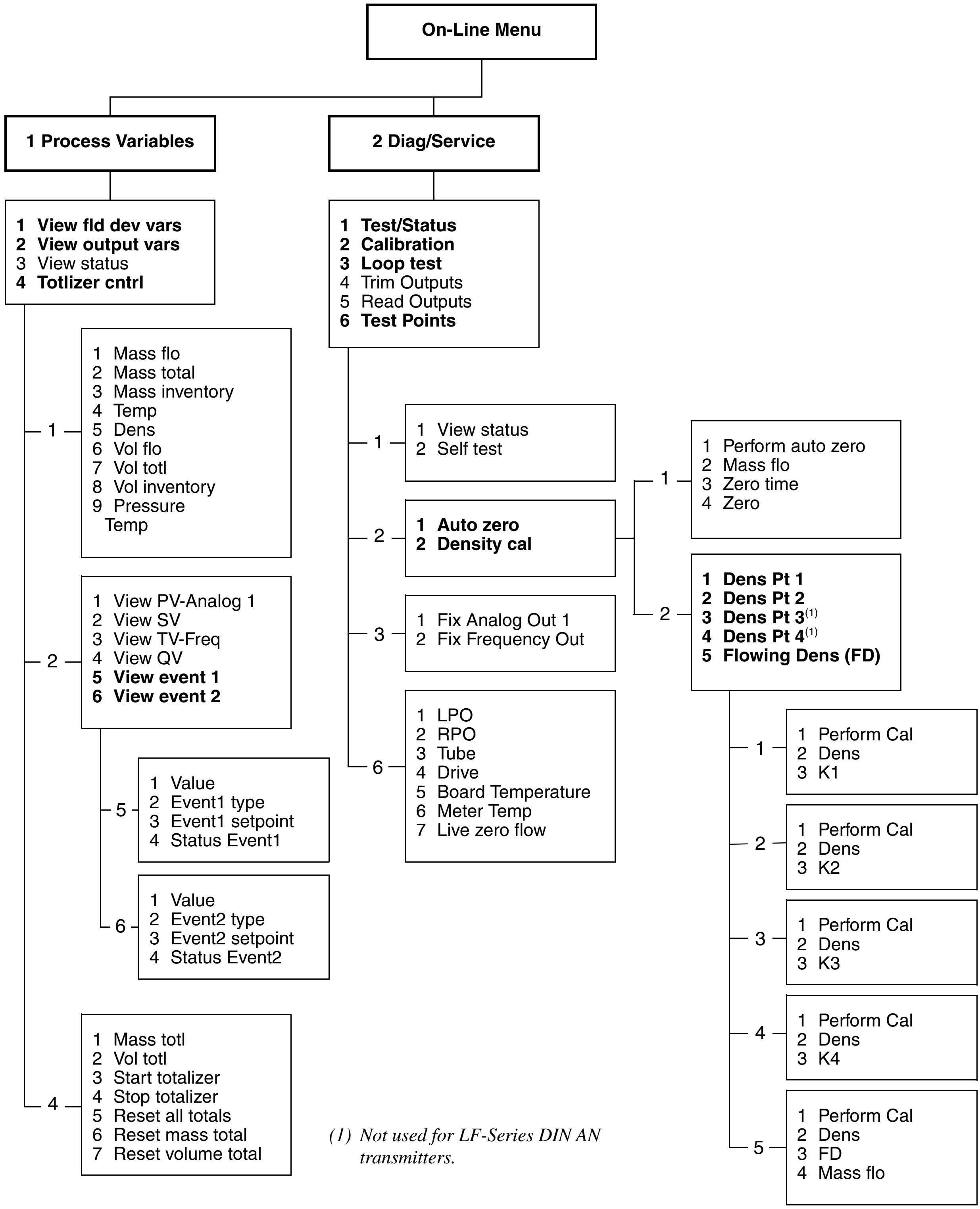
(1) Not used for LF-Series DIN AN transmitters.

Figure F-3 ProLink II operating menus



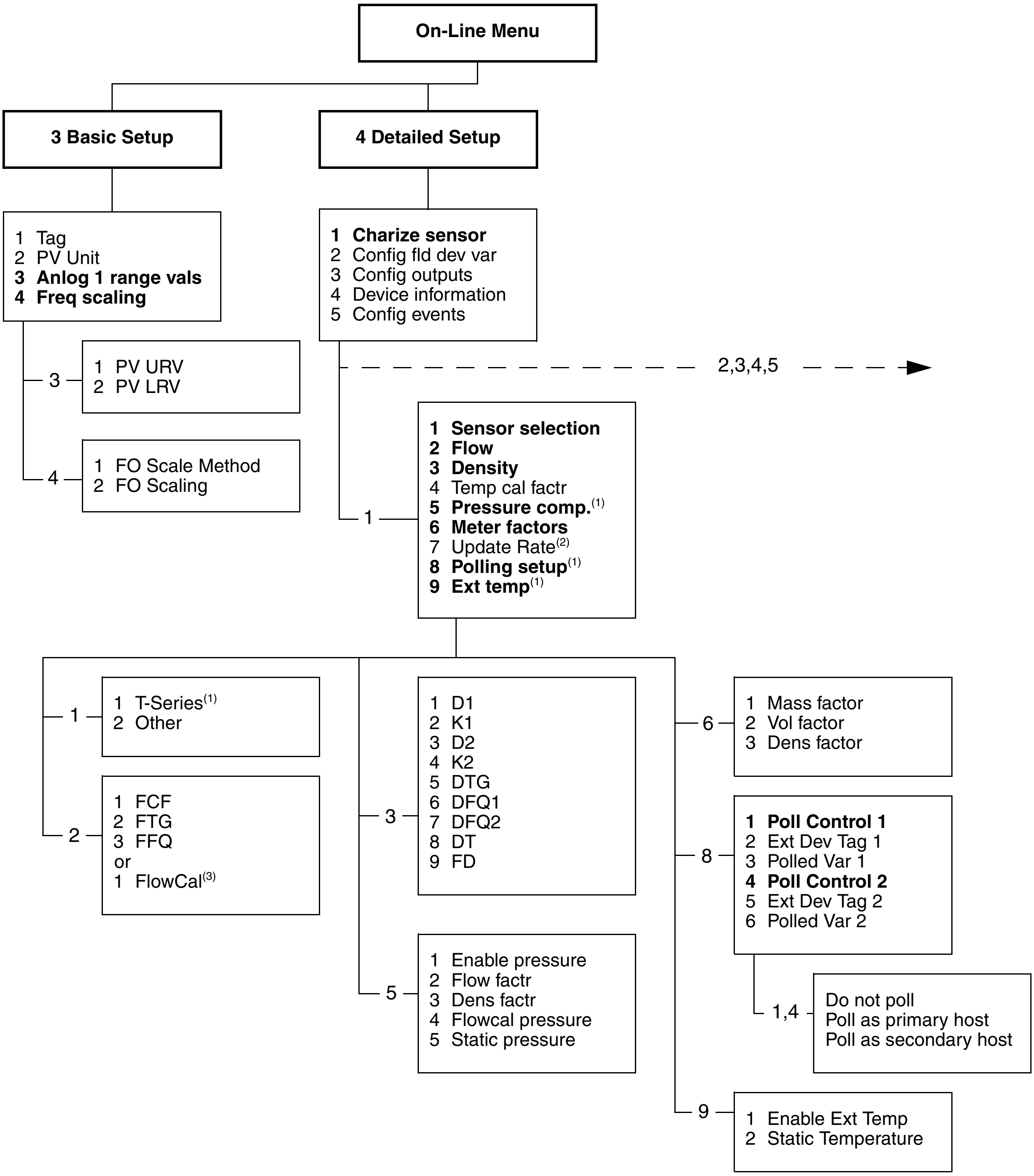
(1) The licensing feature is not available on all versions of ProLink II.
(2) Not used for LF-Series DIN AN transmitters.
(3) For information about using Data Logger, see the ProLink II manual.
(4) The Reset Inventories option is available only if it has been enabled in the ProLink II Preferences menu.

Figure F-4 Communicator menus



(1) Not used for LF-Series DIN AN transmitters.

Figure F-5 Communicator menus *continued*



(1) Not used for LF-Series DIN AN transmitters.
(2) If Update Rate is set to Special, a parameter called Update Rate Var is listed directly beneath Update Rate. Menu numbers are adjusted accordingly.
(3) The flow calibration factor can be configured only via a Modbus register. The Communicator does not allow all digits to be entered, thereby causing measurement error.

Figure F-6 Communicator menus *continued*

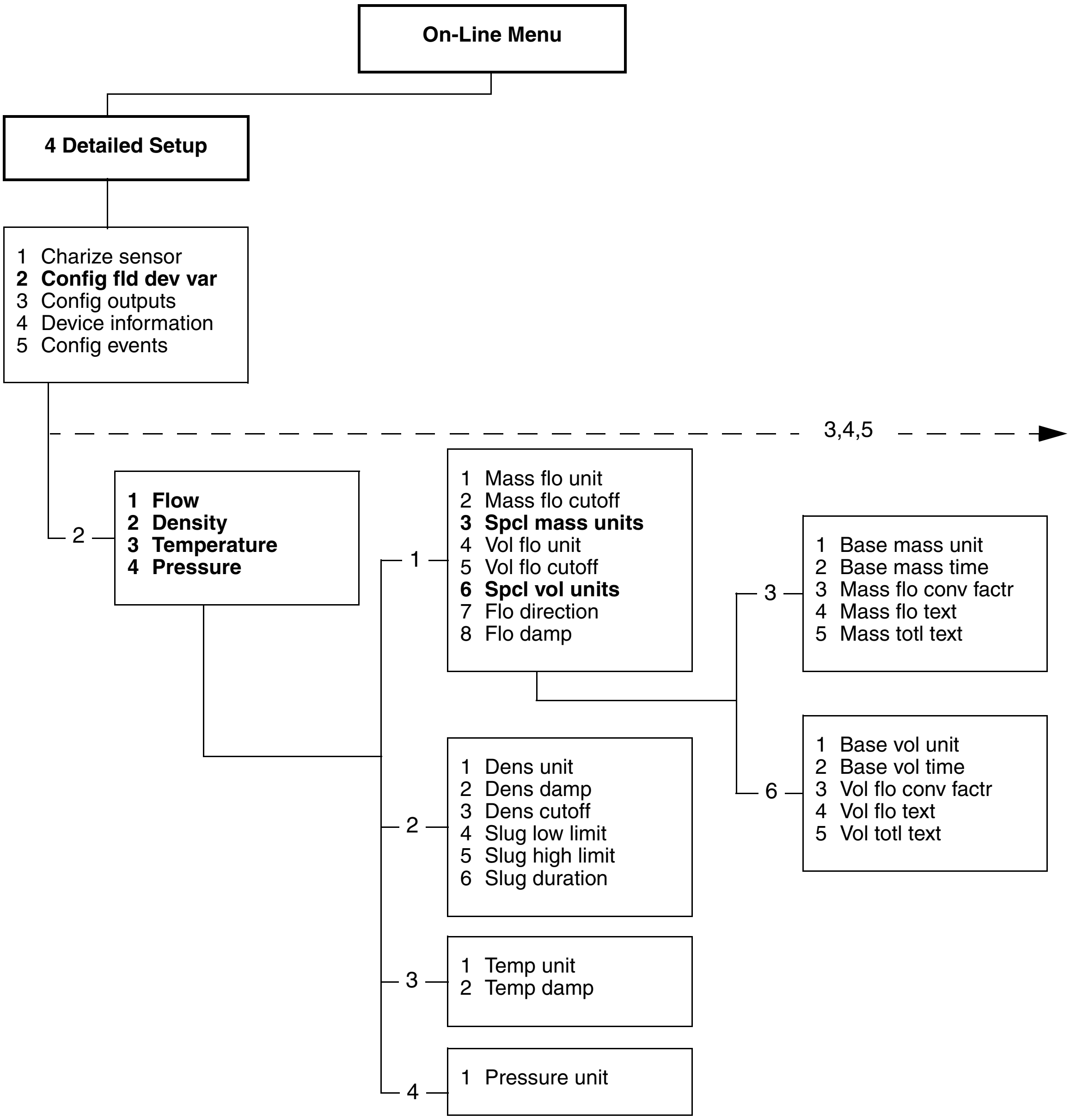


Figure F-7 **Communicator menus** *continued*

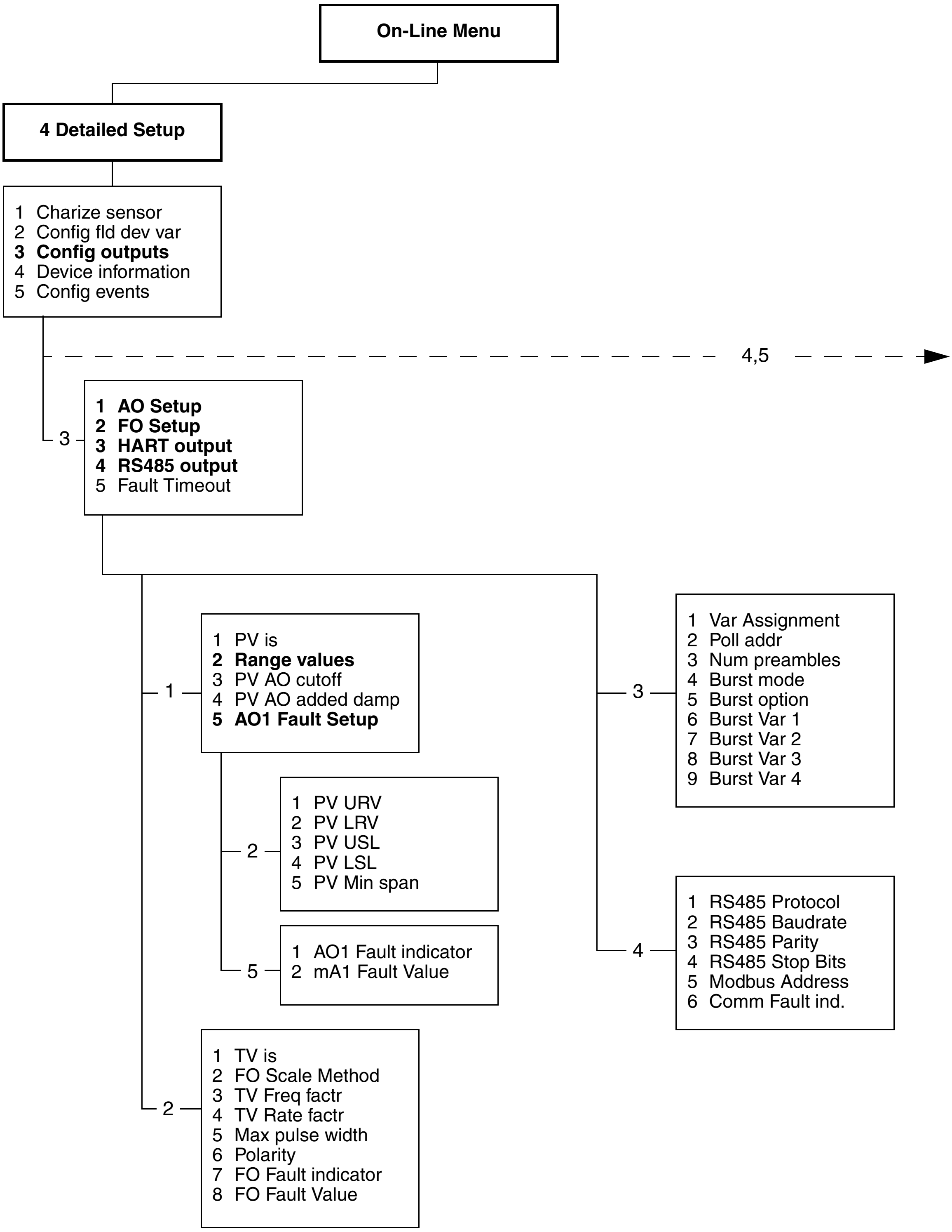
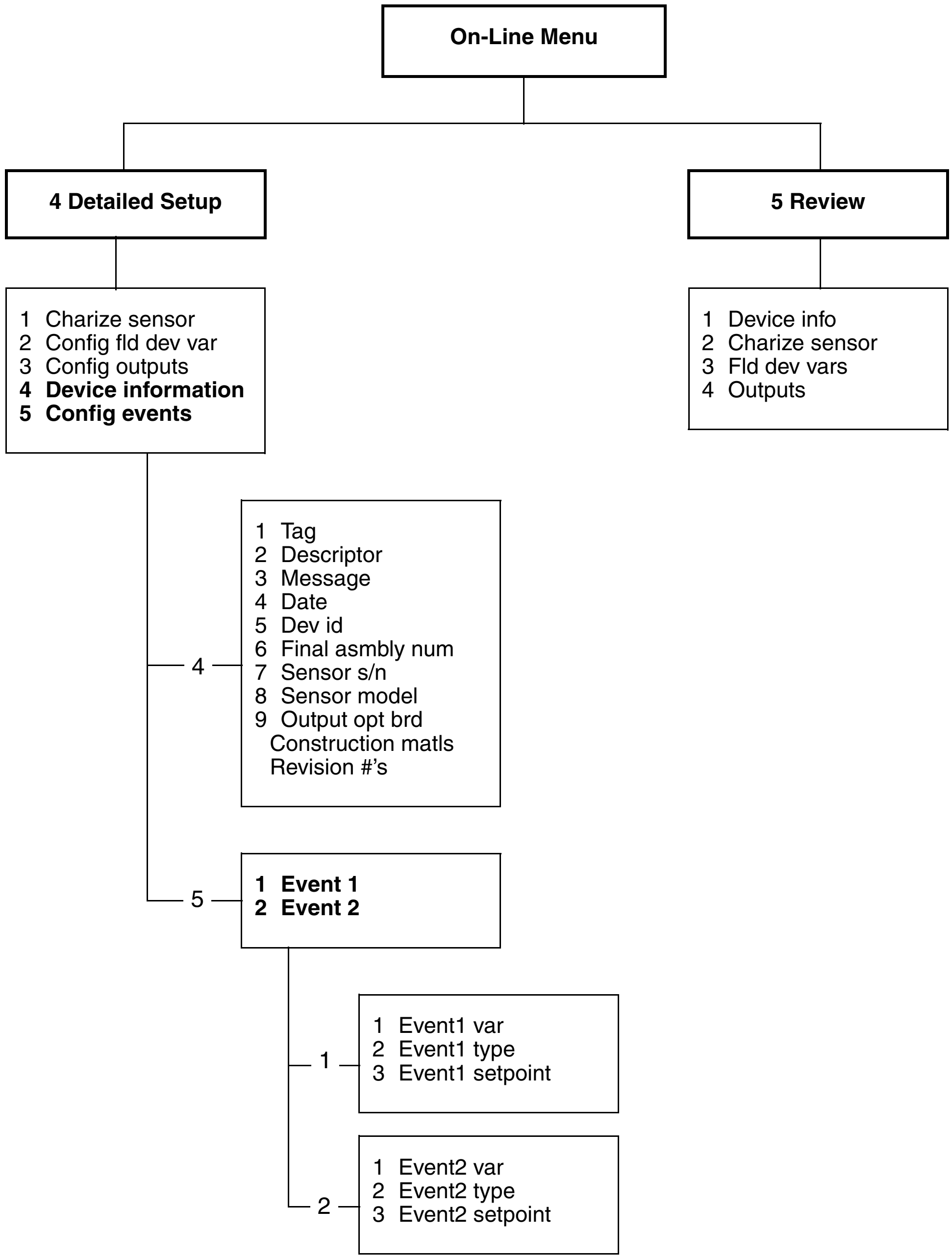


Figure F-8 Communicator menus *continued*



Appendix G
Menu Flowcharts – DIN CIO and DIN CIO FD Transmitters

G.1 Overview

This appendix provides the following menu flowcharts for the LF-Series DIN CIO and DIN CIO FD transmitters:

- ProLink II menus
  - Configuration menus – Figures G-1 and G-2
  - Operating menus – Figure G-3
- Communicator menus – Figures G-4 through G-8

For flowmeter zero, loop testing, and mA output trim procedures, see Chapter 5.

Note: DIN CIO FD transmitters are configurable only with ProLink II.

G.2 Communication tool requirements

G.2.1 ProLink II

ProLink II v2.0 or higher is required for full support of the LF-Series DIN CIO transmitter. ProLink II v2.3 or higher is required for full support of the LF-Series DIN CIO FD transmitter. If you use previous versions of ProLink II, you will not be able to perform all functions.

G.2.2 Communicator

For full support of the LF-Series DIN CIO transmitter, you must use the 375 Field Communicator. The DIN CIO FD transmitter is not compatible with the Communicator.

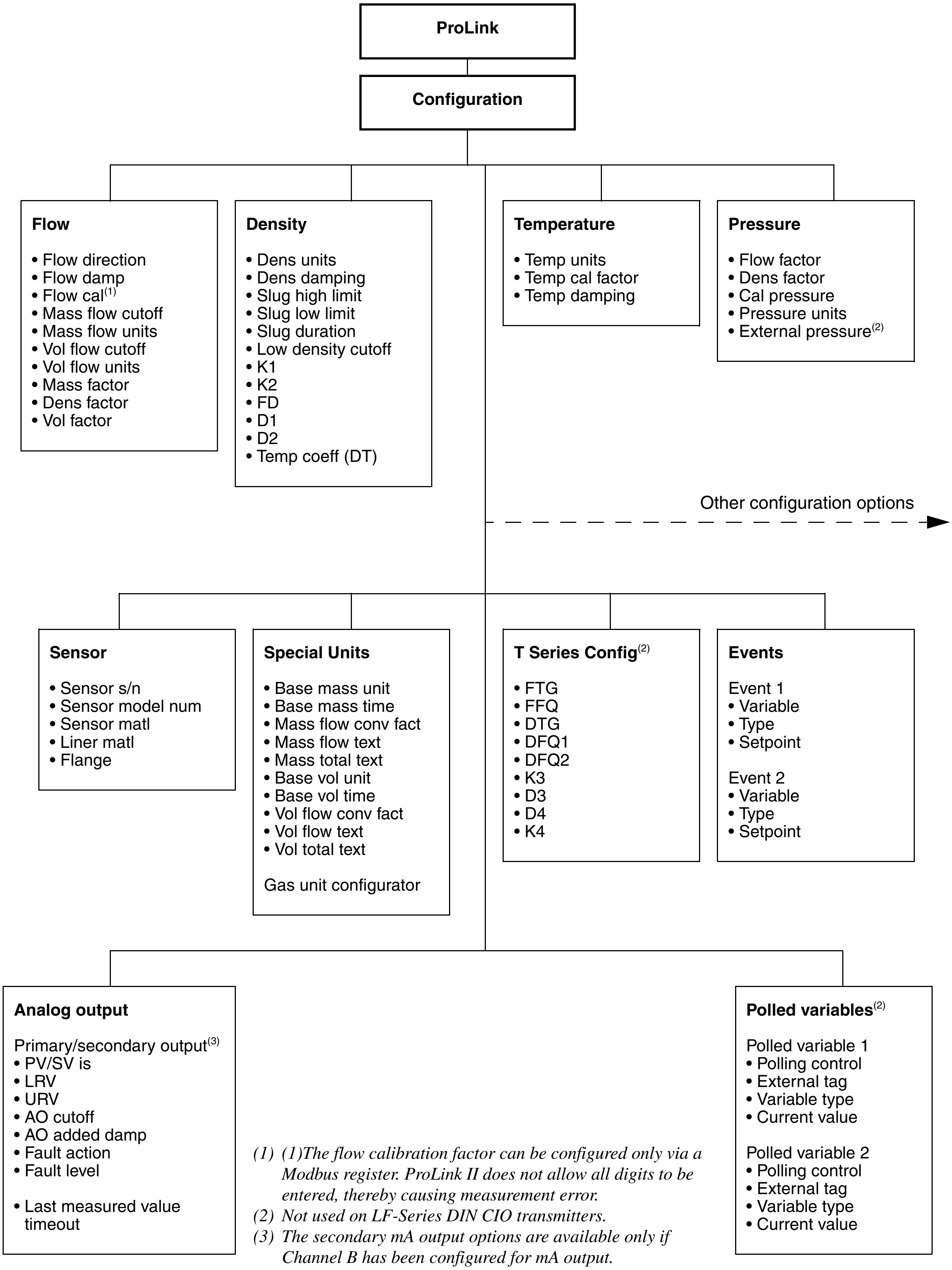
G.3 Version information

These menu flowcharts are based on:

- Transmitter software v4.0
- Sensor software v2.1
- ProLink II v2.1
- 375 Field Communicator device rev4, DD rev1 (menus apply also to DD rev2)

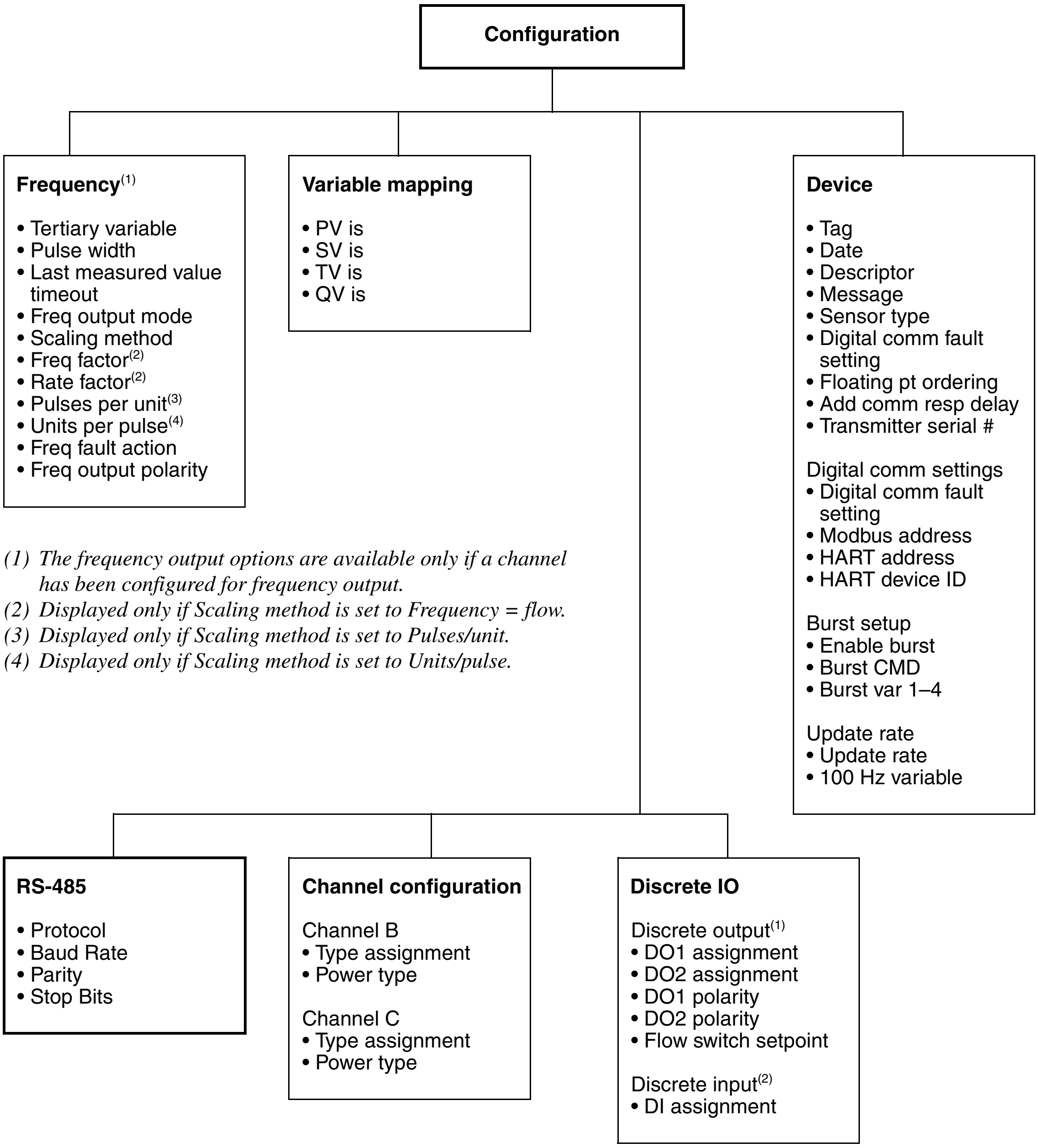
Menus may vary slightly for different versions of these components.

Figure G-1 ProLink II configuration menu



(1) (1)The flow calibration factor can be configured only via a Modbus register. ProLink II does not allow all digits to be entered, thereby causing measurement error.
(2) Not used on LF-Series DIN CIO transmitters.
(3) The secondary mA output options are available only if Channel B has been configured for mA output.

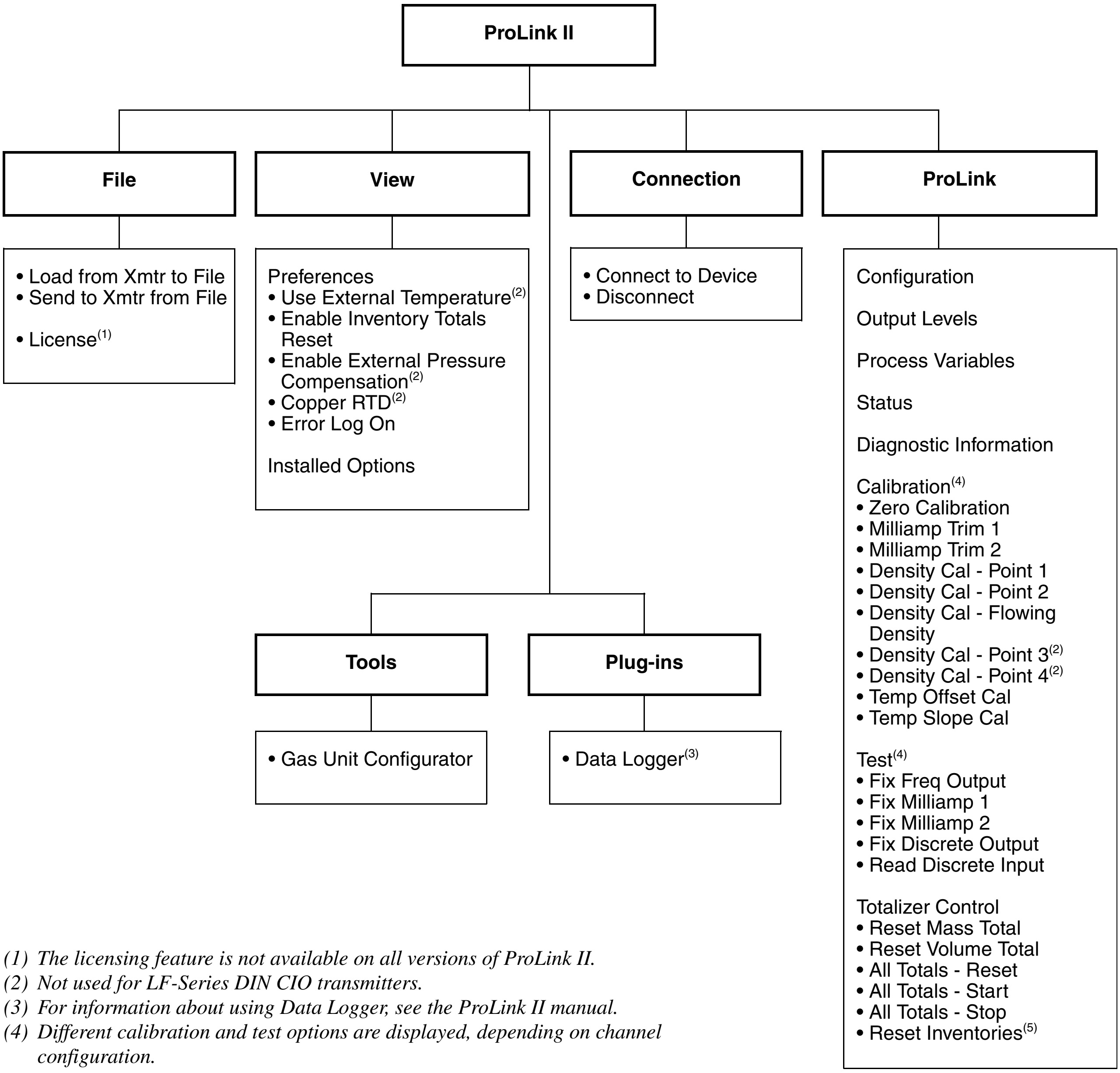
Figure G-2 ProLink II configuration menu *continued*



(1) The frequency output options are available only if a channel has been configured for frequency output.
(2) Displayed only if Scaling method is set to Frequency = flow.
(3) Displayed only if Scaling method is set to Pulses/unit.
(4) Displayed only if Scaling method is set to Units/pulse.

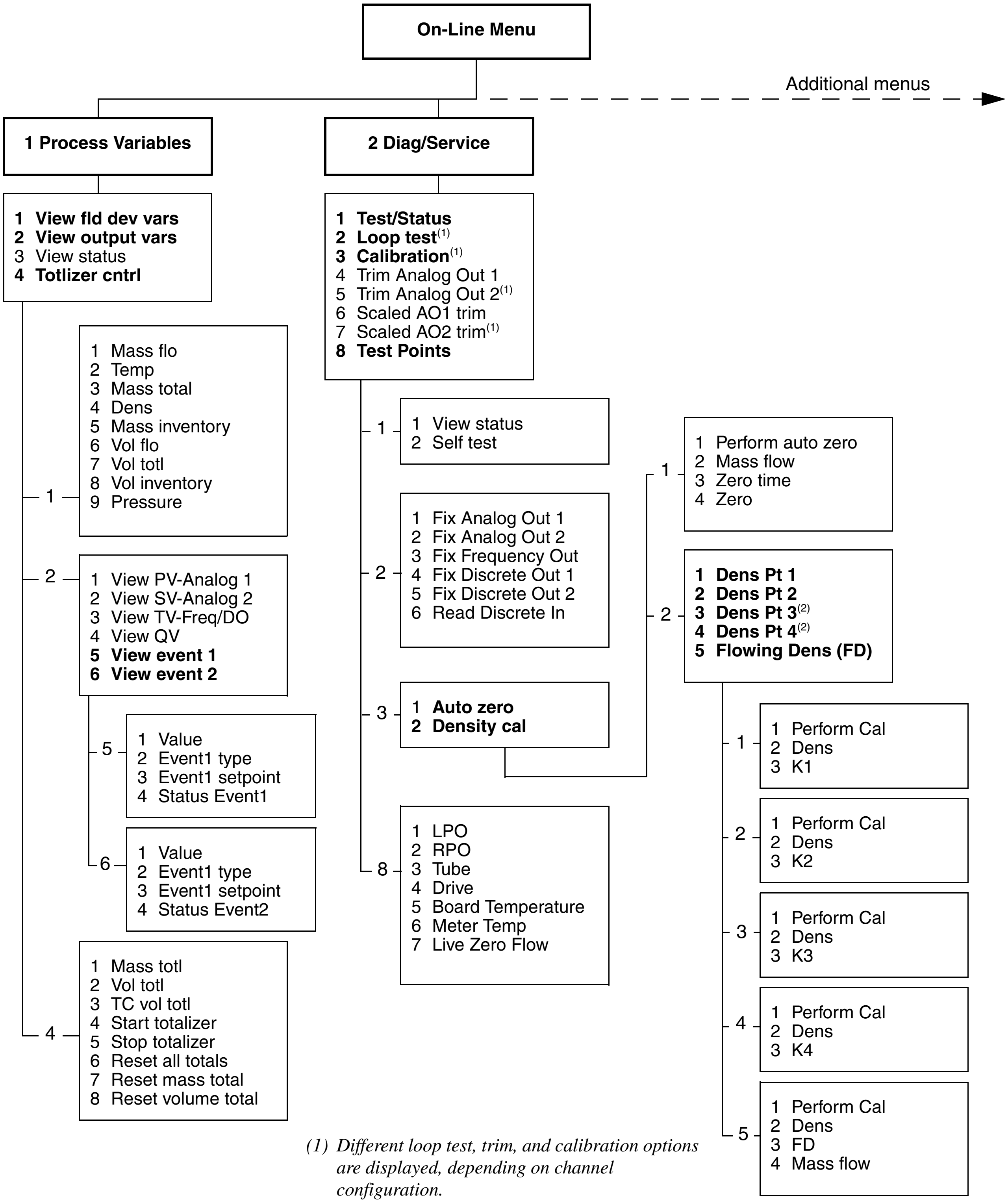
(1) The discrete output options are available only if a channel has been configured for discrete output.
(2) The discrete input options are available only if a channel has been configured for discrete input.

Figure G-3 ProLink II operating menus



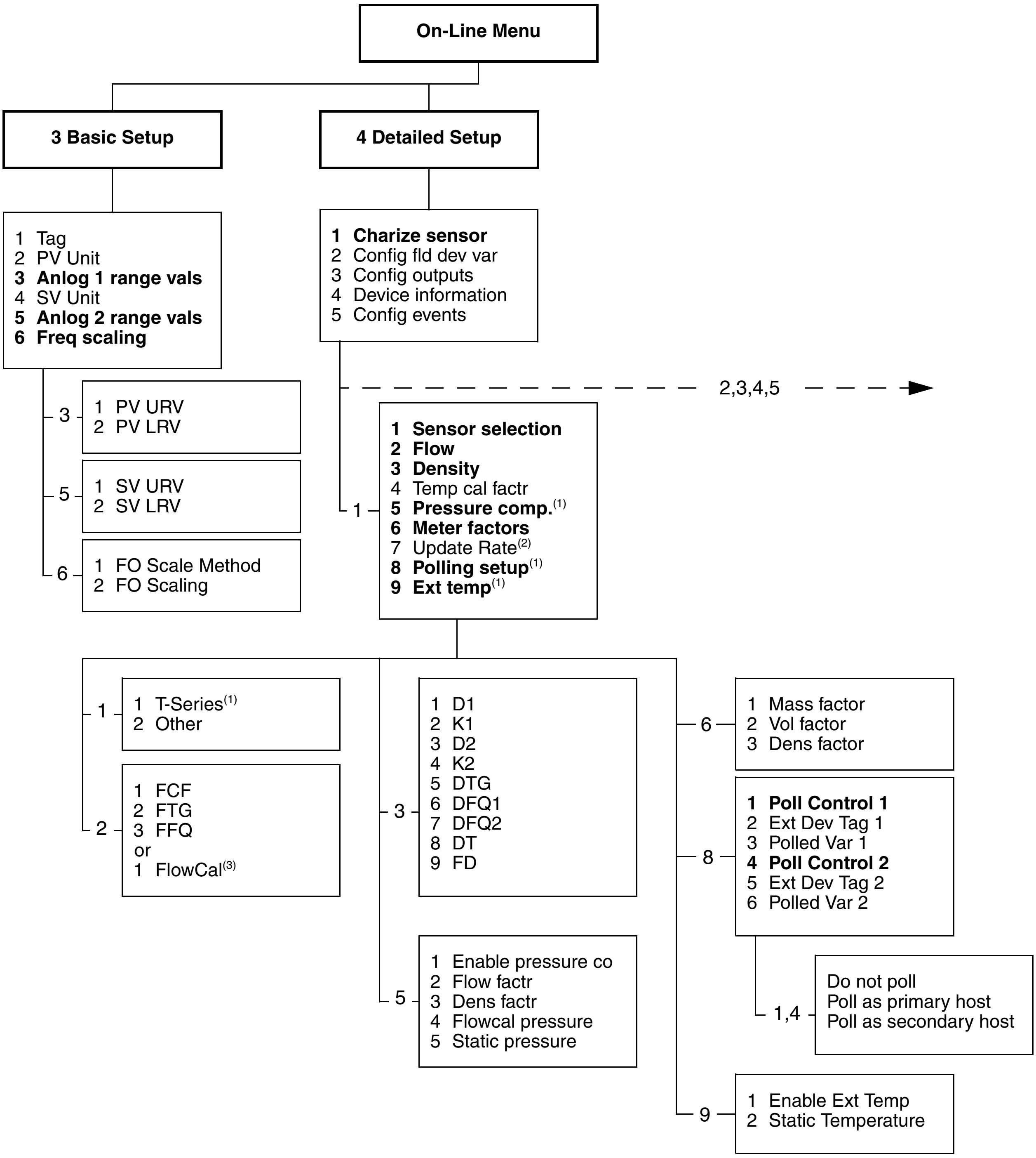
(1) *The licensing feature is not available on all versions of ProLink II.*
(2) *Not used for LF-Series DIN CIO transmitters.*
(3) *For information about using Data Logger, see the ProLink II manual.*
(4) *Different calibration and test options are displayed, depending on channel configuration.*
(5) *The Reset Inventories option is available only if it has been enabled in the ProLink II Preferences menu.*

Figure G-4 Communicator menus



(1) Different loop test, trim, and calibration options are displayed, depending on channel configuration.
(2) Not used for LF-Series DIN CIO transmitters.

Figure G-5 Communicator menus *continued*



(1) Not used for LF-Series DIN CIO transmitters.
(2) If Update Rate is set to Special, a parameter called Update Rate Var is listed directly beneath Update Rate. Menu numbers are adjusted accordingly.
(3) The flow calibration factor can be configured only via a Modbus register. The Communicator does not allow all digits to be entered, thereby causing measurement error.

Figure G-6 Communicator menus *continued*

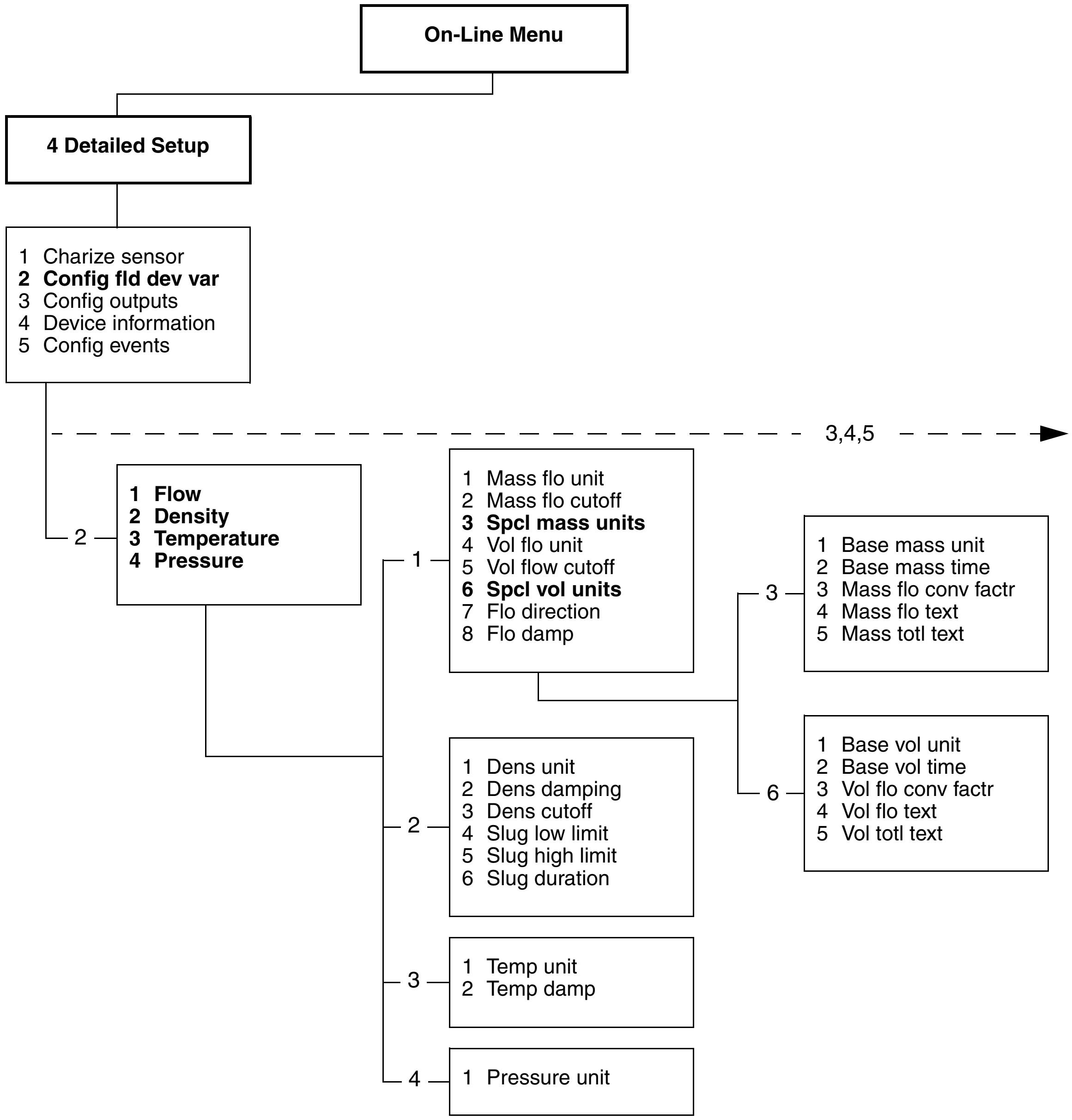
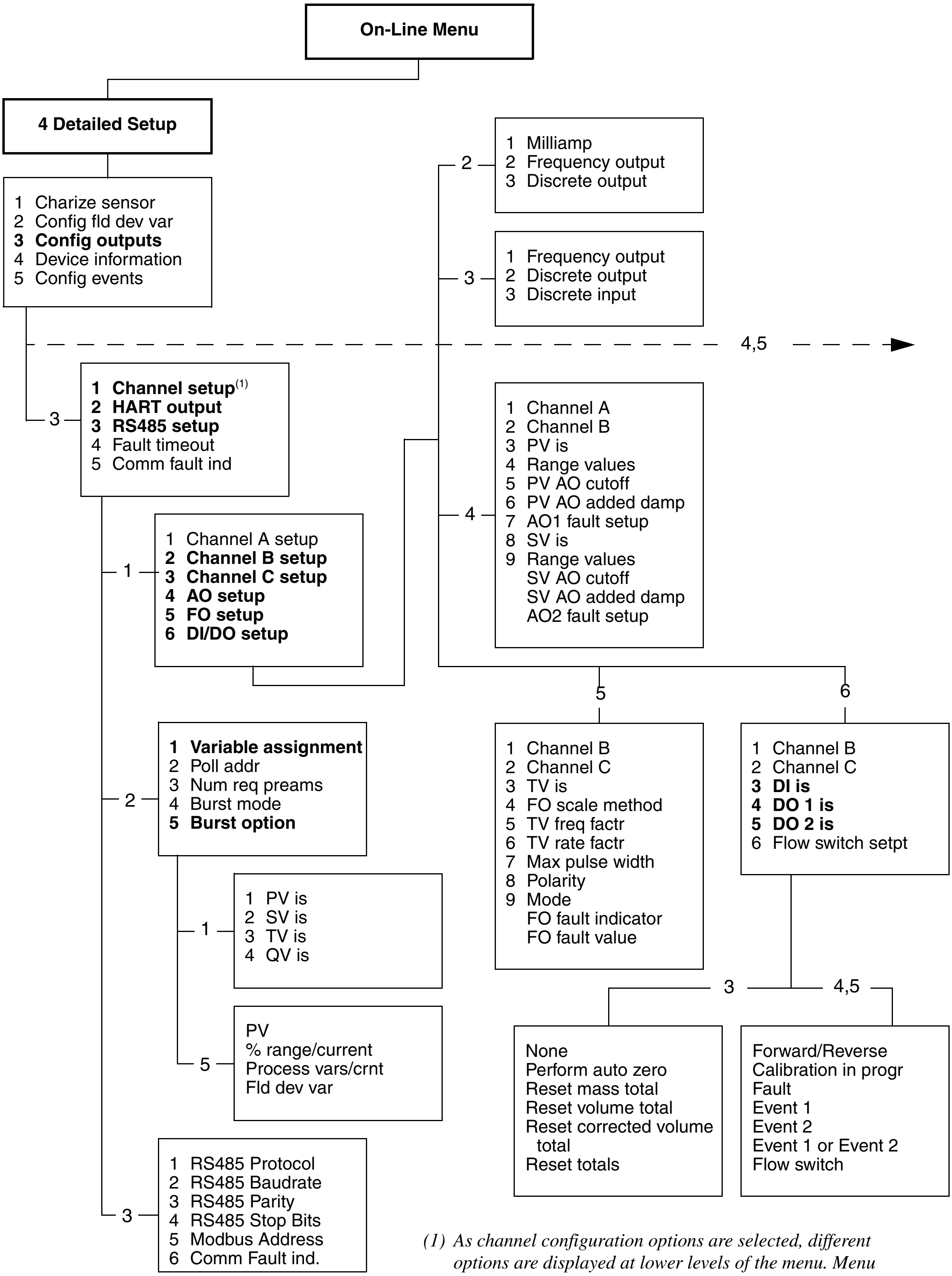
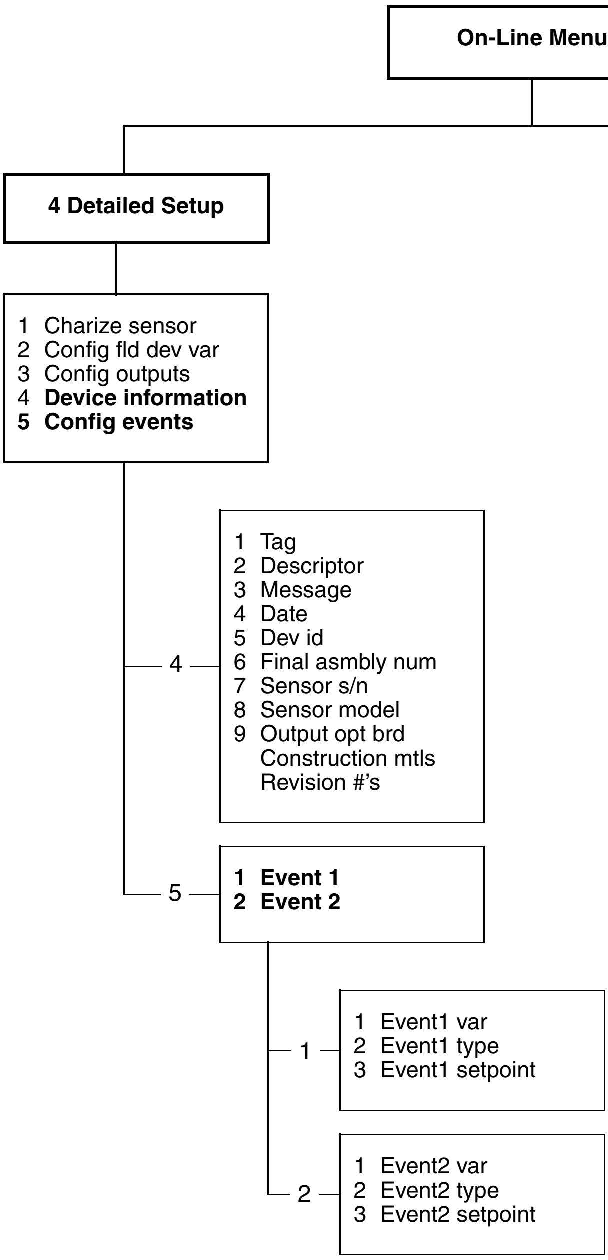


Figure G-7 Communicator menus *continued*



(1) As channel configuration options are selected, different options are displayed at lower levels of the menu. Menu numbers are adjusted accordingly. This menu does not show all configuration options.

Figure G-8 **Communicator menus** *continued*



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 8.14.4 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.

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_T	External temperature	
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	Mass flow rate	
NET V	Volume flow rate	
NETMI	Net mass inventory	
NETVI	Net volume inventory	
PWRIN	Input voltage	Refers to power input to the sensor
RDENS	Density at reference temperature	
RPO_A	Right pickoff amplitude	
SGU	Specific gravity units	
STD V	Standard volume flow rate	

Table H-1 Display codes used for display variables *continued*

Code or abbreviation	Definition	Comment or reference
STD V	Standard volume flow rate	
STDVI	Standard volume inventory	
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	
CHANGE PASSW	Change password	Change the password required for access to display functions
CONFG	Configuration	
CORE	Core processor component of sensor	
DENS	Density	
DGAIN	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	
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	
EVNT2	Event 2	
FLDIR	Flow direction	
FLSWT	Flow switch	
FO	Frequency output	
FREQ	Frequency	
M_ASC	Modbus ASCII	
M_RTU	Modbus RTU	
MAO1	mA output 1 (primary mA output)	

Table H-2 Display codes used in off-line menu *continued*

Code or abbreviation	Definition	Comment or reference
MAO2	mA output 2 (secondary mA output)	
MASS	Mass flow	
MBUS	Modbus	
MFLOW	Mass flow	
OFF-LINE MAINT	Off-line maintenance	
r.	Revision	
SIM	Simulation	
SPECL	Special	
SrC	Source	
TEMPR	Temperature	
VER	Version	
VFLOW	Volume flow	
VOL	Vol flow	
XMTR	Transmitter	

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

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

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

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

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

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