Configuration and Use Manual
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Micro Motion®
Model 2400S Transmitters for PROFIBUS-DP

Configuration and Use Manual

Micro Motion®

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Process Management

Contents

Chapter 1
Before You Begin

1.1 Overview

This chapter provides an orientation to the use of this manual, and includes a configuration overview flowchart and a pre-configuration worksheet. This manual describes the procedures required to start, configure, use, maintain, and troubleshoot the Micro Motion® Model 2400S transmitter for PROFIBUS-DP (the Model 2400S DP transmitter).

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

Note: Information on configuration and use of Model 2400S transmitters with different I/O options is provided in separate manuals. See the manual for your transmitter.

1.2 Safety

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

1.3 Determining transmitter information

Transmitter type, user interface option, and output options are encoded in the model number located on the transmitter tag. The model number is a string of the following form:

2400S*X*X****

In this string:

- **2400S** identifies the transmitter family.
- The first **X** (the seventh character) identifies the I/O option: **D** = PROFIBUS-DP
- The second **X** (the ninth character) identifies the user interface option:
  - **1** = Display with glass lens
  - **3** = No display
  - **4** = Display with non-glass lens

1.4 PROFIBUS-DP functionality

The Model 2400S DP transmitter implements the following PROFIBUS-DP functionality:

- Baud rates: standard baud rates between 9.6 kbits/sec and 12.0 Mbits/sec, automatically detected by transmitter
- I/O slave messaging:
  - Data exchange
  - Acyclic
- Configuration methods:
  - Node address: hardware address switches or software addressing
  - Device description (EDD) conforming to the following: *Specification for PROFIBUS Device Description and Device Integration: Volume 2: EDDL V1.1*, *January 2001*
  - DP-V1 read and write services with PROFIBUS bus parameters
- Operation methods:
  - GSD conforming to the following: *Specification for PROFIBUS Device Description and Device Integration: Volume 1: GSD V5.0*, *May 2003*
  - DP-V0 cyclic services
  - Device description listed above
  - DP-V1 read and write services
- Identification and maintenance (I&M) functions:
  - I&M 0
  - I&M 1

  as specified in *Profile Guidelines Part 1: Identification & Maintenance Functions Version 1.1.1*, March 2005.

1.5 Determining version information

Table 1-1 lists the version information that you may need and describes how to obtain the information. (Additional information is available via the I&M functions. See Section 7.2.)

Table 1-1 Obtaining version information

Component	Tool	Method
Transmitter software	With ProLink II	**View > Installed Options > Software Revision**
	With EDD	**MMI Coriolis Flow > Configuration Parameters > Device**
	With display	**OFF-LINE MAINT > VER**
ProLink II	With ProLink II	**Help > About ProLink II**
GSD version	Text editor	Open file **MMI0A60.GSD** Check parameter **GSD_Revision**
EDD version	Text editor	Open file **MMICorFlowDP.ddl** Check parameter **DD_Revision**

1.6 Communication tools

Most of the procedures described in this manual require the use of a communication tool. Table 1-2 lists the communication tools that can be used, with their functionality and requirements.

Note: You can use either ProLink II, the EDD, or PROFIBUS bus parameters for transmitter setup and maintenance. It is not necessary to have more than one of these methods available.

Table 1-2 Communication tools for Model 2400S DP transmitter

	Functionality		
Tool	**View/operation**	**Setup/maintenance**	**Requirement**
Transmitter display	Partial	Partial	Transmitter with display
ProLink® II	Full	Full(1)	v2.5 (preliminary implementation) v2.6 (full implementation)
Pocket ProLink®	Full	Full(1)	v1.3 (preliminary implementation) v1.4 (full implementation)
PROFIBUS host			
• GSD	Partial	None	GSD file (**MMI0A60.GSD**)
• EDD	Full	Full(1)	EDD file set
• Bus parameters	Full	Full(1)	None

(1) Except for node address.

The EDD and the GSD can be downloaded from the Micro Motion web site: **www.micromotion.com**.

In this manual:

- Basic information on using the transmitter's user interface and display is provided in Chapter 3.
- Basic information on using ProLink II or Pocket ProLink, and connecting ProLink II or Pocket ProLink to your transmitter, is provided in Chapter 4. For more information, see the ProLink II or Pocket ProLink manual, available on the Micro Motion web site (www.micromotion.com).
- Basic information on using a PROFIBUS host is provided in Chapter 5.

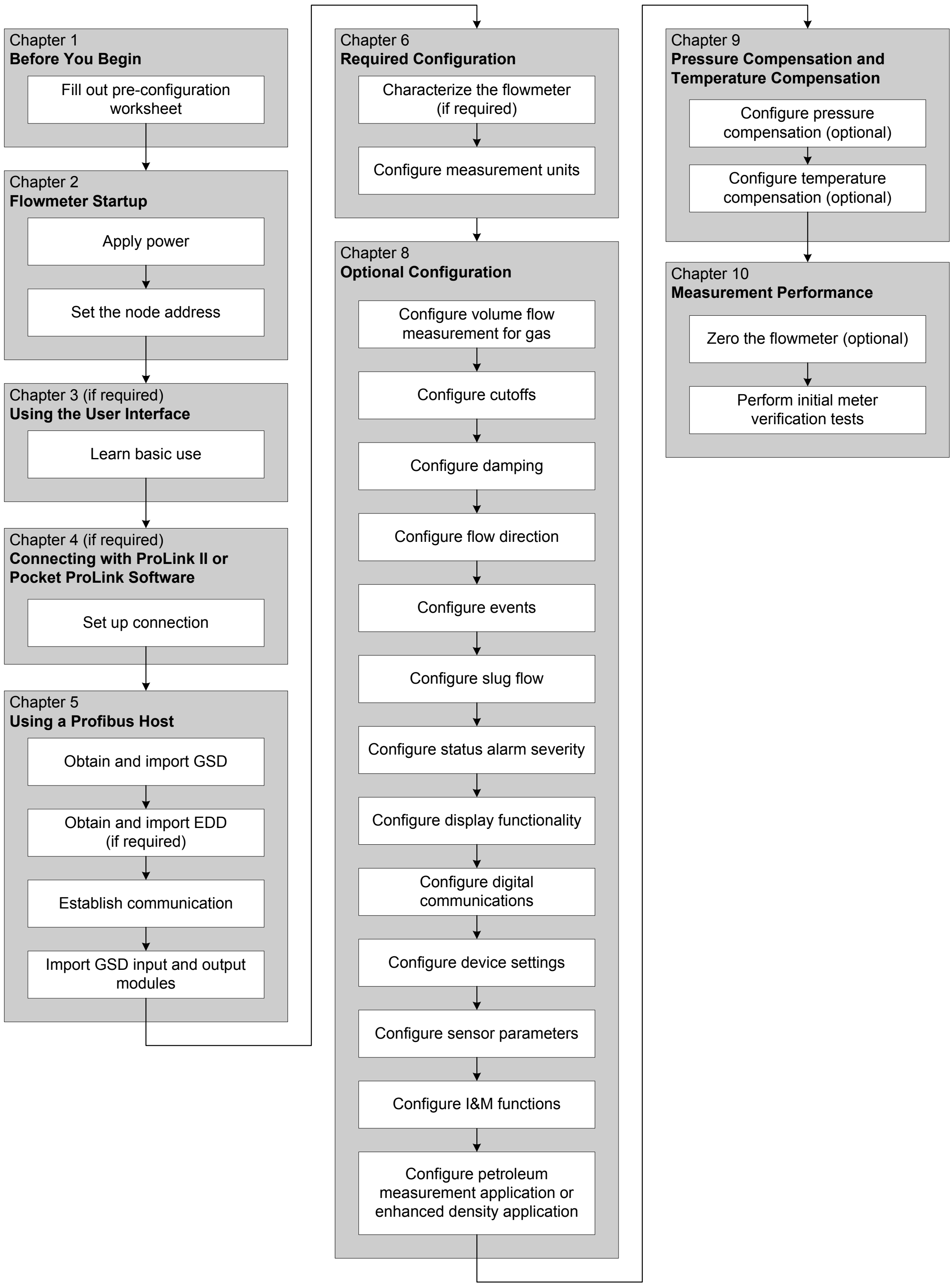
1.7 Planning the configuration

Refer to the configuration overview flowchart in Figure 1-1 to plan transmitter configuration. In general, perform configuration steps in the order shown here.

Note: Depending on your installation and application, some configuration tasks may be optional.

Note: This manual provides information on topics that are not included in the configuration overview flowchart, e.g.: using the transmitter, troubleshooting, and calibration procedures. Be sure to review these topics as required.

Figure 1-1 Configuration overview



1.8 Pre-configuration worksheet

The pre-configuration worksheet provides a place to record information about your flowmeter and your application. This information will affect your configuration options as you work through this manual. 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.

Pre-configuration worksheet **Transmitter** ____________________

Item		Configuration data
Transmitter model number		____________________
Transmitter serial number		____________________
Transmitter software revision		____________________
Sensor model number		____________________
Sensor serial number		____________________
PROFIBUS-DP node address		____________________
Measurement units	Mass flow	____________________
	Volume flow	____________________
	Density	____________________
	Pressure	____________________
	Temperature	____________________
Installed applications		☐ Micro Motion Smart Meter Verification ☐ Meter verification application, original version ☐ Petroleum measurement application ☐ Enhanced density application

1.9 Flowmeter documentation

Table 1-3 lists documentation sources for additional information.

Table 1-3 Flowmeter documentation resources

Topic	Document
Sensor installation	Sensor documentation
Transmitter installation	*Micro Motion® Model 2400S Transmitters: Installation Manual*
Hazardous area installation	See the approval documentation shipped with the transmitter, or download the appropriate documentation from the Micro Motion web site (www.micromotion.com)

1.10 Micro Motion customer service

For customer service, phone the support center nearest you:

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

Customers outside the U.S.A. can also email Micro Motion customer service at *flow.support@emerson.com*.

Chapter 2
Flowmeter Startup

2.1 Overview

This chapter describes the following procedures:

- Setting the node address – see Section 2.2
- Bringing the flowmeter online – see Section 2.3

2.2 Setting the node address

Three address switches are provided on the user interface module (see Figure 3-1 or Figure 3-2). These switches are used to set a three-digit node address for the device:

- The leftmost switch sets the first digit.
- The center switch sets the second digit.
- The rightmost switch sets the third digit.

The default setting for the address switches is **126**.

You can set the node address manually before bringing the device online, by rotating the address switches to any value between **0** and **125**. If the transmitter was powered on at the time the address switches were set, it will not accept the new node address until you perform a power cycle.

If the transmitter is brought online with the switches set to **126**:

- The device shows up at address **126** in the live list.
- You can set the node address programmatically by sending a Set Slave Address telegram from the PROFIBUS host.
- You can set the node address manually by rotating the switches to any value between **0** and **125**, then power-cycling the device.

For more information on setting the node address, see Section 8.10.1.

Note: It is not necessary to set the baud rate. because the Model 2400S DP transmitter automatically detects and uses the DP segment baud rate.

2.3 Bringing the transmitter online

To bring the transmitter online:

1. Follow appropriate procedures to ensure that the process of configuring and commissioning the Model 2400S DP transmitter does not interfere with existing measurement and control loops.
2. Ensure that the PROFIBUS cable is connected to the transmitter as described in the transmitter installation manual.
3. Ensure that all transmitter and sensor covers and seals are closed.

⚠ WARNING

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

To avoid electrical hazards, ensure that the transmitter housing cover and all other covers are in place before connecting the transmitter to the network.

4. Apply power to the transmitter. The flowmeter will automatically perform diagnostic routines. When the flowmeter has completed its power-up sequence, the status LED will turn green. If the status LED exhibits different behavior, an alarm condition is present or transmitter calibration is in progress. See Section 7.6.

Note: If this is the initial startup, or if power has been off long enough to allow components to reach ambient temperature, the flowmeter is ready to receive process fluid approximately one minute after power-up. However, it may take up to ten minutes for the electronics in the flowmeter to reach thermal equilibrium. During this warm-up period, you may observe minor measurement instability or inaccuracy.

5. Ensure that the transmitter is visible on the network. For information on establishing communications between the Model 2400S DP transmitter and a PROFIBUS host, see Chapter 5.

Chapter 3
Using the Transmitter User Interface

3.1 Overview

This chapter describes the user interface of the Model 2400S DP transmitter. The following topics are discussed:

- Transmitters without or with display – see Section 3.2
- Removing and replacing the transmitter housing cover – see Section 3.3
- Using the **Scroll** and **Select** optical switches – see Section 3.4
- Using the display – see Section 3.5

3.2 User interface without or with display

The user interface of the Model 2400S DP transmitter depends on whether it was ordered with or without a display:

- If ordered without a display, there is no LCD panel on the user interface. The user interface provides the following features and functions:
  - Three address switches, used to set the PROFIBUS node address
  - An internal termination resistor switch
  - Three LEDs: a status LED, a network LED, and a software address LED
  - Service port clips
  - Zero button

  For all other functions, either ProLink II or a customer-supplied PROFIBUS host is required.
- If ordered with a display, no zero button is provided (you must zero the transmitter with the display menu, ProLink II, or a PROFIBUS host), and the following features are added:
  - An LCD panel, which displays process variable data and also provides access to the off-line menu for basic configuration and management. Optical switches are provided for LCD control.
  - An IrDA port which provides wireless access to the service port

Note: The off-line menu does not provide access to all transmitter functionality; for access to all transmitter functionality, either ProLink II, the EDD, or PROFIBUS bus parameters must be used.

Figures 3-1 and 3-2 show the user interface of the Model 2400S DP transmitter without and with a display. In both illustrations, the transmitter housing cover has been removed.

Figure 3-1 User interface – Transmitters without display

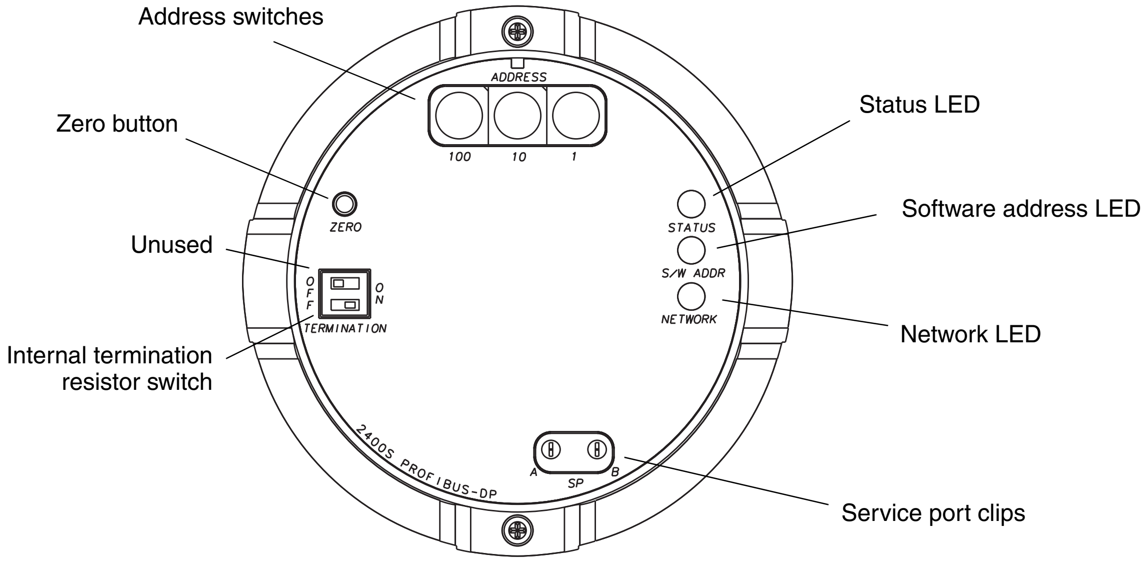
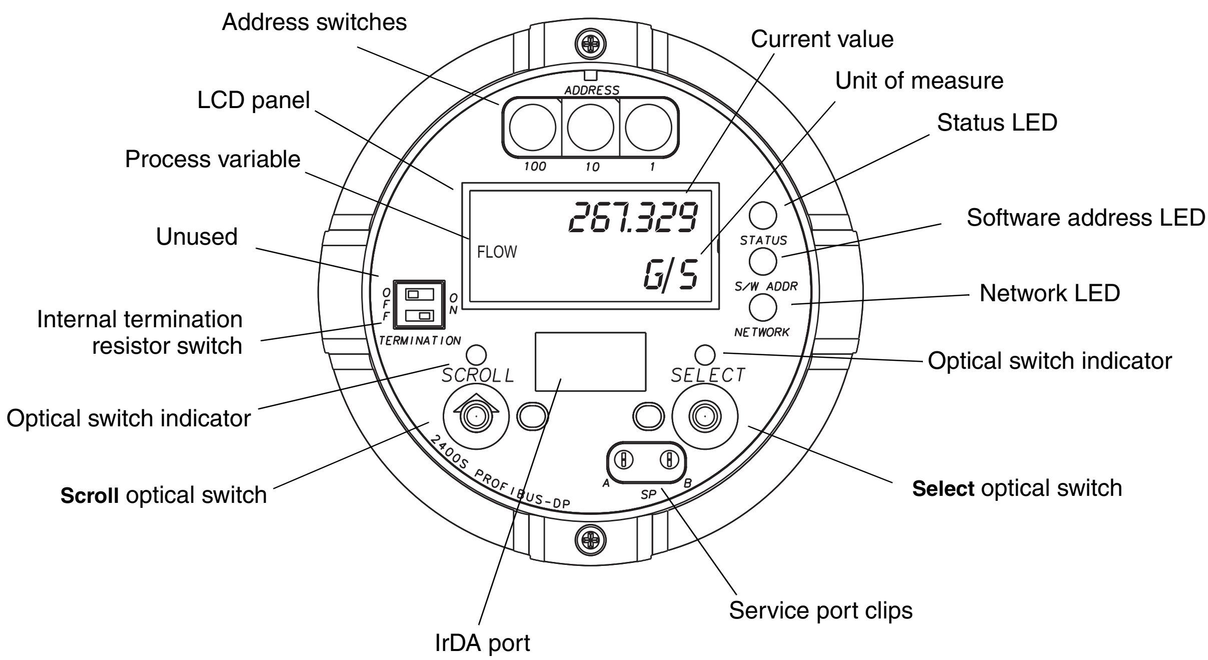


Figure 3-2 User interface – Transmitters with display



If the transmitter does not have a display, the transmitter housing cover must be removed to access all user interface features and functions.

If the transmitter has a display, the transmitter housing cover has a lens. All of the features shown in Figure 3-2 are visible through the lens, and the following functions may be performed through the lens (i.e., with the transmitter housing cover in place):

- Viewing the LEDs
- Viewing the LCD panel
- Using the **Select** and **Scroll** optical switches
- Making a service port connection via the IrDA port

All other functions require removal of the transmitter housing cover.

For information on:

- Using the address switches, see Section 8.10.1.
- Using the LEDs, see Section 7.5.
- Making a service port connection, see Section 4.4.
- Using the zero button, see Section 10.5.

Note: The termination resistor switch is used to enable or disable the internal terminator. The internal terminator can be used instead of an external terminator if termination is required at the transmitter.

3.3 Removing and replacing the transmitter housing cover

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

1. If the transmitter is in a Division 2 or Zone 2 area, remove power from the unit.

⚠ WARNING

Removing the transmitter housing cover in a Division 2 or Zone 2 area while the transmitter is powered up can cause an explosion.

To avoid the risk of an explosion, remove power from the transmitter before removing the transmitter housing cover.

2. Loosen the four captive screws.
3. Lift the transmitter housing cover away from the transmitter.

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

3.4 Using the optical switches

Note: This section applies only to transmitters with a display.

The **Scroll** and **Select** optical switches are used to navigate the display menus. To activate an optical switch, touch the lens in front of the optical switch or move your finger over the optical switch close to the lens. There are two optical switch indicators: one for each switch. When an optical switch is activated, the associated optical switch indicator is a solid red.

⚠ CAUTION

Attempting to activate an optical switch by inserting an object into the opening can damage the equipment.

To avoid damage to the optical switches, do not insert an object into the openings. Use your fingers to activate the optical switches.

3.5 Using the display

Note: This section applies only to transmitters with a display.

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

3.5.1 Display language

The display can be configured for the following languages:

- English
- French
- Spanish
- German

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

For information on configuring the display language, see Section 8.9.

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

3.5.2 Viewing process variables

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

- See Section 8.9.3 for information on configuring the display variables.
- See Appendix E 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 LCD panel is displaying a mass inventory value, the **Units of measure** line alternates between the measurement unit (for example, **G**) and the name of the inventory (for example, **MASSI**).

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.

3.5.3 Using display menus

Note: The display menu system provides access to basic transmitter functions and data. It does not provide access to all functions and data. To access all functions and data, use either ProLink II or a customer-supplied PROFIBUS tool.

To enter the display menu system:

1. Activate **Scroll** and **Select** simultaneously.
2. Hold **Scroll** and **Select** until the words **SEE ALARM** or **OFF-LINE MAINT** appear.

Note: Access to the display menu system may be enabled or disabled. If disabled, the OFF-LINE MAINT option does not appear. For more information, see Section 8.9.

For entry into certain sections of the display menu:

- If a password has been enabled, you will be prompted to enter it. See Section 3.5.4.
- If a display password is not required, you will be prompted to activate the optical switches in a pre-defined sequence (**Scroll-Select-Scroll**). This feature is designed to prevent unintentional entry to the menu caused by variations in ambient lighting or other environmental factors.

If no optical switch activity occurs for two minutes, the transmitter will exit the off-line menu system and return to the process variable display.

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

To select from a list or to enter a lower-level menu, scroll to the desired option, then activate **Select**. If a confirmation screen is displayed:

- To confirm the change, activate **Select**.
- To cancel the change, activate **Scroll**.

To exit a menu without making any changes:

- Use the **EXIT** option if available.
- Otherwise, activate **Scroll** at the confirmation screen.

3.5.4 Display password

Some of the display menu functions, such as accessing the off-line menu, can be protected by a display password. For information about enabling and setting the display password, refer to Section 8.9.

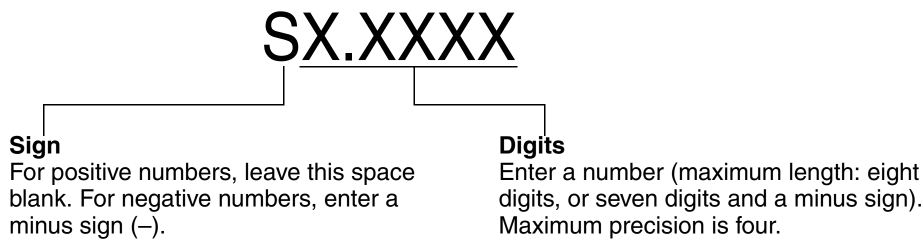
If a password is required, the word **CODE?** appears at the top of the password screen. Enter the digits of the password one at a time by using **Scroll** to choose a number and **Select** to move to the next digit.

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.

3.5.5 Entering floating-point values with the display

Certain configuration values, such as meter factors or output ranges, are entered as floating-point values. When you first enter the configuration screen, the value is displayed in decimal notation (as shown in Figure 3-3) and the active digit is flashing.

Figure 3-3 Numeric values in decimal notation



To change the value:

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

To change the sign of a value:

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

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

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

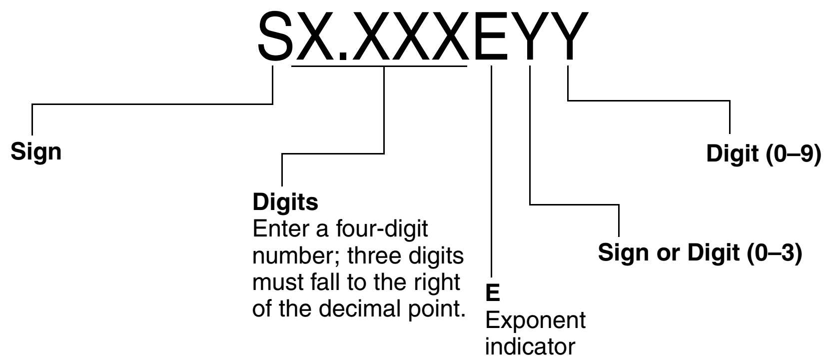
To change from decimal to exponential notation (see Figure 3-4):

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

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

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

Figure 3-4 **Numeric values in exponential notation**



To change from exponential to decimal notation:

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

To exit the menu:

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

Before You Begin
Startup
Transmitter User Interface
Using ProLink II

Chapter 4
Connecting with ProLink II or Pocket ProLink Software

4.1 Overview

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

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

- Requirements – see Section 4.2
- Configuration upload/download – see Section 4.3
- Connecting to a Model 2400S DP transmitter – see Section 4.4

The instructions in this manual assume that users are already familiar with ProLink II or Pocket ProLink software. For more information on using ProLink II, see the ProLink II manual. For more information on using Pocket ProLink, see the Pocket ProLink manual. Both manuals are available on the Micro Motion web site (www.micromotion.com). Instructions in this manual will refer only to ProLink II.

4.2 Requirements

To use ProLink II with the Model 2400S DP transmitter:

- You must have ProLink II v2.5 or higher.
- You must have either the ProLink II installation kit appropriate to your PC and connection type, or the equivalent equipment. See the ProLink II manual or quick reference guide for details.

To use Pocket ProLink with the Model 2400S DP transmitter:

- You must have Pocket ProLink v1.3 or higher.
- In addition:
  - If you will connect to the transmitter via the service port clips, you must have either the Pocket ProLink installation kit or the equivalent equipment. See the Pocket ProLink manual or quick reference guide for details.
  - If you will connect via the IrDA port, no additional equipment is required.

4.3 Configuration upload/download

ProLink II and Pocket ProLink provide 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 saved to a PC as soon as the configuration is complete. See Figure C-1, and refer to the ProLink II or Pocket ProLink manual for details.

4.4 Connecting from a PC to a Model 2400S DP transmitter

To connect to the Model 2400S DP transmitter using ProLink II or Pocket ProLink, you must use a service port connection.

4.4.1 Connection options

The service port can be accessed via the service port clips or the IrDA port.

The service port clips have priority over the IrDA port:

- If there is an active connection via the service port clips, access via the IrDA port is disabled.
- If there is an active connection via the IrDA port and a connection attempt is made via the service port clips, the IrDA connection is terminated.

Additionally:

- Access via the IrDA port may be disabled altogether. In this case, it is not available for connections at any time. By default, access via the IrDA port is disabled.
- The IrDA port may be write-protected. In this case, it can be used only to retrieve data from the transmitter. By default, the IrDA port is write-protected.

See Section 8.10.2 for more information or to change these settings.

4.4.2 Service port connection parameters

The service port uses default connection parameters. Both ProLink II and Pocket ProLink automatically use these default parameters when Protocol is set to Service Port.

Additionally, to minimize configuration requirements, the service port employs an auto-detection scheme when responding to connection requests. The service port will accept all connection requests within the limits described in Table 4-1. If you are connecting to the service port from another tool, ensure that configuration parameters are set within these limits.

Table 4-1 Service port auto-detection limits

Parameter	Option
Protocol	Modbus ASCII or Modbus RTU(1)
Address	Responds to both: • Service port address (111) • Configured Modbus address (default=1)(2)
Baud rate(3)	Standard rates between 1200 and 38,400
Stop bits	1, 2
Parity	Even, odd, none

(1) Service port support for Modbus ASCII may be disabled. See Section 8.10.4.
(2) See Section 8.10.3 for information on configuring the Modbus address.
(3) This is the baud rate between the service port and the connecting program. It is not the PROFIBUS DP baud rate.

4.4.3 Making the connection

To connect to the service port:

1. If you are using the IrDA port:
   a. Ensure that the IrDA port is enabled (see Section 8.10.2).
   b. Ensure that there is no connection via the service port clips.

Note: Connections via the service port clips have priority over connections via the IrDA port. If you are currently connected to the service port clips, you will not be able to connect via the IrDA port.

   c. Position the IrDA device for communication with the IrDA port (see Figure 3-2). You do not need to remove the transmitter housing cover.

Note: The IrDA port is typically used with Pocket ProLink. To use the IrDA port with ProLink II, a special device is required; the IrDA port built into many laptop PCs is not supported. For more information on using the IrDA port with ProLink II, contact Micro Motion customer service.

2. If you are using the service port clips:
   a. Attach the signal converter to the serial or USB port of your PC, using the appropriate connectors or adapters (e.g., a 25-pin to 9-pin adapter or a USB connector).
   b. Remove the transmitter housing cover from the transmitter (see Section 3.3), then connect the signal converter leads to the service port clips. See Figure 4-1.

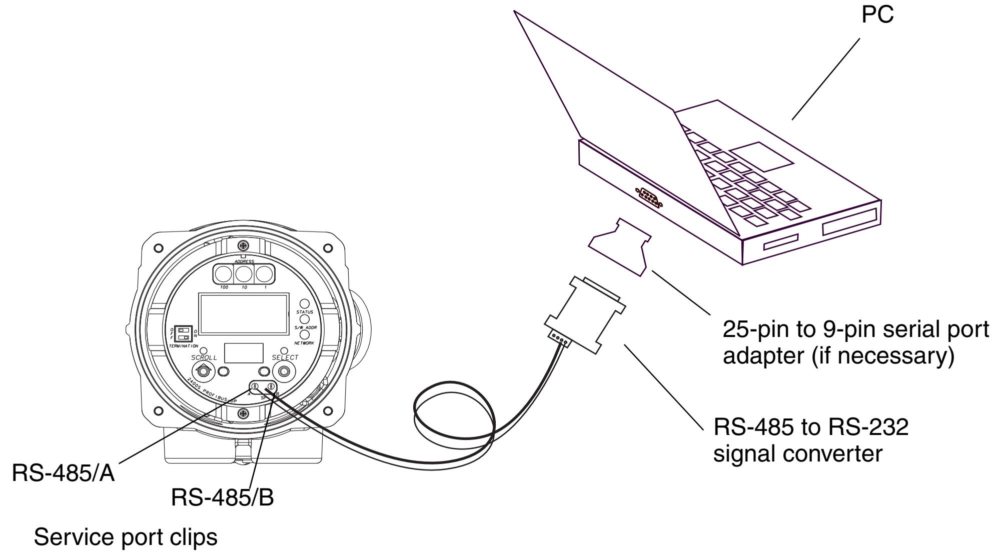
⚠ WARNING

Removing the transmitter housing cover in a hazardous area can cause an explosion.

Because the transmitter housing cover must be removed to connect to the service port clips, the service port clips should be used only for temporary connections, for example, for configuration or troubleshooting purposes.

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

Figure 4-1 Service port connections to service port clips



3. Start ProLink II or Pocket ProLink software. From the Connection menu, click **Connect to Device**. In the screen that appears, specify:
   - **Protocol**: **Service Port**
   - **COM Port**: as appropriate for your PC

   No other parameters are required.
4. Click **Connect**. The software will attempt to make the connection.

Note: While you are connected to the IrDA port, both optical switch indicators will flash red, and both the Scroll and Select optical switches are disabled.

5. If an error message appears:
   a. Ensure that you are using the correct COM port.
   b. For connections to the IrDA port, ensure that the IrDA port is enabled.
   c. For connections to the service port clips, swap the leads between the clips and try again.
   d. For connections to the service port clips, check all the wiring between the PC and the transmitter.

4.5 ProLink II language

ProLink II can be configured for several different languages. To configure the ProLink II language, use the Tools menu. See Figure C-1.

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

Chapter 5
Using a PROFIBUS Host

5.1 Overview

This chapter provides basic information for using a PROFIBUS host with the Model 2400S DP transmitter. The following topics are discussed:

- Support files – see Section 5.2
- Connecting to the Model 2400S DP transmitter from a PROFIBUS host – see Section 5.3
- Using a PROFIBUS host with the GSD – see Section 5.4
- Using a PROFIBUS host with the device description (EDD) – see Section 5.5
- Using PROFIBUS bus parameters – see Section 5.6

5.2 Support files

The following files are available for use with the Model 2400S DP transmitter:

- **MMI0A60.GSD** – enables:
  - Viewing process data and alarms
  - Managing totalizers and inventories
  - Accepting external pressure or temperature data for use in pressure or temperature compensation
- Device description (EDD) – enables all of the above, plus:
  - Configuration functionality
  - Viewing event status
  - Acknowledging alarms
  - Performing zero and density calibration
  - Performing meter verification

The GSD can be downloaded from the Micro Motion web site (**www.micromotion.com**), and can be used with any compatible PROFIBUS host. The EDD can be downloaded from the Micro Motion web site, and has been certified to work with Siemens Simatic PDM.

Set up the GSD or EDD using the method appropriate to your PROFIBUS host.

5.3 Connecting to the Model 2400S DP transmitter

To connect to the Model 2400S DP transmitter:

1. The transmitter automatically detects and uses the DP segment baud rate. If no baud rate is detected, the transmitter does not attempt communication.

2. The factory setting for the hardware address switches is **126**, which is the default PROFIBUS address for decommissioned devices. To commission the transmitter, the node address must be set to a value in the commissioned range (**0–125**).
   - If you will set the node address via the hardware address switches:
     a. Set the node address to the desired value. See Section 8.10.1.
     b. From the PROFIBUS host, connect to the network where the transmitter is installed.
     c. Using the same methods that you use for other PROFIBUS-DP devices, establish a connection to the Model 2400S DP transmitter.
   - If you will set the node address via software:
     a. Ensure that the hardware address switches are set to **126** or above.
     b. From the PROFIBUS host, connect to the network where the transmitter is installed.
     c. Using the same methods that you use for other PROFIBUS-DP devices, establish a connection to the Model 2400S DP transmitter.
     d. Send a Set Slave Address telegram. See Section 8.10.1.

5.4 Using the GSD

Modules available with the GSD are listed in Table 5-1. Note that input and output are from the perspective of the PROFIBUS host; i.e.:

- Input modules input data from the transmitter onto the network, and to the PROFIBUS host.
- Output modules take output data from the network into the transmitter.

Set up any desired modules for data exchange. You may select a maximum of 10 input modules.

Table 5-1 Input and output modules

Module number	Module name	Type	Size (bytes)	Comments
1	Device Status	Input	1	• 0 = Good data • 1 = Bad data
2	Mass Flow	Input	4	
3	Mass Total	Input	4	
4	Mass Inventory	Input	4	
5	Temperature	Input	4	
6	Density	Input	4	
7	Volume Flow	Input	4	Liquid volume
8	Volume Total	Input	4	Liquid volume
9	Volume Inventory	Input	4	Liquid volume
10	Drive Gain	Input	4	
11	GSV Flow	Input	4	Gas standard volume
12	GSV Total	Input	4	Gas standard volume
13	GSV Inventory	Input	4	Gas standard volume
14	API Density	Input	4	
15	API Volume Flow	Input	4	
16	API Volume Total	Input	4	
17	API Volume Inventory	Input	4	

Table 5-1 **Input and output modules** *continued*

Module number	Module name	Type	Size (bytes)	Comments
18	API Avg Density	Input	4	
19	API Avg Temperature	Input	4	
20	API CTL	Input	4	
21	ED Ref Density	Input	4	
22	ED Specific Gravity	Input	4	
23	ED Std Vol Flow	Input	4	
24	ED Std Vol Total	Input	4	
25	ED Std Vol Inv	Input	4	
26	ED Net Mass Flow	Input	4	
27	ED Net Mass Total	Input	4	
28	ED Net Mass Inv	Input	4	
29	ED Net Vol Flow	Input	4	
30	ED Net Vol Total	Input	4	
31	ED Net Vol Inv	Input	4	
32	ED Concentration	Input	4	
33	ED Baume	Input	4	
34	Ext Pressure	Output	4	
35	Ext Temperature	Output	4	
36	Start/Stop Totals	Output	1	• 0 = Stop • 1 = Start
37	Reset Process Totals	Output	1	• 0 = No action • 1 = Reset
38	Reset Inv Totals	Output	1	• 0 = No action • 1 = Reset

5.5 Using the EDD

When imported into a PROFIBUS host, the EDD controls the organization of specific menus and parameters. The menus and parameters controlled by the EDD are shown in Appendix C, Figures C-4 through C-12.

5.6 Using PROFIBUS bus parameters

Depending on your PROFIBUS host, you may be able to read and write PROFIBUS bus parameters directly using DP-V1 services. PROFIBUS bus parameters provide direct access to all of the functionality available through the transmitter's DP port. PROFIBUS bus parameters are documented in Appendix D.

Note that if you choose to configure or use the Model 2400S DP transmitter using PROFIBUS bus parameters, several kinds of detailed information will be required, for example:

- The codes used to represent different options (e.g., different measurement units)
- The bits used to start and stop activities (e.g., totalizers or calibration procedures) or reset totals
- The meaning of status bits within status words

The required information is supplied either in the relevant section in the manual or in Appendix D.

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:

- Characterizing the flowmeter – see Section 6.2
- Configuring measurement units – see Section 6.3

This chapter provides basic flowcharts for each procedure. For more detailed flowcharts, see the flowcharts for your communication tool, provided in the appendices to this manual.

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

Note: All procedures provided in this chapter assume that you have established communication with the Model 2400S DP transmitter and that you are complying with all applicable safety requirements.

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

6.2 Characterizing the flowmeter

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

6.2.1 When to characterize

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

6.2.2 Characterization parameters

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

The characterization parameters are provided on the sensor tag. See Figure 6-1 for illustrations of sensor tags.

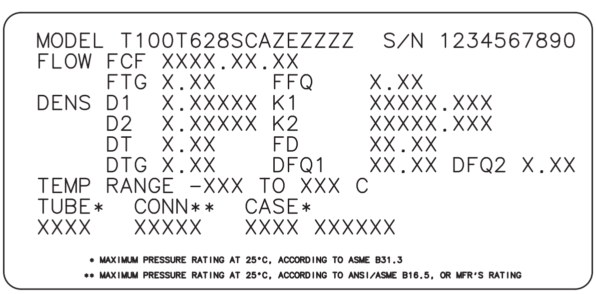
Table 6-1 Sensor calibration parameters

Parameter	Sensor type: T-Series	Sensor type: Other
K1	✓	✓
K2	✓	✓
FD	✓	✓
D1	✓	✓
D2	✓	✓
Temp coeff (DT)(1)	✓	✓
Flowcal		✓(2)
FCF	✓	
FTG	✓	
FFQ	✓	
DTG	✓	
DFQ1	✓	
DFQ2	✓	

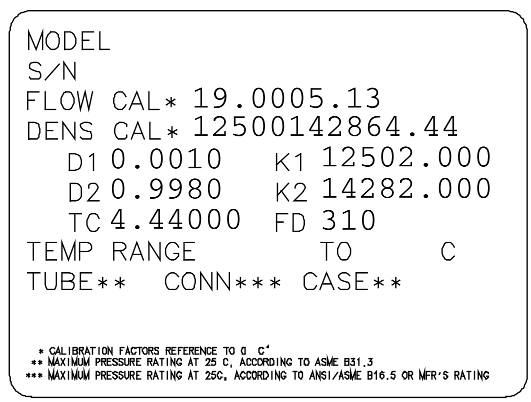
(1) On some sensor tags, shown as TC.
(2) See the section entitled "Flow calibration values."

Figure 6-1 Sample calibration tags

T-Series



Other sensors



Flow calibration values

Two factors are used to define flow calibration:

- The flow calibration factor, which is a 6-character string (five numbers and a decimal point)
- The temperature coefficient for flow, which is a 4-character string (three numbers and a decimal point)

These values are concatenated on the sensor tag, but different labels are used for different sensors. As shown in Figure 6-1:

- For T-Series sensors, the value is called the FCF value.
- For other sensors, the value is called the Flow Cal value.

When configuring the flow calibration factor:

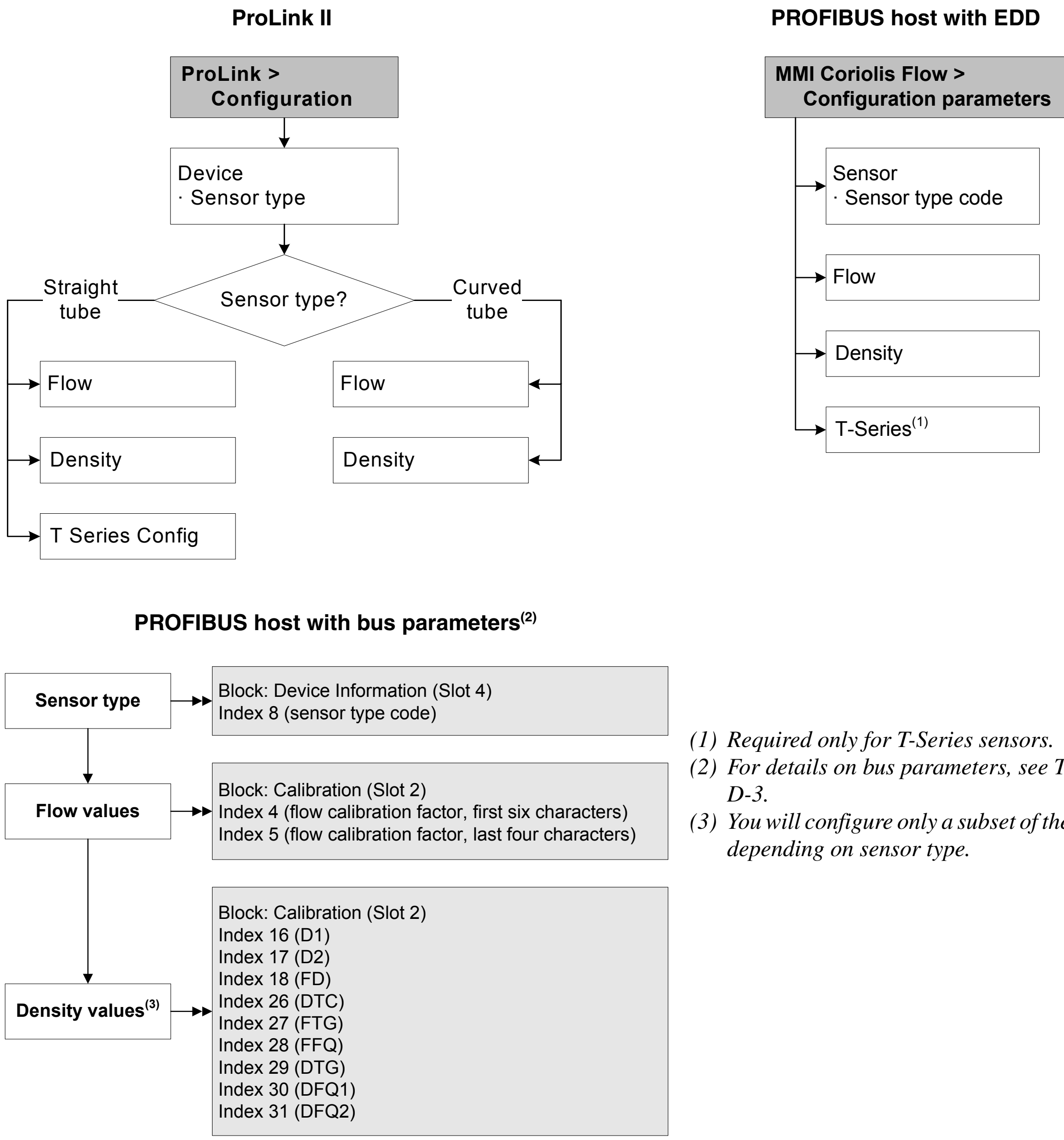
- Using ProLink II, enter the concatenated 10-character string exactly as shown, including the decimal points. For example, using the Flow Cal value from Figure 6-1, enter **19.0005.13**.
- Using other methods, you may be required to enter the concatenated value, or you may be required to enter the two factors separately, i.e., enter a 6-character string and a 4-character string. Include the decimal point in both strings. For example, using the Flow Cal value from Figure 6-1:
  - Enter **19.000** for the flow calibration factor.
  - Enter **5.13** for the temperature coefficient for flow.

6.2.3 How to characterize

To characterize the flowmeter:

1. See the menu flowcharts in Figure 6-2.
2. Ensure that the correct sensor type is configured.
3. Set required parameters, as listed in Table 6-1.

Figure 6-2 Characterizing the flowmeter



(1) Required only for T-Series sensors.
(2) For details on bus parameters, see Tables D-5 and D-3.
(3) You will configure only a subset of the density values, depending on sensor type.

6.3 Configuring the measurement units

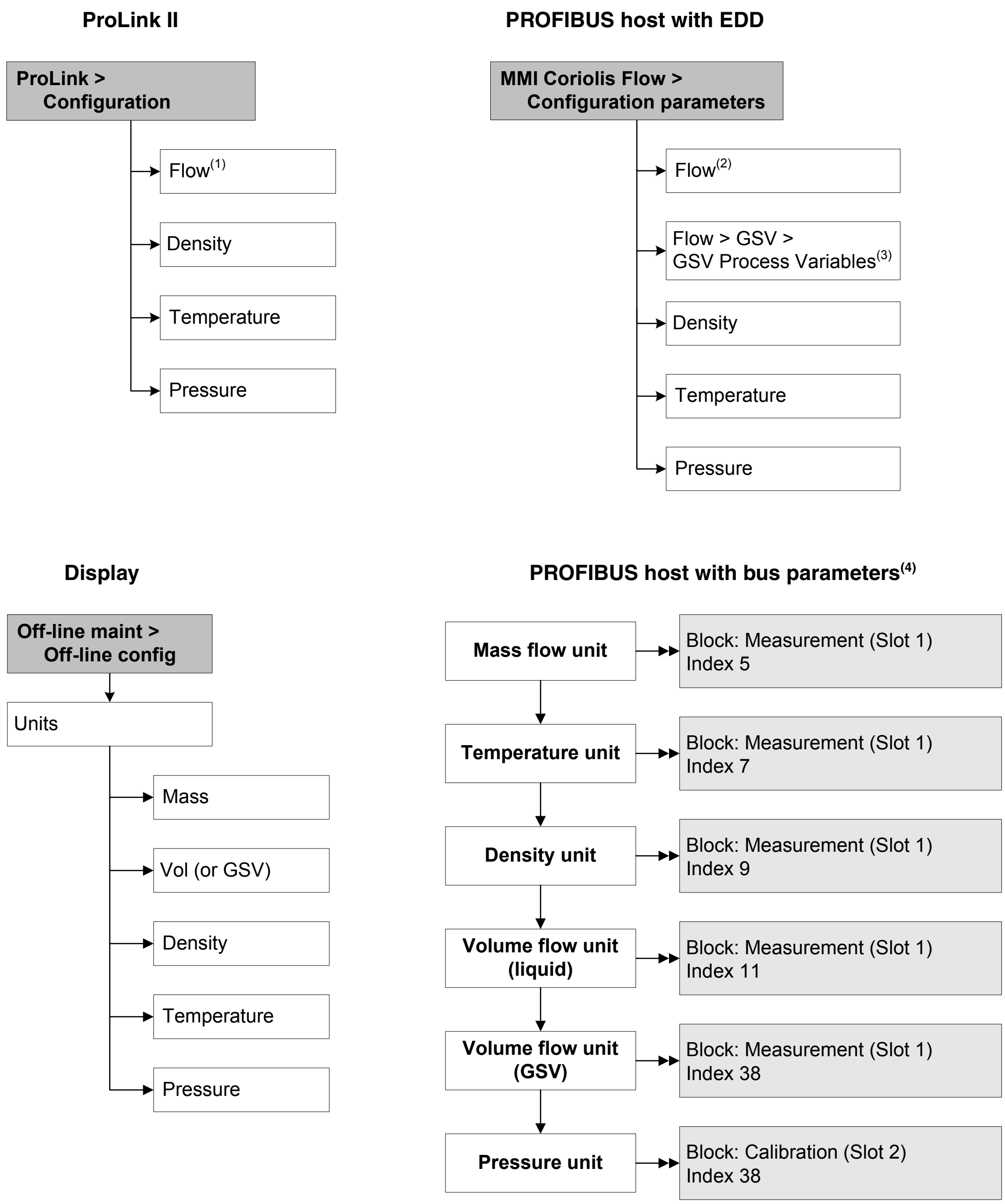
For each process variable, the transmitter must be configured to use the measurement unit appropriate to your application.

To configure measurement units, see the menu flowcharts in Figure 6-3. For details on measurement units for each process variable, see Sections 6.3.1 through 6.3.4.

The measurement units used for totalizers and inventories are assigned automatically, based on the measurement unit configured for the corresponding process variable. For example, if **kg/hr** (kilograms per hour) is configured for mass flow, the unit used for the mass flow totalizer and mass flow inventory is **kg** (kilograms). Codes used for the totalizer measurement units are listed in Tables D-10 through D-12.

Note: Pressure unit configuration is required only if you are using pressure compensation (see Section 9.2) or you are using the Gas Wizard and you need to change the pressure units (see Section 8.2.1).

Figure 6-3 Configuring measurement units



(1) *Used for mass flow, liquid volume flow, and gas standard volume flow.*
(2) *Used for mass flow and liquid volume flow.*
(3) *Used for gas standard volume flow.*
(4) *Set parameters to the desired Unit Code, as listed in Tables 6-2 through 6-7. See Tables D-2 and D-3 if required.*

6.3.1 Mass flow units

The default mass flow measurement unit is **g/s**. See Table 6-2 for a complete list of mass flow measurement units.

Table 6-2 Mass flow measurement units

Mass flow unit				
Display	**ProLink II**	**EDD label**	**EDD code**	**Unit description**
G/S	g/s	g_per_s	1318	Grams per second
G/MIN	g/min	g_per_min	1319	Grams per minute
G/H	g/hr	g_per_hr	1320	Grams per hour
KG/S	kg/s	kg_per_s	1322	Kilograms per second
KG/MIN	kg/min	kg_per_min	1323	Kilograms per minute
KG/H	kg/hr	kg_per_hr	1324	Kilograms per hour
KG/D	kg/day	kg_per_day	1325	Kilograms per day
T/MIN	mTon/min	t_per_min	1327	Metric tons per minute
T/H	mTon/hr	t_per_hr	1328	Metric tons per hour
T/D	mTon/day	t_per_day	1329	Metric tons per day
LB/S	lbs/s	lb_per_s	1330	Pounds per second
LB/MIN	lbs/min	lb_per_min	1331	Pounds per minute
LB/H	lbs/hr	lb_per_hr	1332	Pounds per hour
LB/D	lbs/day	lb_per_day	1333	Pounds per day
ST/MIN	sTon/min	Ston_per_min	1335	Short tons (2000 pounds) per minute
ST/H	sTon/hr	Ston_per_hr	1336	Short tons (2000 pounds) per hour
ST/D	sTon/day	Ston_per_day	1337	Short tons (2000 pounds) per day
LT/H	lTon/hr	Lton_per_hr	1340	Long tons (2240 pounds) per hour
LT/D	lTon/day	Lton_per_day	1341	Long tons (2240 pounds) per day

6.3.2 Volume flow units

The default volume flow measurement unit is **l/s** (liters per second).

Two different sets of volume flow measurement units are provided:

- Units typically used for liquid volume – see Table 6-3
- Units typically used for gas standard volume – see Table 6-4

If you are using ProLink II or the display, only liquid volume flow units are listed by default. To access the gas standard volume flow units, you must first configure the volume flow type: liquid or gas standard.

If you want to measure gas standard volume flow, additional configuration is required. See Section 8.2 for more information.

Table 6-3 Volume flow measurement units – Liquid

Volume flow unit				
Display	**ProLink II**	**EDD label**	**EDD code**	**Unit description**
CUFT/S	ft3/sec	CFS	1356	Cubic feet per second
CUF/MN	ft3/min	CFM	1357	Cubic feet per minute
CUFT/H	ft3/hr	CFH	1358	Cubic feet per hour
CUFT/D	ft3/day	ft3_per_day	1359	Cubic feet per day
M3/S	m3/sec	m3_per_s	1347	Cubic meters per second
M3/MIN	m3/min	m3_per_min	1348	Cubic meters per minute
M3/H	m3/hr	m3_per_hr	1340	Cubic meters per hour
M3/D	m3/day	m3_per_day	1350	Cubic meters per day
USGPS	US gal/sec	gal_per_s	1362	U.S. gallons per second
USGPM	US gal/min	GPM	1363	U.S. gallons per minute
USGPH	US gal/hr	gal_per_hour	1364	U.S. gallons per hour
USGPD	US gal/d	gal_per_day	1365	U.S. gallons per day
MILG/D	mil US gal/day	Mgal_per_day	1366	Million U.S. gallons per day
L/S	l/sec	L_per_s	1351	Liters per second
L/MIN	l/min	L_per_min	1352	Liters per minute
L/H	l/hr	L_per_hr	1353	Liters per hour
MILL/D	mil l/day	Ml_per_day	1355	Million liters per day
UKGPS	Imp gal/sec	ImpGal_per_s	1367	Imperial gallons per second
UKGPM	Imp gal/min	ImpGal_per_min	1368	Imperial gallons per minute
UKGPH	Imp gal/hr	ImpGal_per_hr	1369	Imperial gallons per hour
UKGPD	Imp gal/day	ImpGal_per_day	1370	Imperial gallons per day
BBL/S	barrels/sec	bbl_per_s	1371	Barrels per second(1)
BBL/MN	barrels/min	bbl_per_min	1372	Barrels per minute(1)
BBL/H	barrels/hr	bbl_per_hr	1373	Barrels per hour(1)
BBL/D	barrels/day	bbl_per_day	1374	Barrels per day(1)
BBBL/S	Beer barrels/sec	Beer_bbl_per_s	1642	Beer barrels per second(2)
BBBL/MN	Beer barrels/min	Beer_bbl_per_min	1643	Beer barrels per minute(2)
BBBL/H	Beer barrels/hr	Beer_bbl_per_hr	1644	Beer barrels per hour(2)
BBBL/D	Beer barrelsday	Beer_bbl_per_day	1645	Beer barrels per day(2)

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

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

Volume flow unit				
Display	**ProLink II**	**EDD label**	**EDD code**	**Unit description**
NM3/S	Nm3/sec	Nm3_per_s	1522	Normal cubic meters per second
NM3/MN	Nm3/min	Nm3_per_min	1523	Normal cubic meters per minute
NM3/H	Nm3/hr	Nm3_per_hr	1524	Normal cubic meters per hour
NM3/D	Nm3/day	Nm3_per_day	1525	Normal cubic meters per day
NLPS	NLPS	NL_per_s	1532	Normal liter per second
NLPM	NLPM	NL_per_min	1533	Normal liter per minute
NLPH	NLPH	NL_per_hr	1534	Normal liter per hour
NLPD	NLPD	NL_per_day	1535	Normal liter per day
SCFS	SCFS	SCFS	1604	Standard cubic feet per second
SCFM	SCFM	SCFM	1360	Standard cubic feet per minute
SCFH	SCFH	SCFH	1361	Standard cubic feet per hour
SCFD	SCFD	SCFD	1605	Standard cubic feet per day
SM3/S	Sm3/S	Sm3_per_s	1527	Standard cubic meters per second
SM3/MN	Sm3/min	Sm3_per_min	1528	Standard cubic meters per minute
SM3/H	Sm3/hr	Sm3_per_hr	1529	Standard cubic meters per hour
SM3/D	Sm3/day	Sm3_per_day	1530	Standard cubic meters per day
SLPS	SLPS	SL_per_s	1537	Standard liter per second
SLPM	SLPM	SL_per_min	1538	Standard liter per minute
SLPH	SLPH	SL_per_hr	1539	Standard liter per hour
SLPD	SLPD	SL_per_day	1540	Standard liter per day

6.3.3 Density units

The default density measurement unit is **g/cm3**. See Table 6-2 for a complete list of density measurement units.

Table 6-5 **Density measurement units**

Density unit				
Display	**ProLink II**	**EDD label**	**EDD code**	**Unit description**
G/CM3	g/cm3	g_per_cm3	1100	Grams per cubic centimeter
G/L	g/l	g_per_L	1105	Grams per liter
G/ML	g/ml	g_per_ml	1104	Grams per milliliter
KG/L	kg/l	kg_per_L	1103	Kilograms per liter
KG/M3	kg/m3	kg_per_m3	1097	Kilograms per cubic meter
LB/GAL	lbs/Usgal	lb_per_gal	1108	Pounds per U.S. gallon
LB/CUF	lbs/ft3	lb_per_ft3	1107	Pounds per cubic foot
LB/CUI	lbs/in3	lb_per_in3	1106	Pounds per cubic inch

Table 6-5 Density measurement units *continued*

Density unit				
Display	**ProLink II**	**EDD label**	**EDD code**	**Unit description**
ST/CUY	sT/yd3	Ston_per_yd3	1109	Short ton per cubic yard
D API	degAPI	DegAPI	1113	Degrees API
SGU	SGU	SGU	1114	Specific gravity unit (not temperature corrected)

6.3.4 Temperature units

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

Table 6-6 Temperature measurement units

Temperature unit				
Display	**ProLink II**	**EDD label**	**EDD code**	**Unit description**
°C	°C	Deg_C	1001	Degrees Celsius
°F	°F	Deg_F	1002	Degrees Fahrenheit
°R	°R	Deg_R	1003	Degrees Rankine
°K	°K	K	1000	Kelvin

6.3.5 Pressure units

The flowmeter does not measure pressure. You need to configure the pressure units if either of the following is true:

- You will configure pressure compensation (see Section 9.2). In this case, configure the pressure unit to match the pressure unit used by the external pressure device.
- You will use the Gas Wizard, you will enter a reference pressure value, and you need to change the pressure unit to match the reference pressure value (see Section 8.2).

If you do not know whether or not you will use pressure compensation or the Gas Wizard, you do not need to configure a pressure unit at this time. You can always configure the pressure unit later.

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

Table 6-7 Pressure measurement units

Pressure unit				
Display	**ProLink II**	**EDD label**	**EDD code**	**Unit description**
FTH2O	Ft Water @ 68°F	ft. H2O @68 DegF	1154	Feet water @ 68 °F
INW4C	In Water @ 4°C	inch H2O @4 DegC	1147	Inches water @ 4 °C
INW60	In Water @ 60°F	inch H2O @60 DegF	1146	Inches water @ 60 °F
INH2O	In Water @ 68°F	inch H2O @68 DegF	1148	Inches water @ 68 °F
mmW4C	mm Water @ 4°C	mm H2O @4 DegC	1150	Millimeters water @ 4 °C
mmH2O	mm Water @ 68°F	mm H2O @68 DegF	1151	Millimeters water @ 68 °F
mmHG	mm Mercury @ 0°C	mm Hg @0 DegC	1158	Millimeters mercury @ 0 °C

Table 6-7 Pressure measurement units *continued*

Pressure unit				
Display	**ProLink II**	**EDD label**	**EDD code**	**Unit description**
INHG	In Mercury @ 0°C	inch Hg @0 DegC	1156	Inches mercury @ 0 °C
PSI	PSI	psi	1141	Pounds per square inch
BAR	bar	bar	1137	Bar
mBAR	millibar	milibar	1138	Millibar
G/SCM	g/cm2	g_per_cm2	1144	Grams per square centimeter
KG/SCM	kg/cm2	kg_per_cm2	1145	Kilograms per square centimeter
PA	pascals	Pa	1130	Pascals
KPA	Kilopascals	KiloPa	1133	Kilopascals
MPA	megapascals	MegaPa	1132	Megapascals
TORR	Torr @ 0C	torr @0 DegC	1139	Torr @ 0 °C
ATM	atms	atm	1140	Atmospheres

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:

- Using the I&M functions – see Section 7.2
- Recording process variables – see Section 7.3
- Viewing process variables – see Section 7.4
- Using the LEDs – see Section 7.5
- Viewing transmitter status and alarms – see Section 7.6
- Handling status alarms – see Section 7.7
- Viewing and using the totalizers and inventories – see Section 7.8

Note: All procedures provided in this chapter assume that you have established communication with the Model 2400S DP transmitter and that you are complying with all applicable safety requirements.

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

7.2 Using the I&M functions

The Model 2400S DP transmitter implements the following PROFIBUS identification and maintenance (I&M) functions:

- I&M 0
- I&M 1

as specified in *Profile Guidelines Part 1: Identification & Maintenance Functions Version 1.1.1*, *March 2005*.

The I&M functions contain a variety of device and manufacturer information. Two of the I&M value are set by the user during installation (see Section 8.12). The other values, including the Manufacturer ID, are hard-coded. The Manufacturer ID stored on the transmitter can be used as a code to obtain current device and manufacturer data from the PROFIBUS web site (*http://www.profibus.com/IM/Man_ID_Table.xml*).

The I&M functions are not accessible via ProLink II or the display. If you are using Siemens Simatic PDM, v6.0 SP2 or higher is required. Earlier versions do not support I&M functions.

To use the I&M functions:

1. Read the data from the transmitter:
   - Using a PROFIBUS host with the EDD, connect to the transmitter as a Specialist. See Figure C-12.
   - Using PROFIBUS bus parameters, use the I&M Functions block (see Table D-9). You must read the entire 64-byte dataset.
2. If desired, log onto the PROFIBUS web site and enter the Manufacturer ID code retrieved from the transmitter.

7.3 Recording process variables

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

Record the following process variables:

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

To view these values, see Section 7.4. For information on using this information in troubleshooting, see Section 11.13.

7.4 Viewing process variables

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

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

Note: If the petroleum measurement application is enabled, two of the API process variables are averages: Batch Weighted Average Density and Batch Weighted Average Temperature. For both of these, the averages are calculated for the current totalizer period, i.e., since the last reset of the API volume totalizer.

7.4.1 With the display

By default, the display shows the mass flow rate, mass total, volume flow rate, volume total, temperature, density, and drive gain. If desired, you can configure the display to show other process variables. See Section 8.9.3.

The LCD panel 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 E for information on the codes and abbreviations used for display variables.

To view a process variable with the display, refer to Figure 3-2 and:

- If Auto Scroll is enabled, wait until the desired process variable appears on the LCD panel.
- If Auto Scroll is not enabled, **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

The display precision can be configured separately for each process variable (see Section 8.9.3). This affects only the value shown on the display, and does not affect the actual value as reported by the transmitter via digital communications.

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

- Values < 100,000,000 are displayed in decimal notation (e.g., **1234567.8**).
- Values ≥ 100,000,000 are displayed using exponential notation (e.g., **1.000E08**).
  - If the value is less than the precision configured for that process variable, the value is displayed as **0** (i.e., there is no exponential notation for fractional numbers).
  - If the value is too large to be displayed with the configured precision, the displayed precision is reduced (i.e., the decimal point is shifted to the right) as required so that the value can be displayed.

7.4.2 With ProLink II

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

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

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

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

7.4.3 With a PROFIBUS host and the EDD

If you are using a PROFIBUS host with the EDD:

- Use the View menu (see Figure C-5) to view the standard process variables. Gas standard volume, API, and enhanced density process variables are not displayed.
- Use the Device menu (see Figure C-6) to view all process variables.

7.4.4 With a PROFIBUS host and the GSD

If you are using a PROFIBUS host with the GSD, you must import the desired input modules to your PROFIBUS host (see Section 5.4). The selected process variables will be available for viewing at the PROFIBUS host.

7.4.5 With PROFIBUS bus parameters

To read process variable data with PROFIBUS bus parameters:

- For petroleum measurement process variables, use the API block (see Table D-7)
- For enhanced density process variables, use the Enhanced Density block (see Table D-8)
- For all other process variables, use the Measurement block (see Table D-2)

7.5 Using the LEDs

The user interface module provides three LEDs: a status LED, a network LED, and a software address LED (see Figures 3-1 and 3-2).

- For transmitters with a display, the LEDs can be viewed with the transmitter housing cover in place.
- For transmitters without a display, the transmitter housing cover must be removed to view the LEDs (see Section 3.3).

For information on:

- Using the network LED, see Section 7.5.1.
- Using the software address LED, see Section 7.5.2.
- Using the status LED, see Section 7.6.1.

7.5.1 Using the network LED

Table 7-1 lists the different states of the network LED and defines each state.

Table 7-1 Network LED states, definitions, and recommendations

Network LED state	Definition	Comments
Off	Device not online	The PROFIBUS-DP communication channel is not connected to any host system. Check the host configuration and the wiring, and retry the connection.
Solid green	Device online and connected	The device is in data exchange with a Class 1 master or is being configured by a Class 2 master. No action is required.
Flashing green	Device online but not connected	The device has detected the network baud rate, but communication with a host has not been established.
Solid red	Communication error	Check for any of the following PROFIBUS communication issues: Invalid Parameterization, Invalid Configuration, Invalid Slot, Invalid Index, Invalid C2 Acyclic Communication Initiate Telegram.

7.5.2 Using the software address LED

Table 7-2 lists the different states of the software address LED and defines each state.

Table 7-2 **Software address LED states, definitions, and recommendations**

Software address LED state	Definition
Off	Device is in hardware addressing mode.
Solid red	Device is in software addressing mode but address has not been set by host.
Solid green	Device is in software addressing mode and address has been set by host.

7.6 Viewing transmitter status

You can view transmitter status using the status LED, ProLink II, a PROFIBUS host using the EDD, or PROFIBUS bus parameters. Depending on the method chosen, different information is displayed.

7.6.1 Using the status LED

The status LED shows transmitter status as described in Table 7-3. Note that the status LED does not report event status or alarm status for alarms with severity level set to Ignore (see Section 8.8).

Table 7-3 **Transmitter status LED**

Status LED state	Alarm priority	Definition
Green	No alarm	Normal operating mode
Flashing yellow	A104 alarm	Zero or calibration in progress
Yellow	Low severity (information) alarm	• Alarm condition: will not cause measurement error • Digital communications report process data
Red	High severity (fault) alarm	• Alarm condition: will cause measurement error • Digital communications go to configured fault action (see Section 8.10.7)

7.6.2 Using ProLink II

ProLink II provides a Status window that displays:

- Device (alarm) status
- Event status
- Assorted other transmitter data

7.6.3 Using a PROFIBUS host and the EDD

Status information is located in the View menu (see Figure C-5) and the Device menu (see Figures C-6 and C-7). The View menu displays alarm status. The Device menu displays:

- Alarm status
- Event status
- Meter and core processor diagnostics

7.6.4 Using PROFIBUS bus parameters

Status information is located in the Diagnostic block (see Table D-4).

7.7 Handling status alarms

Specific process or flowmeter conditions cause status alarms. Each status alarm has an alarm code.

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

Note: Some status alarms can be reclassified, i.e., configured for a different severity level. For information on configuring severity level, see Section 8.8.

Note: For detailed information on a specific status alarm, including possible causes and troubleshooting suggestions, see Table 11-2. Before troubleshooting status alarms, first acknowledge all alarms. This will remove inactive alarms from the list so that you can focus troubleshooting efforts on active alarms.

The transmitter maintains two status flags for each alarm:

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

In addition, the transmitter maintains alarm history for the 50 most recent alarm occurrences. Alarm history includes:

- The alarm code
- The “alarm active” timestamp
- The “alarm inactive” timestamp
- The “alarm acknowledged” timestamp

When the transmitter detects an alarm condition, it checks the severity level of the specific alarm and performs the actions described in Table 7-4.

Table 7-4 Transmitter responses to status alarms

	Transmitter response		
Alarm severity level(1)	**Status flags**	**Alarm history**	**Digital communications fault action**
Fault	• “Alarm active” status flag set immediately • “Alarm unacknowledged” status flag set immediately	“Alarm active” record written to alarm history immediately	Activated after configured fault timeout has expired (if applicable)(2)
Informational	• “Alarm active” status flag set immediately • “Alarm unacknowledged” status flag set immediately	“Alarm active” record written to alarm history immediately	Not activated
Ignore	• “Alarm active” status flag set immediately • “Alarm unacknowledged” status flag set immediately	No action	Not activated

(1) See Section 8.8 for information on setting the alarm severity level.
(2) See Sections 8.10.7 and 8.10.8 for more information on digital communications fault action and fault timeout.

When the transmitter detects that the alarm condition has cleared:

- The first status flag is set to “inactive.”
- Digital communications fault action is deactivated (Fault alarms only).
- The “alarm inactive” record is written to alarm history (Fault and Informational alarms only).
- The second status flag is not changed.

Operator action is required to return the second status flag to “acknowledged.” Alarm acknowledgment is optional. If the alarm is acknowledged, the “alarm acknowledged” record is written to alarm history.

7.7.1 Using the display

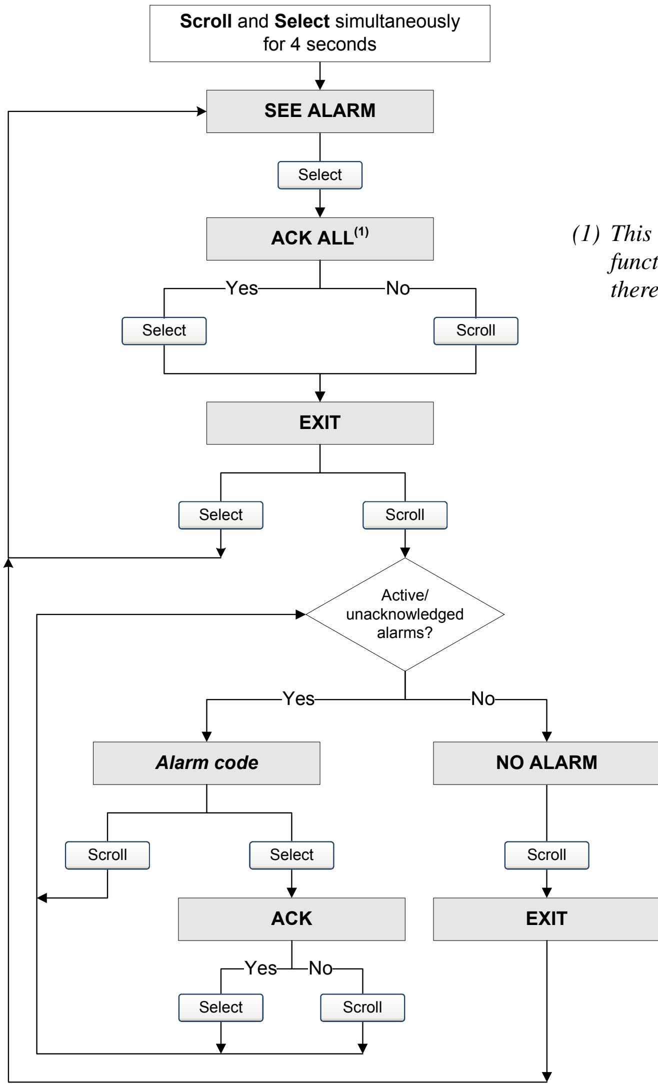
The display shows information only about active Fault or Informational alarms, based on alarm status bits. Ignore alarms are filtered out, and you cannot access alarm history via the display.

To view or acknowledge alarms using the display menus, see the flowchart in Figure 7-1.

If the transmitter does not have a display, or if operator access to the alarm menu is disabled (see Section 8.9.5), alarms can be viewed and acknowledged using ProLink II, a PROFIBUS host with the EDD, or PROFIBUS bus parameters. Alarm acknowledgment is optional.

Additionally, the display may be configured to enable or disable the Ack All function. If disabled, the Ack All screen is not displayed and alarms must be acknowledged individually.

Figure 7-1 Viewing and acknowledging alarms with the display



(1) This screen is displayed only if the ACK ALL function is enabled (see Section 8.9.5) and there are unacknowledged alarms.

7.7.2 Using ProLink II

ProLink II provides two ways to view alarm information:

- The Status window
- The Alarm Log window

Status window

The Status window displays the current status of the alarms considered to be most useful for information, service, or troubleshooting, including Ignore alarms. The Status window reads alarm status bits, and does not access alarm history. The Status window does not display acknowledgment information, and you cannot acknowledge alarms from the Status window.

In the Status window:

- Alarms are organized into three categories: Critical, Informational, and Operational. Each category is displayed on a separate panel.
- If one or more alarms is active on a panel, the corresponding tab is red.
- On a panel, a green LED indicates "inactive" and a red LED indicates "active."

Note: The location of alarms on the Status panels is pre-defined, and is not affected by alarm severity.

To use the Status window:

1. Click **ProLink > Status**.
2. Click the tab for the alarm category you want to view.

Alarm Log window

The Alarm Log window selects information from alarm history, and lists all alarms of the following types:

- All active Fault and Information alarms
- All inactive but unacknowledged Fault and Information alarms

Ignore alarms are never listed.

You can acknowledge alarms from the Alarm Log window.

In the Alarm Log window:

- The alarms are organized into two categories: High Priority and Low Priority. Each category is displayed on a separate panel.
- On a panel, a green LED indicates "inactive but unacknowledged" and a red LED indicates "active."

Note: The location of alarms on the Alarm Log panels is pre-defined, and is not affected by alarm severity.

To use the Alarm Log window:

1. Click **ProLink > Alarm Log**.
2. Click the tab for the alarm category you want to view.
3. To acknowledge an alarm, click the **Ack** checkbox. When the transmitter has processed the command:
   - If the alarm was inactive, it will be removed from the list.
   - If the alarm was active, it will be removed from the list as soon as the alarm condition clears.

7.7.3 Using a PROFIBUS host with the EDD

If you are using a PROFIBUS host with the EDD, alarm information can be viewed in the Alarm Status window. You can open the Alarm Status window in either of the following ways:

- By clicking **Device > Device > Alarm Status**
- By clicking **View > Display > Alarm Status**

Using a PROFIBUS Host
Required Configuration
Using the Transmitter
Optional Configuration

The Alarm Status window displays the current status of the alarms considered to be most useful for information, service, or troubleshooting, including Ignore alarms. Active alarms are indicated with a check.

Note: The Alarm Status window reads alarm status bits, and does not access alarm history.

You can use the Alarm Status window to acknowledge a single alarm or to acknowledge all alarms. To acknowledge a single alarm:

1. Set the **Acknowledge Alarm** control to the alarm you want to acknowledge.
2. Send the command to the transmitter.

To acknowledge all alarms:

1. Set the **Acknowledge All Alarms** control to **Acknowledge**.
2. Send the command to the transmitter.

7.7.4 Using PROFIBUS bus parameters

Using PROFIBUS bus parameters, you can use the Diagnostic block to view the status of a group of preselected alarms, view information about a specific alarm, acknowledge a single alarm or all alarms, and retrieve information from alarm history. See Table D-4.

To view the status of a group of preselected alarms, use Indices 10–17.

Note: These are the same alarms that are displayed in the ProLink II Status window.

To view information about a single alarm:

1. Set Index 20 to the code of the alarm you want to check.
2. Read Index 22, and interpret the data using the following codes:
   - 0x00 = Acknowledged and cleared
   - 0x01 = Active and acknowledged
   - 0x10 = Not acknowledged, but cleared
   - 0x11 = Not acknowledged, and active
3. Other information about the indexed alarm is available in the following locations:
   - Index 23: Number of times this alarm has become active
   - Index 24: The time this alarm was last posted
   - Index 25: The time this alarm was last cleared

To acknowledge a single alarm:

1. Set Index 20 to the code of the alarm you want to check.
2. Write a value of **0** to Index 22.

To acknowledge all alarms, write a value of **1** to Index 30.

To retrieve information from alarm history:

1. Set Index 26 to specifying the number of the alarm record you want to check. Valid values are **0–49**.

Note: The alarm history is a circular buffer, and older records are overwritten by newer records. To determine whether a record is newer or older than another record, you must compare their timestamps.

2. Read the following values:
   - Index 27: The alarm type
   - Index 29: The time that this alarm changed status
   - Index 28: The type of status change:
     - 1 = Alarm posted
     - 2 = Alarm cleared

7.8 Using the totalizers and inventories

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

The *inventories* track the same values as the totalizers. Whenever totalizers are started or stopped, all inventories (including the API volume inventory and enhanced density inventories) are started or stopped automatically. However, when totalizers are reset, inventories are not reset automatically – you must reset inventories separately. This allows you to use the inventories to keep running totals across multiple totalizer resets.

The transmitter can store totalizer and inventory values up to 2^{64}. Values larger than this cause the internal totalizer to go into overflow.

7.8.1 Viewing current totals for totalizers and inventories

You can view current totals for the totalizers and inventories with the display (if your transmitter has a display), ProLink II, a PROFIBUS host, or PROFIBUS bus parameters.

With the display

You cannot view current totals with the display unless the display has been configured to show them. See Section 8.9.3.

To view a totalizer or inventory value, refer to Figure 7-2 and:

1. Check for the word **TOTAL** in the lower left corner of the LCD panel.
   - If Auto Scroll is enabled, wait until the desired value appears on the LCD panel. You can also **Scroll** until the desired value appears.
   - If Auto Scroll is not enabled, **Scroll** until the desired value appears.
2. Refer to Table 7-5 to identify the process variable and unit of measure.
3. Read the current value from the top line of the display.

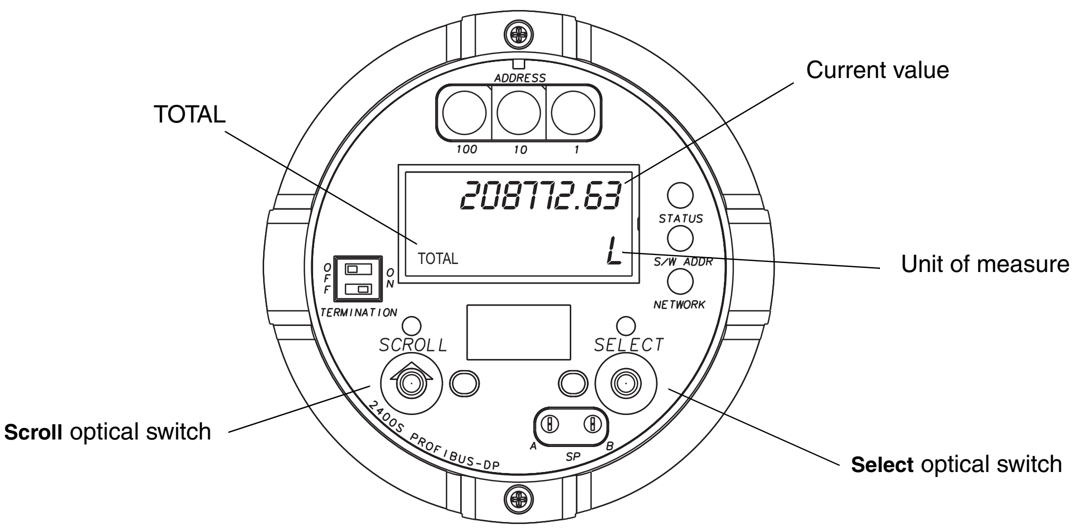
Table 7-5 Totalizer and inventory values on display

Process variable	Display behavior
Mass total	Unit of measure displayed; no alternation
Mass inventory	Unit of measure alternates with **MASSI**
Volume total (liquid)	Unit of measure displayed; no alternation
Volume inventory (liquid)	Unit of measure alternates with **LVOLI**
Gas standard volume total	Unit of measure displayed; no alternation
Gas standard volume inventory	Unit of measure alternates with **GSV I**
API corrected volume total	Unit of measure alternates with **TCORR**

Table 7-5 Totalizer and inventory values on display *continued*

Process variable	Display behavior
API corrected volume inventory	Unit of measure alternates with **TCORI**
ED net mass total	Unit of measure alternates with **NET M**
ED net mass inventory	Unit of measure alternates with **NETMI**
ED net volume total	Unit of measure alternates with **NET V**
ED net volume inventory	Unit of measure alternates with **NETVI**
ED standard volume total	Unit of measure alternates with **STD V**
ED standard volume inventory	Unit of measure alternates with **STDVI**

Figure 7-2 Totalizer and inventory values on display



With ProLink II

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

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

With a PROFIBUS host and the EDD

If you are using a PROFIBUS host with the EDD:

- Use the View menu (see Figure C-5) to view the standard totals and inventories. Totals for gas standard volume, API, and enhanced density process variables are not displayed.
- Use the Device menu (see Figure C-6) to view all total and inventory values.

With a PROFIBUS host and the GSD

If you are using a PROFIBUS host with the GSD, you must import the desired input modules to your PROFIBUS host (see Section 5.4). The selected process variables will be available for viewing at the PROFIBUS host.

With PROFIBUS bus parameters

To view current totals for the totalizers and inventories using PROFIBUS bus parameters, see Section 7.4.5.

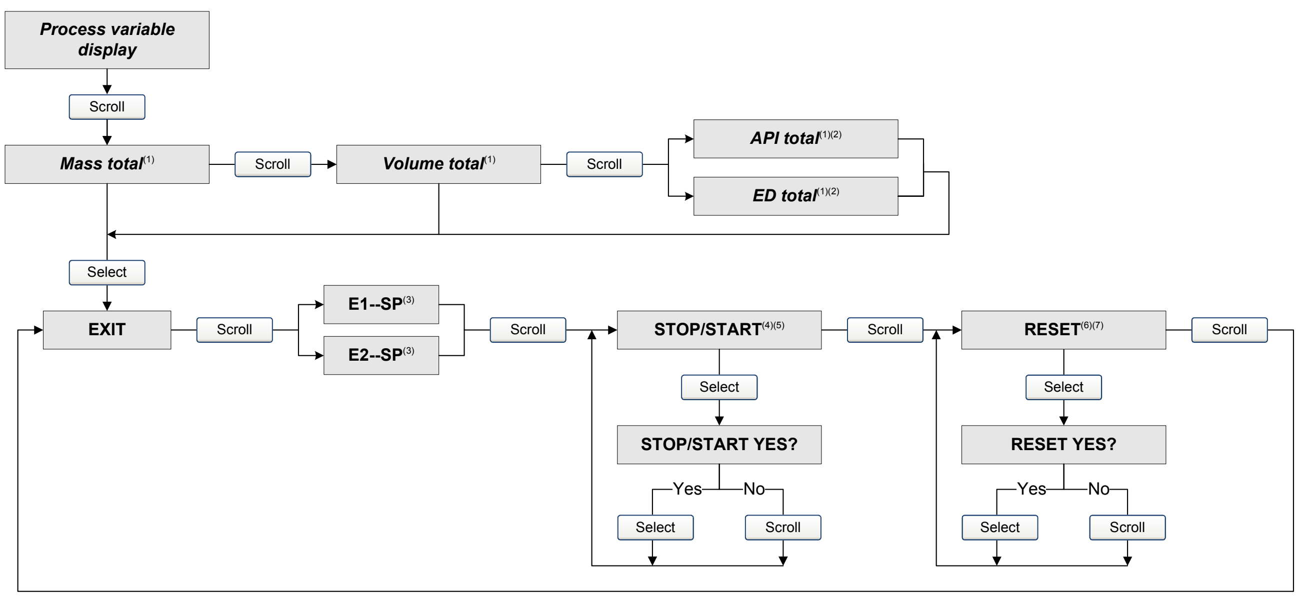
7.8.2 Controlling totalizers and inventories

Specific starting, stopping, and resetting functionality depends on the tool you are using.

With the display

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

Figure 7-3 **Controlling totalizers and inventories with the display**



(1) Displayed only if configured as a display variable.
(2) The petroleum measurement application or enhanced density application must be enabled.
(3) The Event Setpoint screens can be used to define or change Setpoint A for Event 1 or Event 2 only. These screens are displayed only for specific types of events. To reset the setpoint for an event defined on mass total, you must enter the totalizer management menu from the mass total screen. To reset the setpoint for an event defined on volume total, you must enter the totalizer management menu from the volume total screen. See Section 8.6.3 for more information.
(4) The display must be configured to allow stopping and starting. See Section 8.9.5.
(5) All totalizers and inventories will be stopped and started together, including API and enhanced density totalizers and inventories.
(6) The display must be configured to allow totalizer resetting. See Section 8.9.5.
(7) Only the totalizer currently shown on the display will be reset. No other totalizers will be reset, and no inventories will be reset. Be sure that the totalizer you want to reset is displayed before performing this reset.

With ProLink II

The totalizer and inventory control functions available with ProLink II are listed in Table 7-6. Note the following:

- ProLink II does not support separate resetting of the API volume totalizer and API volume inventory. To reset these, you must reset all totalizers or all inventories.
- By default, the ability to reset inventories from ProLink II is disabled. To enable it:
  a. Click **View > Preferences**.
  b. Check the **Enable Inventory Totals Reset** checkbox.
  c. Click **Apply**.

Table 7-6 Totalizer and inventory control functions supported by ProLink II

		Inventory reset	
Object	**Function**	**Disabled**	**Enabled**
Totalizers and inventories	Starting and stopping as a group	✓	✓
Totalizers	Resetting all	✓	✓
	Resetting mass totalizer separately	✓	✓
	Resetting volume totalizer separately	✓	✓
	Resetting enhanced density totalizers separately	✓	✓
	Resetting API volume totalizer separately	Not supported	Not supported
Inventories	Resetting all		✓
	Resetting mass inventory separately		✓
	Resetting volume inventory separately		✓
	Resetting enhanced density inventories separately		✓
	Resetting API volume inventory separately	Not supported	Not supported

To start or stop all totalizers and inventories:

1. Click **ProLink > Totalizer Control** or **ProLink > ED Totalizer Control** (if the enhanced density application is enabled).
2. Click the All Totals **Start** or All Totals **Stop** button.

Note: The All Totals functions are replicated in these two windows for convenience. You can start or stop all totalizers and inventories from either window.

To reset all totalizers:

1. Click **ProLink > Totalizer Control** or **ProLink > ED Totalizer Control** (if the enhanced density application is enabled).
2. Click the All Totals **Reset** button.

To reset all inventories:

1. Click **ProLink > Totalizer Control** or **ProLink > ED Totalizer Control** (if the enhanced density application is enabled).
2. Click the All Totals **Reset Inventories** button.

To reset an individual totalizer or inventory:

1. Click **ProLink > Totalizer Control** or **ProLink > ED Totalizer Control** (if the enhanced density application is enabled).
2. Click the appropriate button (e.g., **Reset Mass Total**, **Reset Volume Inventory**, **Reset Net Mass Total**).

With a PROFIBUS host and the EDD

If you are using a PROFIBUS host with the EDD, you can use the Device window to stop and start all totalizers and inventories together; reset all totalizers together; reset all inventories together; or reset standard, API, or enhanced density totals and inventories separately. See Figure C-6.

With a PROFIBUS host and the GSD

If you are using a PROFIBUS host with the GSD, output modules 36, 37, and 38 are used for totalizer and inventory control. You can start and stop all totalizers and inventories together, reset all totalizers together, or reset all inventories together. To use these output modules:

1. Import them to your PROFIBUS host.
2. Send the appropriate Reset command to the transmitter.

With PROFIBUS bus parameters

The totalizer and inventory control functions available with PROFIBUS bus parameters are listed in Table 7-7.

Table 7-7 Totalizer and inventory control with PROFIBUS bus parameters

To accomplish this	Use
Stop all totalizers and inventories	Measurement block (Slot 1) Index: 22 Value: 0
Start all totalizers and inventories	Measurement block (Slot 1) Index: 22 Value: 1
Reset all totalizers	Measurement block (Slot 1) Index: 23 Value: 1
Reset all inventories	Measurement block (Slot 1) Index: 24 Value: 1
Reset mass totalizer	Measurement block (Slot 1) Index: 25 Value: 1
Reset mass inventory	Measurement block (Slot 1) Index: 43 Value: 1
Reset liquid volume totalizer	Measurement block (Slot 1) Index: 26 Value: 1
Reset liquid volume inventory	Measurement block (Slot 1) Index: 44 Value: 1
Reset gas standard volume totalizer	Measurement block (Slot 1) Index: 41 Value: 1

Table 7-7 Totalizer and inventory control with PROFIBUS bus parameters *continued*

To accomplish this	Use
Reset gas standard volume inventory	Measurement block (Slot 1) Index: 42 Value: 1
Reset API reference volume total	API block (Slot 6) Index: 11 Value: 1
Reset API reference volume inventory	API block (Slot 6) Index: 12 Value: 1
Reset ED standard volume total	Enhanced Density block (Slot 7) Index: 17 Value: 1
Reset ED net mass total	Enhanced Density block (Slot 7) Index: 18 Value: 1
Reset ED net volume total	Enhanced Density block (Slot 7) Index: 19 Value: 1
Reset ED standard volume inventory	Enhanced Density block (Slot 7) Index: 20 Value: 1
Reset ED net mass inventory	Enhanced Density block (Slot 7) Index: 21 Value: 1
Reset ED net volume inventory	Enhanced Density block (Slot 7) Index: 22 Value: 1

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.

Table 8-1 lists the parameters that are discussed in this chapter. Default values and ranges for the most commonly used parameters are provided in Appendix A.

Note: All procedures provided in this chapter assume that you have established communication with the Model 2400S DP transmitter and that you are complying with all applicable safety requirements.

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

Table 8-1 Configuration map

		Method			
Topic	**Subtopic**	**ProLink II**	**PROFIBUS host(1)**	**Display**	**Section**
Volume flow measurement for gas		✓	✓		8.2
Cutoffs		✓	✓		8.3
Damping		✓	✓		8.4
Flow direction		✓	✓		8.5
Events		✓	✓		8.6
Slug flow		✓	✓		8.7
Status alarm severity		✓	✓		8.8
Display(2)	Update period	✓	✓	✓	8.9.1
	Display language	✓	✓	✓	8.9.2
	Display variables and precision	✓	✓		8.9.3
	LCD panel backlight	✓	✓		8.9.4
	Totalizer start/stop	✓	✓	✓	8.9.5
	Totalizer reset	✓	✓	✓	
	Auto scroll	✓	✓	✓	
	Scroll rate	✓	✓	✓	
	Offline menu	✓	✓	✓	
	Password	✓	✓	✓	
	Alarm menu	✓	✓	✓	
	Ack all	✓	✓	✓	

Table 8-1 Configuration map *continued*

Topic	Subtopic	Method: ProLink II	Method: PROFIBUS host[1]	Method: Display	Section
Digital communication settings	PROFIBUS node address		✓[3]	✓[4]	8.10.1
	IrDA port usage	✓	✓	✓	8.10.2
	Modbus address	✓		✓	8.10.3
	Modbus ASCII support	✓		✓	8.10.4
	Floating-point byte order	✓			8.10.5
	Additional communications response delay	✓			8.10.6
	Digital communications fault action	✓	✓		8.10.7
	Fault timeout	✓	✓		8.10.8
Device settings		✓	✓[5]		8.11
I&M functions			✓		8.12
Sensor parameters		✓	✓		8.13
Petroleum measurement application		✓	✓		8.14
Enhanced density application		✓	✓		8.15

(1) Via either the EDD or PROFIBUS bus parameters.
(2) These parameters apply only to transmitters with a display.
(3) Via a Set Slave Address telegram.
(4) Via the address witches on the face of the transmitter.
(5) Via PROFIBUS bus parameters only.

8.2 Configuring volume flow measurement for gas

Two types of volume flow measurement are available:

- Liquid volume (the default)
- Gas standard volume

Only one type of volume flow measurement can be performed at a time (i.e., if liquid volume flow measurement is enabled, gas standard volume flow measurement is disabled, and vice versa). Different sets of volume flow measurement units are available, depending on which type of volume flow measurement is enabled (see Tables 6-3 and 6-4). If you want to use a gas volume flow unit, additional configuration is required.

Note: If you will use the petroleum measurement application or the enhanced density application, liquid volume flow measurement is required.

The method used to configure volume flow measurement for gas depends on the method you are using: ProLink II, a PROFIBUS host with the EDD, or PROFIBUS bus parameters. In all cases, you must:

- Enable gas standard volume flow
- Select the measurement unit to use
- Set the low flow cutoff value
- Specify the standard density (density at reference conditions) of your gas

Note: Using the display, you can only select a volume measurement unit from the set available for the configured volume flow type. You cannot configure any other parameters.

8.2.1 Using ProLink II

To configure volume flow measurement for gas using ProLink II:

1. Click **ProLink > Configure > Flow**.
2. Set **Vol Flow Type** to **Std Gas Volume**.
3. Select the measurement unit you want to use from the **Std Gas Vol Flow Units** dropdown list. The default is **SCFM**.
4. Configure the **Std Gas Vol Flow Cutoff** (see Section 8.3). The default is **0**.
5. If you know the standard density of the gas that you are measuring, enter it in the **Std Gas Density** field. If you do not know the standard density, you can use the Gas Wizard. See the following section.

Using the Gas Wizard

The Gas Wizard is used to calculate the standard density of the gas that you are measuring.

To use the Gas Wizard:

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

Note: Ensure that the values entered here are correct, and that fluid composition is stable. If either of these conditions is not met, gas flow measurement accuracy will be degraded.

5. Click **Next**.
6. Verify the reference temperature and reference pressure. If these are not appropriate for your application, click the **Change Reference Conditions** button and enter new values for reference temperature and reference pressure.

7. Click **Next**. The calculated standard density value is displayed.
   - If the value is correct, click **Finish**. The value will be written to transmitter configuration.
   - If the value is not correct, click **Back** and modify input values as required.

Note: The Gas Wizard displays density, temperature, and pressure in the configured units. If required, you can configure the transmitter to use different units. See Section 6.3.

8.2.2 Using a PROFIBUS host with the EDD

To configure volume flow measurement for gas using a PROFIBUS host with the EDD:

1. Referring to Figure C-8:
   a. Enable GSV.
   b. Send the command to the transmitter.
   c. Configure **Gas density value**, **GSV flow units**, **GSV total units**, and **GSV cutoff** as desired.
2. Send the command to the transmitter.

8.2.3 Using PROFIBUS bus parameters

To configure volume flow measurement for gas using PROFIBUS bus parameters:

1. Referring to the Measurement block (Table D-2):
   a. Enable gas standard volume measurement (Index 33).
   b. Set other gas measurement parameters as desired (Indices 34, 38, and 40).
2. Send the command to the transmitter.

8.3 Configuring cutoffs

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, gas standard volume flow, and density.

See Table 8-2 for cutoff default values and related information. See Section 8.3.1 for information on how the cutoffs interact with other transmitter measurements.

To configure cutoffs:

- Using ProLink II, see Figure C-2.
- Using a PROFIBUS host with the EDD, see Figure C-8.
- Using PROFIBUS bus parameters, use the Measurement block (see Table D-2), Indices 18, 19, 20, and 40.

Note: This functionality cannot be configured via the display menus.

Table 8-2 Cutoff default values

Cutoff type	Default	Comments
Mass flow	0.0 g/s	Recommended setting: 5% of the sensor's rated maximum flowrate
Volume flow	0.0 L/s	Limit: the sensor's flow calibration factor in liters per second, multiplied by 0.2
Gas standard volume flow	0.0 SCFM	No limit
Density	0.2 g/cm^3	Range: 0.0–0.5 g/cm^3

8.3.1 Cutoffs and volume flow

If liquid volume flow is enabled:

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

If gas standard volume flow is enabled, neither the mass flow cutoff nor the density cutoff is applied to the volume flow calculation.

8.4 Configuring the damping values

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.

Damping can be configured for flow, density, and temperature.

When you specify a new damping value, it is automatically rounded down to the nearest valid damping value. Valid damping values are listed in Table 8-3.

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

Before setting the damping values, review Section 8.4.1 for information on how the damping values affect other transmitter measurements.

To configure damping values:

- Using ProLink II, see Figure C-2.
- Using a PROFIBUS host with the EDD, see Figure C-8.
- Using PROFIBUS bus parameters, use the Measurement block (see Table D-2), Indices 12, 13, and 14.

Note: This functionality cannot be configured via the display menus.

Table 8-3 **Valid damping values**

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

8.4.1 Damping and volume measurement

When configuring damping values, note the following:

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

Be sure to set damping values accordingly.

8.5 Configuring the flow direction parameter

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
- Negate/Bidirectional

For the effect of flow direction on flow totals and flow values, see Table 8-4.

To configure flow direction:

- Using ProLink II, see Figure C-2.
- Using a PROFIBUS host with the EDD, see Figure C-8.
- Using PROFIBUS bus parameters, use the Measurement block (see Table D-2), Index 21.

Note: This functionality cannot be configured via the display menus.

Table 8-4 Effect of flow direction on totalizers and flow values

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

8.6 Configuring events

An *event* occurs if the real-time value of a user-specified process variable varies above or below a user-specified value, or inside or outside a user-specified range. You can configure up to five events.

You may optionally specify one or more actions that will occur if the event occurs. For example, if Event 1 occurs, you may specify that the transmitter will stop all totalizers and inventories and reset the mass totalizer.

8.6.1 Defining events

To define an event:

- Using ProLink II, see Figure C-3.
- Using a PROFIBUS host with the EDD, see Figure C-9.
- Using PROFIBUS bus parameters, use the Diagnostic block (see Table D-4).

The following general steps are required:

1. Select the event to define (Diagnostic block, Index 4).
2. Specify the Event Type (Diagnostic block, Index 5). Event Type options are defined in Table 8-5.
3. Assign a process variable to the event (Diagnostic block, Index 8).

4. Specify the event's setpoint(s) – the value(s) at which the event will occur or switch state (ON to OFF, or vice versa).
   - If Event Type is High or Low, only Setpoint A (Diagnostic block, Index 6) is used.
   - If Event Type is In Range or Out of Range, both Setpoint A (Diagnostic block, Index 6) and Setpoint B (Diagnostic block, Index 7) are required.

Note: If a mass or volume total has been assigned to Event 1 or Event 2 and also configured as a display variable, if the event type is High or Low, and the transmitter is configured to allow resetting totalizers from the display, you can use the display to define or change the high setpoint (Setpoint A). See Section 7-3.

5. Assign the event to an action or actions, if desired. Possible actions are listed in Table 8-6. To do this:
   - Using ProLink II, open the Discrete Input panel in the Configuration window, identify the action to be performed, then specify the event using the dropdown list. See Figure C-3.

Note: For consistency with other Micro Motion products, the Discrete Input panel is used here even though the Model 2400S DP transmitter does not provide a discrete input.

   - Using the display, see Figure C-15 and use the ACT submenu.
   - Using a PROFIBUS host with the EDD, see Figure C-10.
   - Using PROFIBUS bus parameters, use Index 83 in the Diagnostic block (see Table D-4) to specify the event, and Index 82 to assign the action.

Table 8-5 Event types

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

(1) An event does not occur if the assigned variable is equal to the setpoint.
(2) An event occurs if the assigned variable is equal to the setpoint.

Table 8-6 Event actions

ProLink II label	Display label	EDD label	Description
Start sensor zero	START ZERO	Start Sensor Zero	Initiates a zero calibration procedure
Reset mass total	RESET MASS	Reset Mass Total	Resets the value of the mass totalizer to 0
Reset volume total	RESET VOL	Reset Volume Total	Resets the value of the liquid volume totalizer to 0(1)
Reset gas std volume total	RESET GSV	Reset GSV Total	Resets the value of the gas standard volume totalizer to 0(2)
Reset API ref vol total	RESET TCORR	Reset API Volume Total	Resets the value of the API temperature-corrected volume totalizer to 0(3)
Reset ED ref vol total	RESET STD V	Reset ED Volume Total	Resets the value of the ED standard volume totalizer to 0(4)

Table 8-6 **Event actions** *continued*

ProLink II label	Display label	EDD label	Description
Reset ED net mass total	RESET NET M	Reset ED Net Mass Total	Resets the value of the ED net mass totalizer to 0(4)
Reset ED net vol total	RESET NET V	Reset ED Net Volume Total	Resets the value of the ED net volume totalizer to 0(4)
Reset all totals	RESET ALL	Reset All Totals	Resets the value of all totalizers to 0
Start/stop all totalization	START STOP	Start/Stop All Totals	If totalizers are running, stops all totalizers If totalizers are not running, starts all totalizers
Increment current ED curve	INCR CURVE	Increment ED Curve	Changes the active enhanced density curve from curve 0 to curve 1, from 1 to 2, etc.(4)
Start meter verification	START VERFY	Start Meter Verification	Starts a Smart Meter Verification test(5)

(1) Displayed only if Volume Flow Type = Liquid.
(2) Displayed only if Volume Flow Type = Gas.
(3) Available only if the petroleum measurement application is installed.
(4) Available only if the enhanced density application is installed.
(5) Applies only to systems with Smart Meter Verification.

Example	Define Discrete Event 1 to be active when the mass flow rate in forward or backward direction is less than 2 lb/min or greater than 20 lb/min. Additionally, if this occurs, all totalizers should be stopped. Using ProLink II: 1. Specify lb/min as the mass flow unit. See Section 6.3.1. 2. Set Flow Direction to Absolute Value. See Section 8.5. 3. Select Event 1. 4. Configure: • Event Type = Out of Range • Process Variable (PV) = Mass Flow Rate • Low Setpoint (A) = 2 • High Setpoint (B) = 20 5. In the Discrete Input panel, open the dropdown list for Start/Stop All Totalization and select Discrete Event 1. Using PROFIBUS bus parameters: 1. Specify lb/min as the mass flow unit. See Section 6.3.1. 2. Set Flow Direction to Absolute Value. See Section 8.5. 3. In the Diagnostic block, set the following attributes: • Discrete event index (Index 4) = 0 • Discrete event action type (Index 5) = 3 • Discrete event process variable (Index 8) = 0 • Discrete event setpoint A (Index 6) = 2 • Discrete event setpoint B (Index 7) = 20 • Discrete event assignment (Index 83) = 57 • Discrete event action code (Index 82) = 9

8.6.2 Checking and reporting event status

There are several ways that event status can be determined:

- ProLink II automatically displays event information on the Informational panel of the Status window, and also in the Output Levels window.
- For PROFIBUS hosts using the EDD, event status is displayed in the Device menu (see Figure C-6).
- Using PROFIBUS bus parameters, event status is reported in the Diagnostic block, Index 9 (see Table D-4).

Note: You cannot view event status using a PROFIBUS host with the GSD.

8.6.3 Changing event setpoints from the display

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

- A mass total, volume total, petroleum measurement total, or enhanced density total must be assigned to the event.
- The event type must be either High or Low.
- The assigned total must be configured as a display variable (see Section 8.9.3).
- The transmitter must be configured to allow resetting totalizers from the display (see Section 8.9.5).

Then, to change Setpoint A from the display:

1. Referring to the totalizer management flowchart in Figure 7-3, **Scroll** to the appropriate display screen.
2. **Select**.
3. Enter the new setpoint value. See Section 3.5.5 for instructions on entering floating-point values with the display.

8.7 Configuring slug flow limits and duration

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/cm3**; range is **0.0–10.0 g/cm3**.
- *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/cm3**; range is **0.0–10.0 g/cm3**.
- *Slug flow duration* – the number of seconds the transmitter waits for a slug flow condition (*outside* the slug flow limits) to return to normal (*inside* the slug flow limits). Default value is **0.0 sec**; range is **0.0–60.0 sec**.

If the transmitter detects slug flow:

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

To configure slug flow parameters:

- Using ProLink II, see Figure C-2.
- Using a PROFIBUS host with the EDD, see Figure C-8.
- Using PROFIBUS bus parameters, use the Diagnostic block (see Table D-4), Indices 1, 2, and 3.

Note: This functionality cannot be configured via the display menus.

Note: The slug flow limits must be entered in g/cm^3, even if another unit has been configured for density. Slug flow duration is entered in seconds. Raising the low slug flow limit or lowering the high slug flow limit will increase the possibility of slug flow conditions. Conversely, lowering the low slug flow limit or raising the high slug flow limit will decrease the possibility of slug flow conditions. If slug flow duration is set to 0, the mass flow rate will be forced to 0 as soon as slug flow is detected.

8.8 Configuring status alarm severity

The 2400S DP transmitter can report faults in the following ways:

- Setting the "alarm active" status bit
- Writing an "alarm active" record to alarm history
- Implementing the digital communications fault action (see Section 8.10.7)

Status alarm severity determines which methods the transmitter will use when a specific alarm condition occurs. See Table 8-8. (For a more extensive discussion of status alarm processing and handling, see Section 7.7.)

Table 8-7 Alarm severity levels and fault reporting

	Transmitter action if condition occurs		
Severity level	**"Alarm active" status bit set?**	**"Alarm active" record written to history?**	**Fault action activated?(1)**
Fault	Yes	Yes	Yes
Informational	Yes	Yes	No
Ignore	Yes	No	No

(1) For some alarms, the digital communications fault action will not begin until the fault timeout has expired. To configure fault timeout, see Section 8.8. Other fault reporting methods occur as soon as the fault condition is recognized. Table 8-8 includes information on which alarms are affected by the fault timeout.

Some alarms can be reclassified. For example:

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

For a list of all status alarms and default severity levels, see Table 8-8. (For more information on status alarms, including possible causes and troubleshooting suggestions, see Table 11-2.)

To configure alarm severity:

- Using ProLink II, see Figure C-3.
- Using a PROFIBUS host with the EDD, see Figure C-9.
- Using PROFIBUS bus parameters, use the Diagnostic block (see Table D-4), Indices 20 and 21.

Note: This functionality cannot be configured via the display menus.

Table 8-8 Status alarms and severity levels

Alarm code	Message[1]	Default severity	Configurable	Affected by fault timeout
A001	EEprom Checksum Error (Core Processor) (E)EPROM Checksum Error (CP)	Fault	No	No
A002	RAM Test Error (Core Processor) RAM Error (CP)	Fault	No	No
A003	Sensor Not Responding (No Tube Interrupt) Sensor Failure	Fault	Yes	Yes
A004	Temperature sensor out of range Temperature Sensor Failure	Fault	No	Yes
A005	Input Over-Range Input Overrange	Fault	Yes	Yes
A006	Transmitter Not Characterized Not Configured	Fault	Yes	No
A008	Density Outside Limits Density Overrange	Fault	Yes	Yes
A009	Transmitter Initializing/Warming Up Transmitter Initializing/Warming Up	Ignore	Yes	No
A010	Calibration Failure Calibration Failure	Fault	No	No
A011	Excess Calibration Correction, Zero too Low Zero Too Low	Fault	Yes	No
A012	Excess Calibration Correction, Zero too High Zero Too High	Fault	Yes	No
A013	Process too Noisy to Perform Auto Zero Zero Too Noisy	Fault	Yes	No
A014	Transmitter Failed Transmitter Failed	Fault	No	No
A016	Line RTD Temperature Out-Of-Range Line RTD Temperature Out-of-Range	Fault	Yes	Yes
A017	Meter RTD Temperature Out-Of-Range Meter RTD Temperature Out-of-Range	Fault	Yes	Yes
A020	Calibration Factors Unentered Calibration Factors Unentered (FlowCal)	Fault	Yes	No

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

Alarm code	Message(1)	Default severity	Configurable	Affected by fault timeout
A021	Unrecognized/Unentered Sensor Type	Fault	No	No
	Incorrect Sensor Type (K1)			
A029	Internal Communication Failure	Fault	No	No
	PIC/Daughterboard Communication Failure			
A030	Hardware/Software Incompatible	Fault	No	No
	Incorrect Board Type			
A031	Undefined	Fault	No	No
	Low Power			
A032(2)	Meter Verification Fault Alarm	Fault	No	No
	Meter Verification/Outputs In Fault			
A032(3)	Outputs Fixed during Meter Verification	Varies(4)	No	No
	Meter Verification In Progress and Outputs Fixed			
A033	Sensor OK, Tubes Stopped by Process	Fault	Yes	Yes
	Sensor OK, Tubes Stopped by Process			
A034(3)	Meter Verification Failed	Info	Yes	No
	Meter Verification Failed			
A035(3)	Meter Verification Aborted	Info	Yes	No
	Meter Verification Aborted			
A102	Drive Over-Range/Partially Full Tube	Info	Yes	No
	Drive Overrange/Partially Full Tube			
A104	Calibration-In-Progress	Info	Yes(5)	No
	Calibration in Progress			
A105	Slug Flow	Info	Yes	No
	Slug Flow			
A107	Power Reset Occurred	Info	Yes	No
	Power Reset Occurred			
A116	API Temperature Out-of-Limits	Info	Yes	No
	API: Temperature Outside Standard Range			
A117	API Density Out-of-Limits	Info	Yes	No
	API: Density Outside Standard Range			
A120	ED: Unable to fit curve data	Info	No	No
	ED: Unable to Fit Curve Data			

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

Alarm code	Message(1)	Default severity	Configurable	Affected by fault timeout
A121	ED: Extrapolation alarm ED: Extrapolation Alarm	Info	Yes	No
A131(2)	Meter Verification Info Alarm Meter Verification/Outputs at Last Value	Info	Yes	No
A131(3)	Meter Verification in Progress Meter Verification In Progress	Info	Yes	No
A132	Simulation Mode Active Simulation Mode Active	Info	Yes	No
A133	PIC UI EEPROM Error PIC UI EEPROM Error	Info	Yes	No

(1) Depending on the method you are using to view the alarm, different messages may be displayed. This table shows two possible message versions. The ProLink II version is displayed in the second message of each pair.
(2) Applies only to systems with the original version of the meter verification application.
(3) Applies only to systems with Smart Meter Verification.
(4) If outputs are set to Last Measured Value, severity is Info. If outputs are set to Fault, severity is Fault.
(5) Can be set to either Informational or Ignore, but cannot be set to Fault.

8.9 Configuring the display

If your transmitter has a display, you can configure a variety of parameters that control the display functionality.

8.9.1 Update period

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

To configure Update Period:

- Using ProLink II, see Figure C-3.
- Using the display, see Figure C-15.
- Using a PROFIBUS host with the EDD, see Figure C-10.
- Using PROFIBUS bus parameters, use the Local Display block (see Table D-6), Index 31.

8.9.2 Language

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

- English
- French
- German
- Spanish

To set the display language:

- Using ProLink II, see Figure C-3.
- Using the display, see Figure C-15.
- Using a PROFIBUS host with the EDD, see Figure C-10.
- Using PROFIBUS bus parameters, use the Local Display block (see Table D-6), Index 33.

8.9.3 Display variables and display precision

The display can scroll through up to 15 process variables in any order. You can configure the process variables to be displayed and the order in which they should appear. Additionally, you can configure display precision for each display variable. Display precision controls the number of digits to the right of the decimal place. Precision can be set to any value between **0** and **5**.

To configure display variables or display precision:

- Using ProLink II, see Figure C-3.
- Using a PROFIBUS host with the EDD, see Figure C-10.
- Using PROFIBUS bus parameters, use the Local Display block (see Table D-6):
  - Use Indices 16–30 to specify the display variables.
  - Use Indices 14 and 15 to specify display precision.

Note: This functionality cannot be configured via the display menus.

Table 8-9 shows an example of a display variable configuration. Notice that you can repeat variables, and you can also specify None for any display variable except Display Variable 1. For information on how the display variables will appear on the display, see Appendix E.

Table 8-9 Example of a display variable configuration

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

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

8.9.4 LCD panel backlight

The backlight of the LCD panel on the display can be turned on or off. To turn the backlight on or off:

- Using ProLink II, see Figure C-3.
- Using the display, see Figure C-15.
- Using a PROFIBUS host with the EDD, see Figure C-10.
- Using PROFIBUS bus parameters, use the Local Display block (see Table D-6), Index 13.

In addition, ProLink II, the EDD, and the bus parameters allow you to control the intensity of the backlight. You can specify any value between **0** and **63**; the higher the value, the brighter the backlight. To control the intensity of the backlight:

- Using ProLink II, see Figure C-3.
- Using a PROFIBUS host with the EDD, see Figure C-10.
- Using PROFIBUS bus parameters, use the Local Display block (see Table D-6), Index 32.

8.9.5 Display functions

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

Table 8-10 Display functions

Parameter	Enabled (shown)	Disabled (hidden)
Totalizer start/stop	Operators can start or stop totalizers using the display.	Operators cannot start or stop totalizers using the display.
Totalizer reset	Operators can reset the mass and volume totalizers using the display.	Operators cannot reset the mass and volume totalizers using the display.
Auto scroll(1)	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(2)	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) If enabled, you may want to configure Scroll Rate.
(2) If enabled, the off-line password must also be configured.

To configure display functions:

- Using ProLink II, see Figure C-3.
- Using a PROFIBUS host with the EDD, see Figure C-10.
- Using PROFIBUS bus parameters, use the Local Display block (see Table D-6), Indices 4–12.
- Using the display, see Figure C-15.

Note the following:

- If you use the display to disable access to the off-line menu, the off-line menu will disappear as soon as you exit the menu system. If you want to re-enable access, you must use a different method (e.g., ProLink II or a PROFIBUS host with the EDD).
- 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 8.9.3) will be shown on the display. The time period is defined in seconds; e.g., if Scroll Rate is set to 10, each display variable will be shown on the display for 10 seconds.
- 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 display to configure the display:
  - You must enable Auto Scroll before you can configure Scroll Rate.
  - You must enable the off-line password before you can configure the password.

8.10 Configuring digital communications

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

- PROFIBUS-DP node address
- IrDA port usage
- Modbus address
- Modbus ASCII support
- Floating-point byte order
- Additional communications response delay
- Digital communications fault action
- Fault timeout

8.10.1 PROFIBUS-DP node address

The PROFIBUS-DP node address can be set with the address switches on the device (hardware addressing mode) or with a PROFIBUS host.

Note: You cannot set the node address from ProLink II or the display.

The transmitter operates in either hardware addressing mode or software addressing mode:

- In hardware addressing mode, the address switches are set to a value between **0** and **126**, and the position of the address switches determines the actual node address. The software address LED on the face of the transmitter is off (see Figure 3-1 or Figure 3-2).
- In software addressing mode, the address switches are set to **126** or greater, and the node address is set via a Set Slave Address telegram from the host. The position of the address switches does not necessarily match the actual node address. The software address LED is either red or green:
  - Red – the transmitter has not received a Set Slave Address telegram.
  - Green – the transmitter has received a Set Slave Address telegram and recognized the address.

The default node address for the Model 2400S DP transmitter is **126**, which allows either hardware addressing or software addressing.

To set the node address with address switches:

1. Remove the transmitter housing cover as described in Section 3.3.
2. Identify the three address switches on the user interface module of your transmitter (see Figure 3-1 or Figure 3-2).
3. For each switch, insert a small blade into the slot to rotate the arrow to the desired position. For example, to set the node address to **60**:
   a. Rotate the arrow in the left switch to point to the digit **0**.
   b. Rotate the arrow in the center switch to point to the digit **6**.
   c. Rotate the arrow in the right switch to point to the digit **0**.
4. Power-cycle the transmitter. At this point, the new node address is recognized by the transmitter, but not the host. You must update the host configuration for the new address.

To set the node address with software:

1. Ensure that the transmitter is in software addressing mode (software address LED is red or green). If it is, skip this step and go to Step 2. If it is currently in hardware addressing mode (software address LED is off):
   a. Set the address switches to **126** or higher.
   b. Power-cycle the transmitter. At this point, the transmitter enters software addressing mode, and the software address LED is red.
2. Send a Set Slave Address telegram from the host. It is not necessary to power-cycle the transmitter. At this point, the new node address is recognized by both the transmitter and the host, and the software address LED is green.

To return the node address to **126** (sometimes required for maintenance):

1. Because a Set Slave Address telegram cannot specify a node address of **126**, you must set this address via the address switches. If the transmitter is currently in hardware addressing mode (software address LED is off), skip this step and go to Step 2. If it is currently in software addressing mode (software address LED is red or green), switch to hardware addressing mode as follows:
   a. Set the address switches to any value between **0** and **125** (e.g., **100**).
   b. Power-cycle the transmitter. The transmitter enters hardware addressing mode, and the software address LED is off.
2. Set the address switches to **126**.
3. Power-cycle the transmitter.

8.10.2 IrDA port usage

The IrDA port on the display can be enabled or disabled. If enabled, it can be set for read-only or read/write.

To enable or disable the IrDA port:

- Using ProLink II, see Figure C-2.
- Using the display menus, see Figure C-15.
- Using a PROFIBUS host with the EDD, see Figure C-10.
- Using PROFIBUS bus parameters, use the Local Display block (see Table D-6), Index 34.

To configure the IrDA port for read-only or read/write access:

- Using ProLink II, see Figure C-2.
- Using the display menus, see Figure C-15.
- Using a PROFIBUS host with the EDD, see Figure C-10.
- Using PROFIBUS bus parameters, use the Local Display block (see Table D-6), Index 35.

8.10.3 Modbus address

Note: The Modbus address is applicable only when you are connecting to the service port from a tool that uses Modbus protocol. After initial startup, service port connections are typically used only for troubleshooting or for specific procedures such as temperature calibration. ProLink II is typically used for service port connections, and by default ProLink II will use the standard service port address rather than the configured Modbus address. See Section 4.4 for more information.

The set of valid Modbus addresses depends on whether or not support for Modbus ASCII is enabled or disabled (see Section 8.10.4). Valid Modbus addresses are as follows:

- Modbus ASCII enabled: **1–15, 32–47, 64–79, 96–110**
- Modbus ASCII disabled: **0–127**

To configure the Modbus address:

- Using ProLink II, see Figure C-2.
- Using the display, see Figure C-15.

Note: This functionality cannot be configured via PROFIBUS protocol.

8.10.4 Modbus ASCII support

When support for Modbus ASCII is enabled, the service port can accept connection requests that use either Modbus ASCII or Modbus RTU. When support for Modbus ASCII is disabled, the service port cannot accept connection requests that use Modbus ASCII. Only Modbus RTU connections are accepted.

The primary reason to disable Modbus ASCII support is to allow a wider range of Modbus addresses for the service port.

To enable or disable Modbus ASCII support:

- Using ProLink II, see Figure C-2.
- Using the display, see Figure C-15.

Note: This functionality cannot be configured via PROFIBUS protocol.

8.10.5 Floating-point byte order

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

Four bytes are used to transmit floating-point values. For contents of bytes, see Table 8-11.

Table 8-11 **Byte contents in Modbus commands and responses**

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

The default byte order for the Model 2400S transmitter is **3–4 1–2**. You may need to reset byte order to match the byte order used by a remote host or PLC.

To configure byte order using ProLink II, see Figure C-2.

Note: This functionality cannot be configured via the display menus or PROFIBUS protocol.

8.10.6 Additional communications response delay

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

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

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

To configure additional communications response delay using ProLink II, see Figure C-2.

Note: This functionality cannot be configured via the display menus or PROFIBUS protocol.

8.10.7 Digital communications fault action

Note: This parameter affects both PROFIBUS and Modbus communications.

Digital communications fault action controls how process variables will be reported via digital communications during fault conditions. Table 8-12 lists the options for digital communications fault action.

Note: Digital communications fault action does not affect the alarm status bits. For example, if digital communications fault action is set to None, the alarm status bits will still be set if an alarm occurs. See Section 7.7 for more information.

Table 8-12 **Digital communications fault action options**

Option		
ProLink II label	**EDD label**	**Definition**
Upscale	Upscale	• Process variables indicate that the value is greater than the upper sensor limit. • Totalizers stop incrementing.
Downscale	Downscale	• Process variables indicate that the value is less than the lower sensor limit. • Totalizers stop incrementing.
Zero	IntZero-All 0	• Flow rate variables go to the value that represents zero flow. Density is reported as zero. • Temperature is reported as 0 °C, or the equivalent if other units are used (e.g., 32 °F). • Totalizers stop incrementing.
Not-A-Number (NAN)	Not-a-Number	• Process variables report IEEE NAN. • Drive gain is reported as measured. • Modbus scaled integers are reported as Max Int. • Totalizers stop incrementing.
Flow to Zero	IntZero-Flow 0	• Flow rate variables go to the value that represents zero flow; • Other process variables are reported as measured. • Totalizers stop incrementing.
None (default)	None	• Process variables are reported as measured. • Totalizers increment if they are running.

To configure digital communications fault action:

- Using ProLink II, see Figure C-2.
- Using a PROFIBUS host with the EDD, see Figure C-9.
- Using PROFIBUS bus parameters, use the Diagnostic block (see Table D-4), Index 18.

Note: This functionality cannot be configured via the display menus.

Note: Digital communications fault action is affected by the configured fault timeout. See Section 8.10.8.

8.10.8 Fault timeout

By default, the transmitter activates the digital communications fault action as soon as the fault is detected. The fault timeout (last measured value timeout) allows you to delay the digital communications fault action for a specified interval, for certain faults only. During the fault timeout period, digital communications reports the last measured value.

Note: The fault timeout applies only to the digital communications fault action. The “alarm active” status bit is set as soon as the fault is detected (all alarm severity levels), and the “alarm active” record is written to history immediately (Fault and Informational alarms only). For more information on alarm handling, see Section 7.7. For more information on alarm severity, see Section 8.8.

The fault timeout applies only to specific faults. Other faults are reported immediately, regardless of the fault timeout setting. For information on which faults are affected by the fault timeout, see Table 8-8.

To configure fault timeout:

- Using ProLink II, see Figure C-2.
- Using a PROFIBUS host with the EDD, see Figure C-9.
- Using PROFIBUS bus parameters, use the Diagnostic block (see Table D-4), Index 19.

Note: This functionality cannot be configured via the display menus.

8.11 Configuring device settings

The device settings are used to describe the flowmeter components. Table 8-13 lists and defines the device settings.

Table 8-13 Device settings

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

To configure device settings using ProLink II, see Figure C-2.

Note: This functionality cannot be configured via the display menus or PROFIBUS protocol.

If you are entering a date, use the left and right arrows at the top of the calendar shown in ProLink II to select the year and month, then click on a date.

8.12 Configuring PROFIBUS I&M function values

Most I&M function values are configured at the factory and cannot be changed by the user. Two I&M function values can be configured by the user:

- Device identification tag
- Device location identification tag

To configure these values:

- Using ProLink II, see Figure C-2. ProLink II v2.6 or later is required.
- Using a PROFIBUS host with the EDD, see Figure C-12. You must connect as a Specialist to use the I&M Functions menu.
- Using PROFIBUS bus parameters, see Table D-9.

Note: These values cannot be configured via the display menus.

8.13 Configuring sensor parameters

The sensor parameters are used to describe the sensor component of your flowmeter. One sensor parameter (curved or straight tube) must be set during characterization (see Section 6.2). The remaining sensor parameters are not used in transmitter processing, and are not required:

- Serial number
- Sensor material
- Liner material
- Flange

To configure sensor parameters:

- Using ProLink II, see Figure C-2.
- Using a PROFIBUS host with the EDD, see Figure C-10.
- Using PROFIBUS bus parameters, use the Device Information block (see Table D-5), Indices 7–12.

Note: This functionality cannot be configured via the display menus.

8.14 Configuring the petroleum measurement application

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

Note: The petroleum measurement application requires liquid volume measurement units. If you plan to use API process variables, ensure that liquid volume flow measurement is specified. See Section 8.2.

8.14.1 About the petroleum measurement application

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

Terms and definitions

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

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

CTL derivation methods

There are two derivation methods for CTL:

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

API reference tables

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

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

Table 8-14 summarizes these options.

Table 8-14 **API reference temperature tables**

Table	CTL derivation method	Base temperature	Density unit and range		
			Degrees API	Base density	Relative density
5A	Method 1	60 °F, non-configurable	0 to +100		
5B	Method 1	60 °F, non-configurable	0 to +85		
5D	Method 1	60 °F, non-configurable	–10 to +40		
23A	Method 1	60 °F, non-configurable			0.6110 to 1.0760
23B	Method 1	60 °F, non-configurable			0.6535 to 1.0760
23D	Method 1	60 °F, non-configurable			0.8520 to 1.1640
53A	Method 1	15 °C, configurable		610 to 1075 kg/m^3	
53B	Method 1	15 °C, configurable		653 to 1075 kg/m^3	
53D	Method 1	15 °C, configurable		825 to 1164 kg/m^3	
			Reference temperature		**Supports**
6C	Method 2	60 °F, non-configurable	60 °F		Degrees API
24C	Method 2	60 °F, non-configurable	60 °F		Relative density
54C	Method 2	15 °C, configurable	15 °C		Base density in kg/m^3

8.14.2 Configuration procedure

The API configuration parameters are listed and defined in Table 8-15.

Table 8-15 **API parameters**

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

(1) Configurable if Table Type is set to 6C, 24C, or 54C.
(2) In most cases, the temperature unit used by the API reference table should also be the temperature unit configured for the transmitter to use in general processing. To configure the temperature unit, see Section 6.3.4.

To configure the petroleum measurement application:

- Using ProLink II, see Figure C-3.
- Using a PROFIBUS host with the EDD, see Figure C-11.
- Using PROFIBUS bus parameters, use the API block (see Table D-7), Indices 13–15.

Note: This functionality cannot be configured via the display menus.

For the temperature value to be used in CTL calculation, you can use the temperature data from the sensor, or you can configure external temperature compensation to use either a static temperature value or temperature data from an external temperature device.

- To use temperature data from the sensor, no action is required.
- To configure external temperature compensation, see Section 9.3.

8.15 Configuring the enhanced density application

Micro Motion sensors provide direct measurements of density, but not of concentration. The enhanced density application calculates enhanced density process variables, such as concentration or density at reference temperature, from density process data, appropriately corrected for temperature.

Note: For a detailed description of the enhanced density application, see the manual entitled Micro Motion Enhanced Density Application: Theory, Configuration, and Use*.*

Note: The enhanced density application requires liquid volume measurement units. If you plan to use enhanced density process variables, ensure that liquid volume flow measurement is specified. See Section 8.2.

8.15.1 About the enhanced density application

The enhanced density calculation requires an enhanced density curve, which specifies the relationship between temperature, concentration, and density for the process fluid being measured. Micro Motion supplies a set of six standard enhanced density curves (see Table 8-16). If none of these curves is appropriate for your process fluid, you can configure a custom curve or purchase a custom curve from Micro Motion.

The derived variable, specified during configuration, controls the type of concentration measurement that will be produced. Each derived variable allows the calculation of a subset of enhanced density process variables (see Table 8-17). The available enhanced density process variables can be used in process control, just as mass flow rate, volume flow rate, and other process variables are used. For example, an event can be defined on an enhanced density process variable.

- For all standard curves, the derived variable is Mass Conc (Dens).
- For custom curves, the derived variable may be any of the variables listed in Table 8-17.

The transmitter can hold up to six curves at any given time, but only one curve can be active (used for measurement) at a time. All curves that are in transmitter memory must use the same derived variable.

Table 8-16 Standard curves and associated measurement units

Name	Description	Density unit	Temperature unit
Deg Balling	Curve represents percent extract, by mass, in solution, based on °Balling. For example, if a wort is 10 °Balling and the extract in solution is 100% sucrose, the extract is 10% of the total mass.	g/cm^3	°F
Deg Brix	Curve represents a hydrometer scale for sucrose solutions that indicates the percent by mass of sucrose in solution at a given temperature. For example, 40 kg of sucrose mixed with 60 kg of water results in a 40 °Brix solution.	g/cm^3	°C
Deg Plato	Curve represents percent extract, by mass, in solution, based on °Plato. For example, if a wort is 10 °Plato and the extract in solution is 100% sucrose, the extract is 10% of the total mass.	g/cm^3	°F

Table 8-16 Standard curves and associated measurement units *continued*

Name	Description	Density unit	Temperature unit
HFCS 42	Curve represents a hydrometer scale for HFCS 42 (high fructose corn syrup) solutions that indicates the percent by mass of HFCS in solution.	g/cm^3	°C
HFCS 55	Curve represents a hydrometer scale for HFCS 55 (high fructose corn syrup) solutions that indicates the percent by mass of HFCS in solution.	g/cm^3	°C
HFCS 90	Curve represents a hydrometer scale for HFCS 90 (high fructose corn syrup) solutions that indicates the percent by mass of HFCS in solution.	g/cm^3	°C

Table 8-17 Derived variables and available process variables

	Available process variables					
Derived variable – ProLink II label and definition	Density at reference temperature	Standard volume flow rate	Specific gravity	Concentration	Net mass flow rate	Net volume flow rate
Density @ Ref *Density at reference temperature* Mass/unit volume, corrected to a given reference temperature	✓	✓				
SG *Specific gravity* The ratio of the density of a process fluid at a given temperature to the density of water at a given temperature. The two given temperature conditions do not need to be the same.	✓	✓	✓			
Mass Conc (Dens) *Mass concentration derived from reference density* The percent mass of solute or of material in suspension in the total solution, derived from reference density	✓	✓		✓	✓	
Mass Conc (SG) *Mass concentration derived from specific gravity* The percent mass of solute or of material in suspension in the total solution, derived from specific gravity	✓	✓	✓	✓	✓	
Volume Conc (Dens) *Volume concentration derived from reference density* The percent volume of solute or of material in suspension in the total solution, derived from reference density	✓	✓		✓		✓

Table 8-17 **Derived variables and available process variables** *continued*

Derived variable – ProLink II label and definition	Available process variables: Density at reference temperature	Standard volume flow rate	Specific gravity	Concentration	Net mass flow rate	Net volume flow rate
Volume Conc (SG) *Volume concentration derived from specific gravity* The percent volume of solute or of material in suspension in the total solution, derived from specific gravity	✓	✓	✓	✓		✓
Conc (Dens) *Concentration derived from reference density* The mass, volume, weight, or number of moles of solute or of material in suspension in proportion to the total solution, derived from reference density	✓	✓		✓		
Conc (SG) *Concentration derived from specific gravity* The mass, volume, weight, or number of moles of solute or of material in suspension in proportion to the total solution, derived from specific gravity	✓	✓	✓	✓		

8.15.2 Configuration procedure

Complete configuration instructions for the enhanced density application are provided in the manual entitled *Micro Motion Enhanced Density Application: Theory, Configuration, and Use*.

Note: The enhanced density manual uses ProLink II as the standard configuration tool for the enhanced density application. Because the menu structure defined in the EDD is very similar to the ProLink II menus, you can follow the instructions for ProLink II and adapt them to your host.

The typical configuration procedure simply sets up the enhanced density application to use a standard curve. The following steps are required:

1. Set the transmitter's density measurement unit to match the unit used by the curve (as listed in Table 8-16).
2. Set the transmitter's temperature measurement unit to match the unit used by the curve (as listed in Table 8-16).
3. Set the derived variable to Mass Conc (Dens).
4. Specify the active curve.

To perform these steps:

- With ProLink II, see Figures C-2 and C-3.
- With a PROFIBUS host and the EDD, see Figures C-8 and C-11.
- With PROFIBUS bus parameters, use the Measurement block and the Enhanced Density block (see Tables D-2 and D-8).

Chapter 9
Pressure Compensation and External Temperature Compensation

9.1 Overview

This chapter describes the following procedures:

- Configuring pressure compensation – see Section 9.2
- Configuring external temperature compensation – see Section 9.3
- Obtaining external pressure or temperature data – see Section 9.4

Note: All procedures provided in this chapter assume that you have established communication with the Model 2400S DP transmitter and that you are complying with all applicable safety requirements.

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

9.2 Pressure compensation

The Model 2400S DP transmitter can compensate for the effect of pressure on the sensor flow tubes. *Pressure effect* is defined as the change in sensor flow and density sensitivity due to process pressure change away from calibration pressure.

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

9.2.1 Options

There are two ways to implement pressure compensation:

- You can use an output module to obtain pressure data from the system. See Section 9.4.
- If the operating pressure is a known static value, you can configure that value in the transmitter.

Note: Ensure that your pressure value is accurate, or that your pressure measurement device is accurate and reliable.

9.2.2 Pressure correction factors

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

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

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

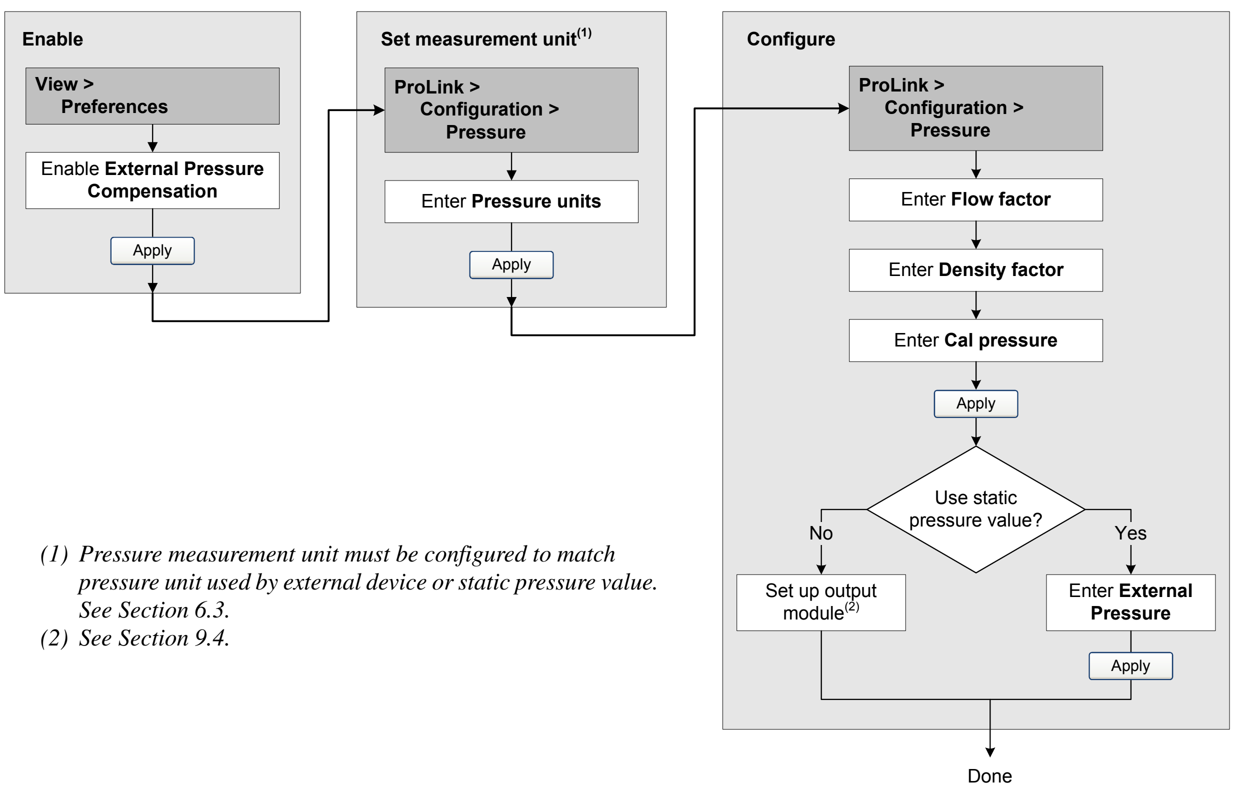
Not all sensors or applications require pressure correction factors. For the pressure correction values to be used, obtain the pressure effect values from the product data sheet for your sensor, then reverse the signs (e.g., if the flow factor is 0.000004 % per PSI, enter a pressure correction flow factor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

9.2.3 Configuration

To enable and configure pressure compensation:

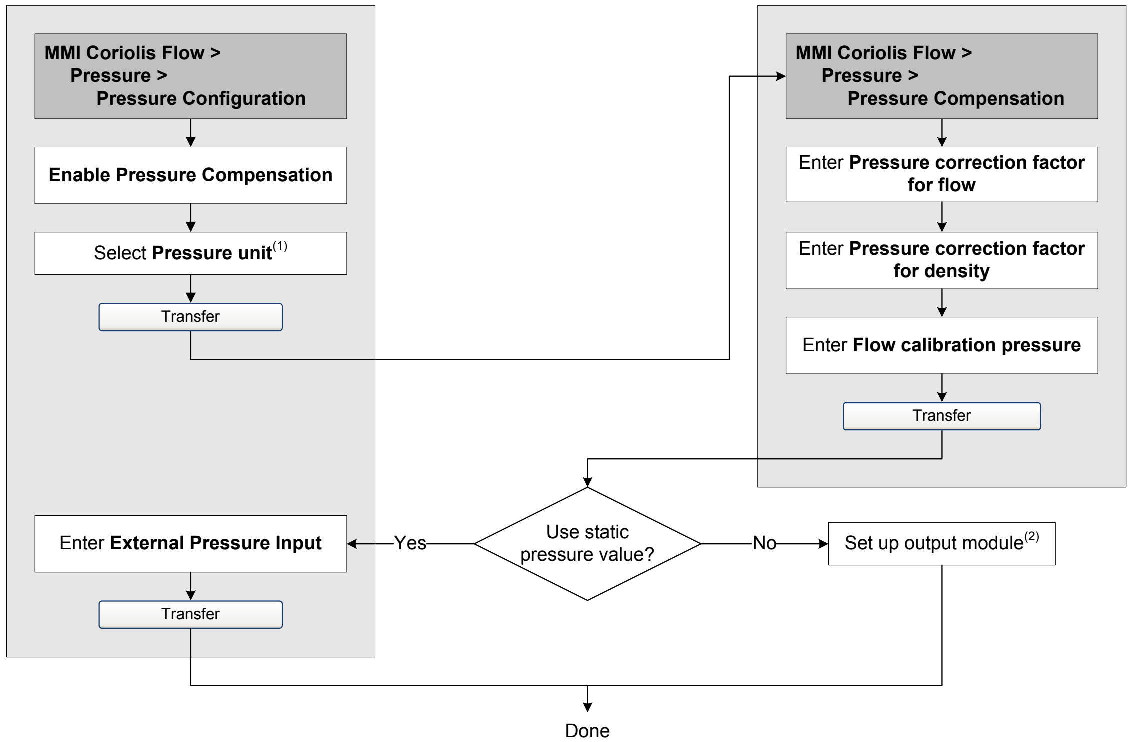
- With ProLink II, see Figure 9-1.
- With a PROFIBUS host with the EDD, see Figure 9-2.
- With PROFIBUS bus parameters, see Figure 9-3.

Figure 9-1 **Pressure compensation – ProLink II**



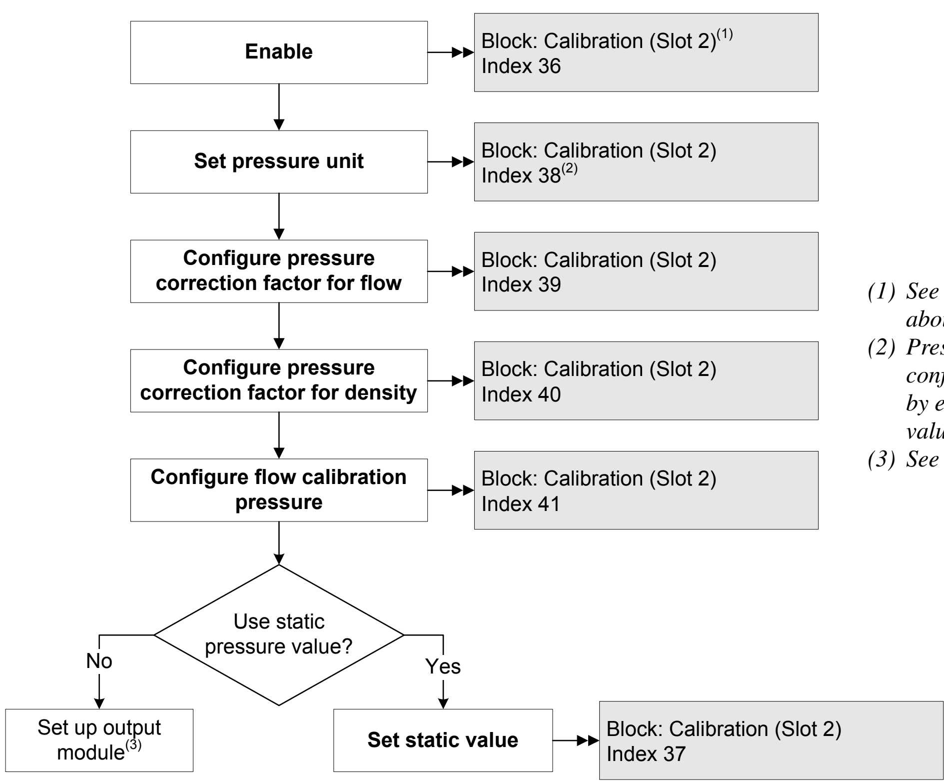
(1) Pressure measurement unit must be configured to match pressure unit used by external device or static pressure value. See Section 6.3.
(2) See Section 9.4.

Figure 9-2 Pressure compensation – PROFIBUS host with the EDD



(1) Pressure measurement unit must be configured to match pressure unit used by external device or static pressure value. See Section 6.3.
(2) See Section 9.4.

Figure 9-3 Pressure compensation – PROFIBUS bus parameters



(1) See Table D-3 for more information about the bus parameters.
(2) Pressure measurement unit must be configured to match pressure unit used by external device or static pressure value. See Section 6.3.
(3) See Section 9.4.

9.3 External temperature compensation

External temperature compensation can be used with the petroleum measurement application or the enhanced density application:

- If external temperature compensation is enabled, an external temperature value (or a static temperature value), rather than the temperature value from the sensor, is used in petroleum measurement or enhanced density calculations only. The temperature value from the sensor is used for all other calculations.
- If external temperature compensation is disabled, the temperature value from the sensor is used in all calculations.

There are two ways to implement external temperature compensation:

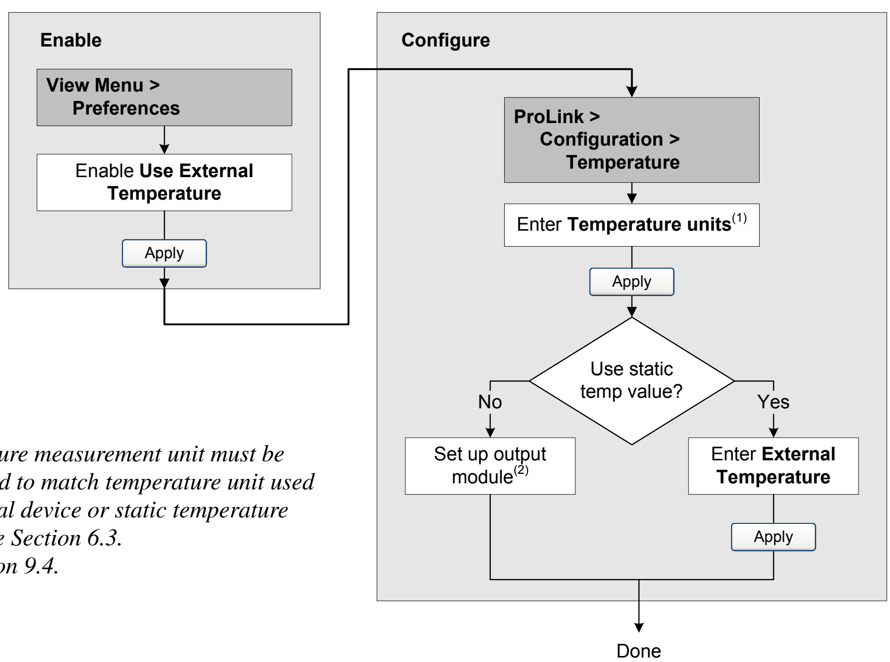
- You can use an output module to obtain temperature data from the system. See Section 9.4.
- If the operating temperature is a known static value, you can configure that value in the transmitter.

Note: Ensure that your temperature value is accurate, or that your temperature measurement device is accurate and reliable.

To enable and configure external temperature compensation:

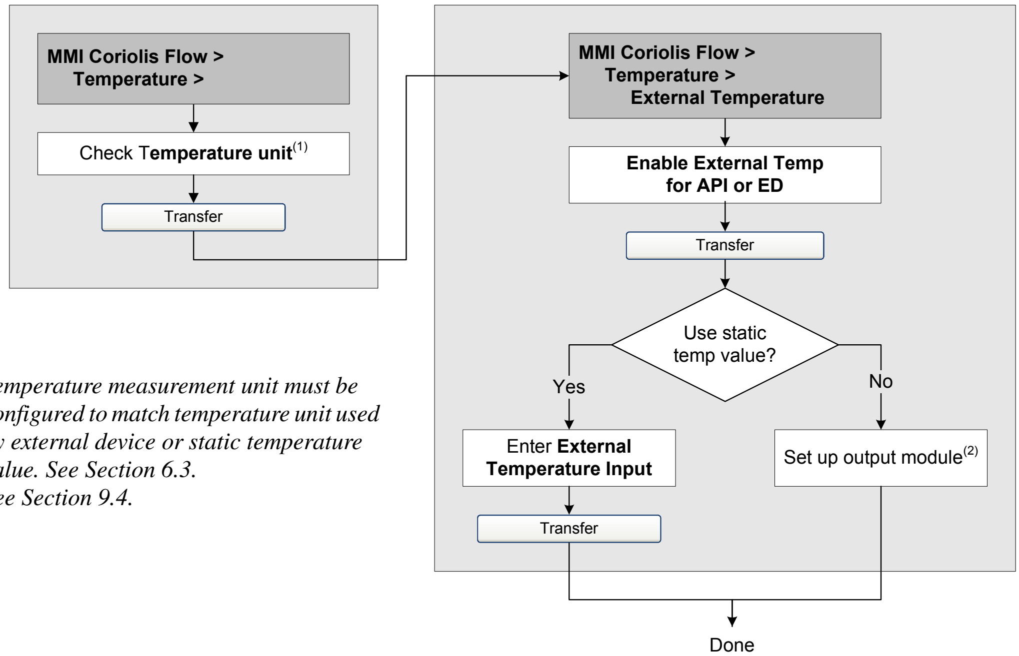
- With ProLink II, see Figure 9-4.
- With a PROFIBUS host with the EDD, see Figure 9-5.
- With PROFIBUS bus parameters, see Figure 9-3.

Figure 9-4 External temperature compensation – ProLink II



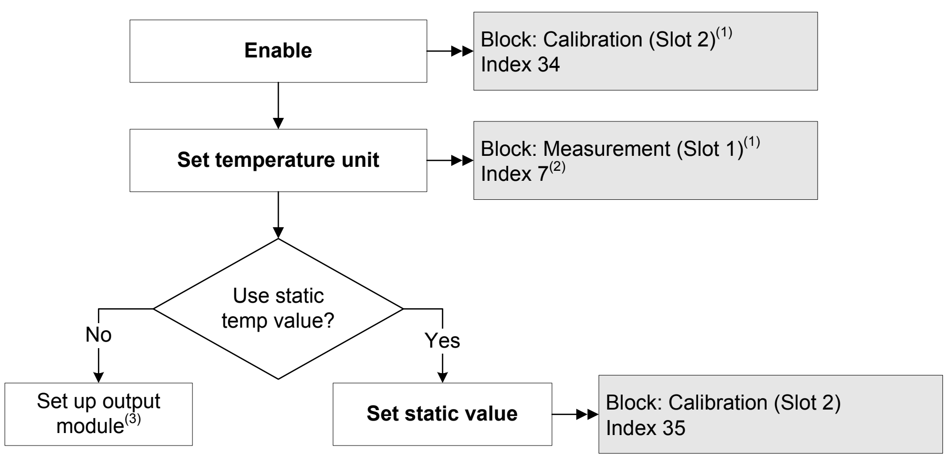
(1) Temperature measurement unit must be configured to match temperature unit used by external device or static temperature value. See Section 6.3.
(2) See Section 9.4.

Figure 9-5 External temperature compensation – PROFIBUS host with the EDD



(1) *Temperature measurement unit must be configured to match temperature unit used by external device or static temperature value. See Section 6.3.*
(2) *See Section 9.4.*

Figure 9-6 External temperature compensation – PROFIBUS bus parameters



(1) *See Tables D-3 and D-2 for more information about the bus parameters.*
(2) *Temperature measurement unit must be configured to match temperature unit used by external device or static temperature value. See Section 6.3.*
(3) *See Section 9.4.*

9.4 Obtaining external pressure and temperature data

The output modules used to obtain external pressure and/or temperature data are listed in Table 9-1. Use standard methods to implement the required connection.

Table 9-1 Output modules used for pressure or temperature compensation

Module number	Module name	Size
34	External pressure	4 bytes
35	External temperature	4 bytes

Chapter 10
Measurement Performance

10.1 Overview

This chapter describes the following procedures:

- Meter verification – see Section 10.3
- Meter validation and adjusting meter factors – see Section 10.4
- Zero calibration – see Section 10.5
- Density calibration – see Section 10.6
- Temperature calibration – see Section 10.7

Note: All procedures provided in this chapter assume that you have established communication with the Model 2400S DP transmitter and that you are complying with all applicable safety requirements.

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

10.2 Meter validation, meter verification, and calibration

The Model 2400S transmitter supports the following procedures for the evaluation and adjustment of measurement performance:

- *Meter verification* – establishing confidence in the sensor's performance by analyzing secondary variables associated with flow and density
- *Meter validation* – confirming performance by comparing the sensor's measurements to a primary standard
- *Calibration* – establishing the relationship between a process variable (flow, density, or temperature) and the signal produced by the sensor

Meter validation and calibration are available on all Model 2400S DP transmitters. Meter verification is available only if the meter verification option was ordered with the transmitter.

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

10.2.1 Meter verification

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

Note: Micro Motion recommends performing meter verification at regular intervals.

There are two versions of the meter verification application: the original version and Micro Motion Smart Meter Verification. Table 10-1 lists requirements for each version. Table 10-2 provides a comparison of the two versions.

Note: If you are running an older version of ProLink II or the EDD, you will not be able to access the additional features in Smart Meter Verification. If you are running an updated version of ProLink II or the EDD with the original version of meter verification, the meter verification procedures will be slightly different from the procedures shown here.

Table 10-1 Version requirements for meter verification application

	Meter verification application	
Requirement type	**Original version**	**Smart Meter Verification**
Transmitter	v1.0	v1.4
ProLink II requirements	v2.5	v2.9
EDD requirements	2400SDP_pdmrev1_00 folder	2400SDP_pdmrev1_40 folder

Table 10-2 Comparison of meter verification features and functions: original version vs. Smart Meter Verification

	Meter verification application	
Feature or function	**Original version**	**Smart Meter Verification**
Process interruption	No need to halt flow	No need to halt flow
Measurement interruption	Three minutes. Outputs go to: • Last Measured Value • Configured Fault Value	User option: • Continue Measurement. Measurement is not interrupted. Test requires approximately 90 seconds. • Last Measured Value. Outputs fixed and measurement interrupted for approximately 140 seconds. • Configured Fault Value Outputs fixed and measurement interrupted for approximately 140 seconds.
Result storage	Test results stored only for tests run with ProLink II, and stored on the PC	Twenty most recent results stored on the transmitter, independent of tool used to perform the procedure. For tests run with ProLink II, additional result data stored on PC.
Result data on display	Pass/Fail/Abort for current test	For all results stored on transmitter: • Pass/Fail/Abort • Abort code (if relevant) • Stiffness of the right and left pickoffs

Table 10-2 Comparison of meter verification features and functions: original version vs. Smart Meter Verification *continued*

	Meter verification application	
Feature or function	**Original version**	**Smart Meter Verification**
Result data with EDD	Pass/Caution/Abort for current test	For all results stored on transmitter: • Pass/Caution/Abort • Abort code (if relevant) • Stiffness of the right and left pickoffs • Comparison table for stored results • Comparison plot for stored results
Result data with ProLink II	For all results stored on PC: • Pass/Fail/Abort • Abort code (if relevant) • Stiffness of the right and left pickoffs • Test execution metadata • Comparison graphs • Test reports • Data export and manipulation capabilities	For all results stored on transmitter: • Pass/Fail/Abort • Abort code (if relevant) • Stiffness of the right and left pickoffs • Test execution metadata • Comparison graphs • Test reports • Data export and manipulation capabilities
Startup methods	Manual	Manual Scheduler Event

10.2.2 Meter validation and meter factors

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

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

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

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

10.2.3 Calibration

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

- Zero, or no flow
- Density calibration
- Temperature calibration

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

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

Micro Motion flowmeters with the Model 2400S transmitter are calibrated at the factory, and normally do not need to be calibrated in the field. Calibrate the flowmeter only if you must do so to meet regulatory requirements. Contact Micro Motion before calibrating your flowmeter.

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

10.2.4 Comparison and recommendations

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

- Process and measurement interruption
  - Smart Meter Verification provides an option that allows process measurement to continue during the test.
  - The original version of meter verification requires approximately three minutes to perform. During these three minutes, flow can continue (provided sufficient stability is maintained); however, measurement is halted.
  - Meter validation for density does not interrupt the process. However, meter validation for mass flow or volume flow requires process down-time for the length of the test.
  - Calibration requires process down-time. In addition, density and temperature calibration require replacing the process fluid with low-density and high density fluids, or with low-temperature and high-temperature fluids. Zero calibration requires stopping flow through the sensor.
- External measurement requirements
  - Neither version of meter verification requires external measurements.
  - Zero calibration does not require external measurements.
  - Density calibration, temperature calibration, and meter validation require external measurements. For good results, the external measurement must be highly accurate.
- Measurement adjustment
  - Meter verification is an indicator of sensor condition, but does not change flowmeter internal measurement in any way.
  - Meter validation does not change flowmeter internal measurement in any way. If you decide to adjust a meter factor as a result of a meter validation procedure, only the reported measurement is changed – the base measurement is not changed. You can always reverse the change by returning the meter factor to its previous value.
  - Calibration changes the transmitter's interpretation of process data, and accordingly changes the base measurement. If you perform a zero calibration, you can return to the factory zero (or, if using ProLink II, the previous zero). However, if you perform a density calibration or a temperature calibration, you cannot return to the previous calibration factors unless you have manually recorded them.

Micro Motion recommends that you purchase the meter verification option and perform meter verification frequently.

10.3 Performing meter verification

10.3.1 Preparing for the meter verification test

Process fluid and process conditions

The meter verification test can be performed on any process fluid. It is not necessary to match factory conditions.

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

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

If stability varies outside test limits, the test will be aborted. Verify the stability of the process and repeat the test.

Transmitter configuration

Meter verification is not affected by any parameters configured for flow, density, or temperature. It is not necessary to change the transmitter configuration.

Control loops and process measurement

If the transmitter outputs will be set to Last Measured Value or Fault during the test, the outputs will be fixed for two minutes (Smart Meter Verification) or three minutes (original version). Disable all control loops for the duration of the test, and ensure that any data reported during this period is handled appropriately.

Specification uncertainty limit

The specification uncertainty limit defines the acceptable degree of variation from factory results, expressed as a percentage. Variation inside the limit is reported as Pass. Variation outside the limit is reported as Fail or Caution.

- In Smart Meter Verification, the specification uncertainty limit is set at the factory and cannot be configured.
- In the original version of meter verification, the specification uncertainty limit is configurable. However, Micro Motion suggests using the default value. Contact Micro Motion Customer Service before changing the specification uncertainty limit.

10.3.2 Running the meter verification test, original version

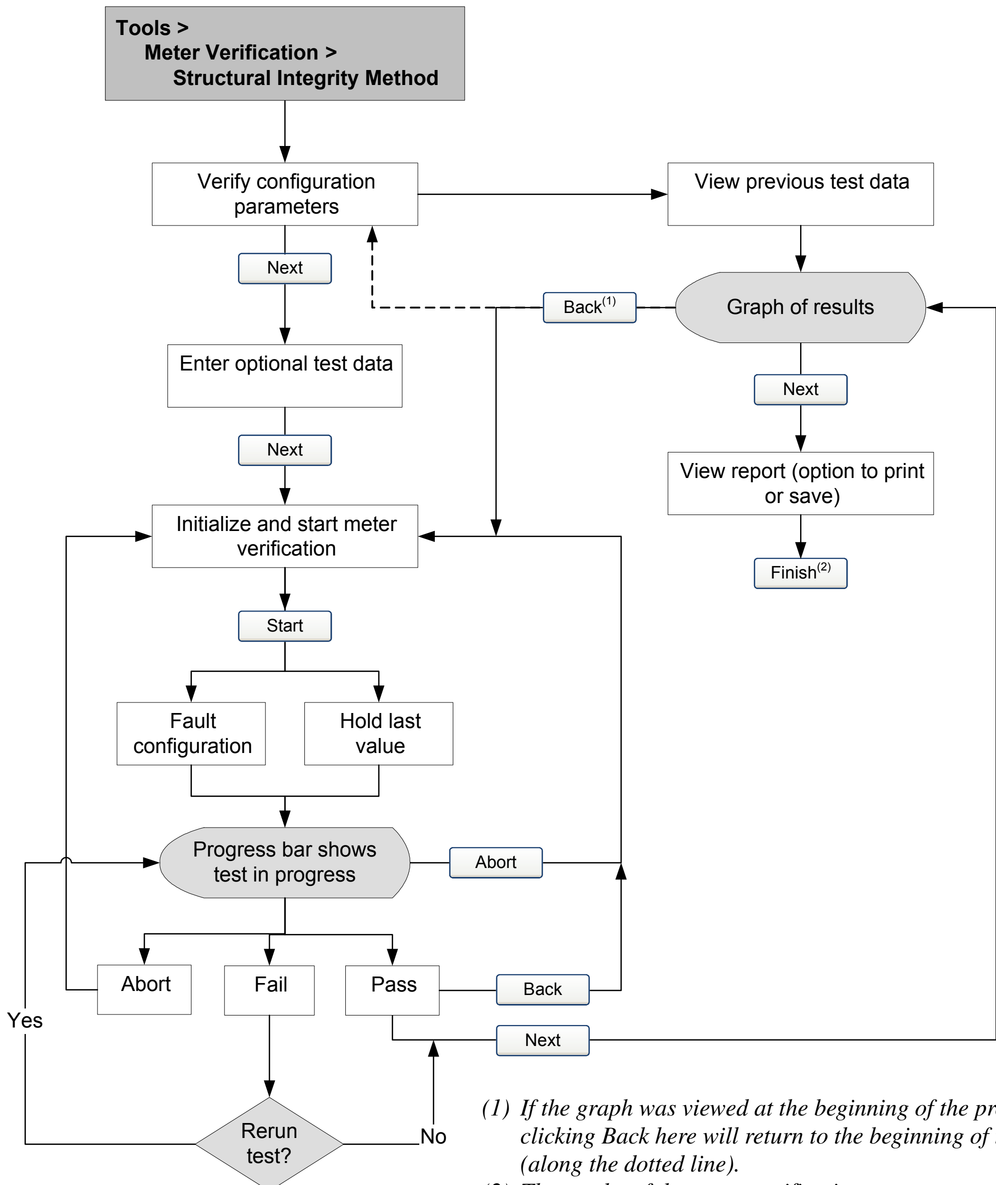
To perform meter verification:

- Using ProLink II, follow the procedure illustrated in Figure 10-1.
- Using the display menu, follow the procedure illustrated in Figure 10-2. For a complete illustration of the meter verification display menu, see Figure C-17.
- Using a PROFIBUS host with the EDD, refer to Figure C-7 and follow the procedure illustrated in Figure 10-4.
- Using PROFIBUS bus parameters, use the Diagnostic block (see Table D-4) and follow the procedure illustrated in Figure 10-4.

Note: If you start a meter verification test remotely, the transmitter display shows the following message:

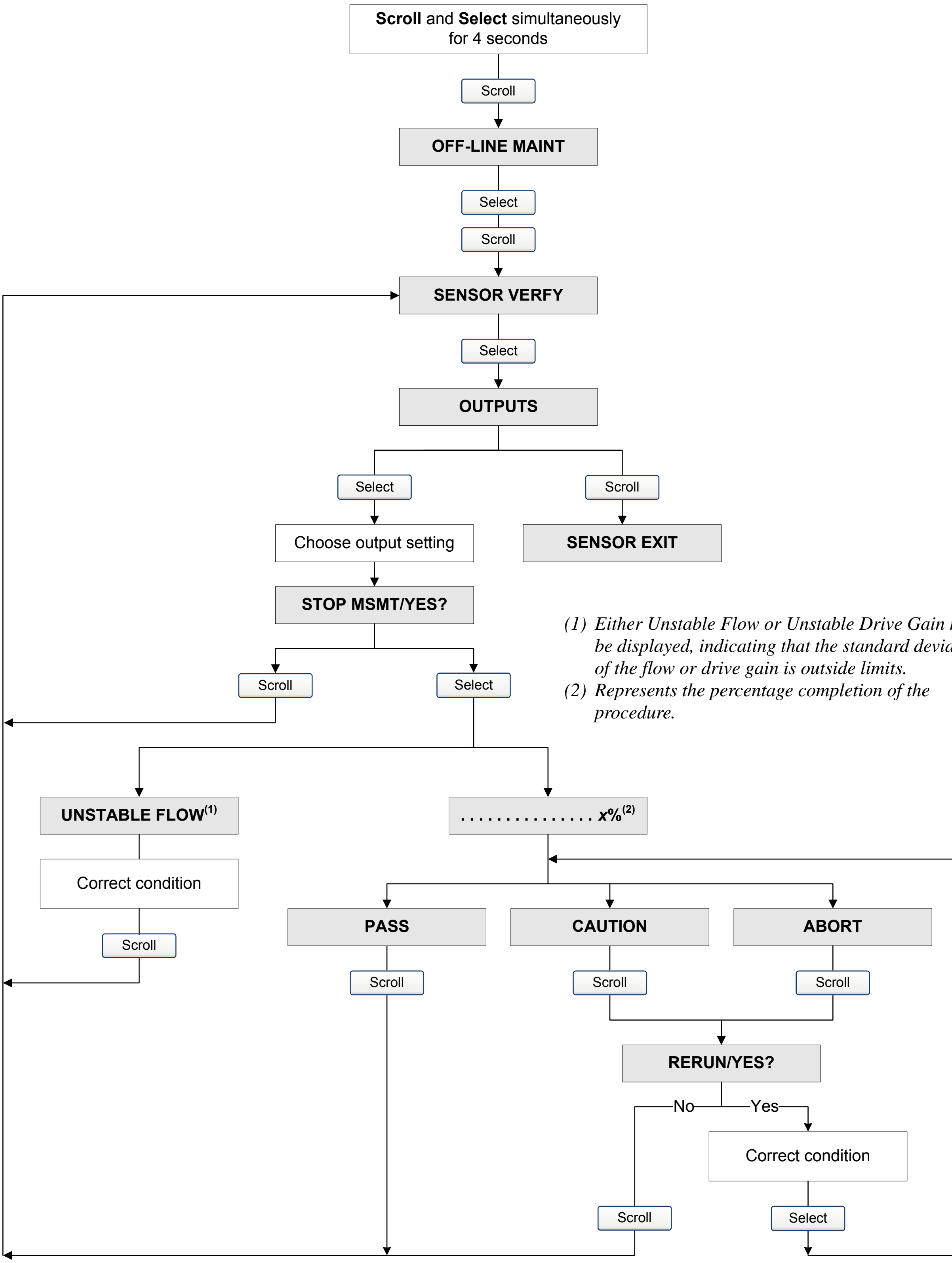
SENSOR
VERFY/*x*%

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



(1) *If the graph was viewed at the beginning of the procedure, clicking Back here will return to the beginning of the procedure (along the dotted line).*
(2) *The results of the meter verification test are not saved until Finish is clicked.*

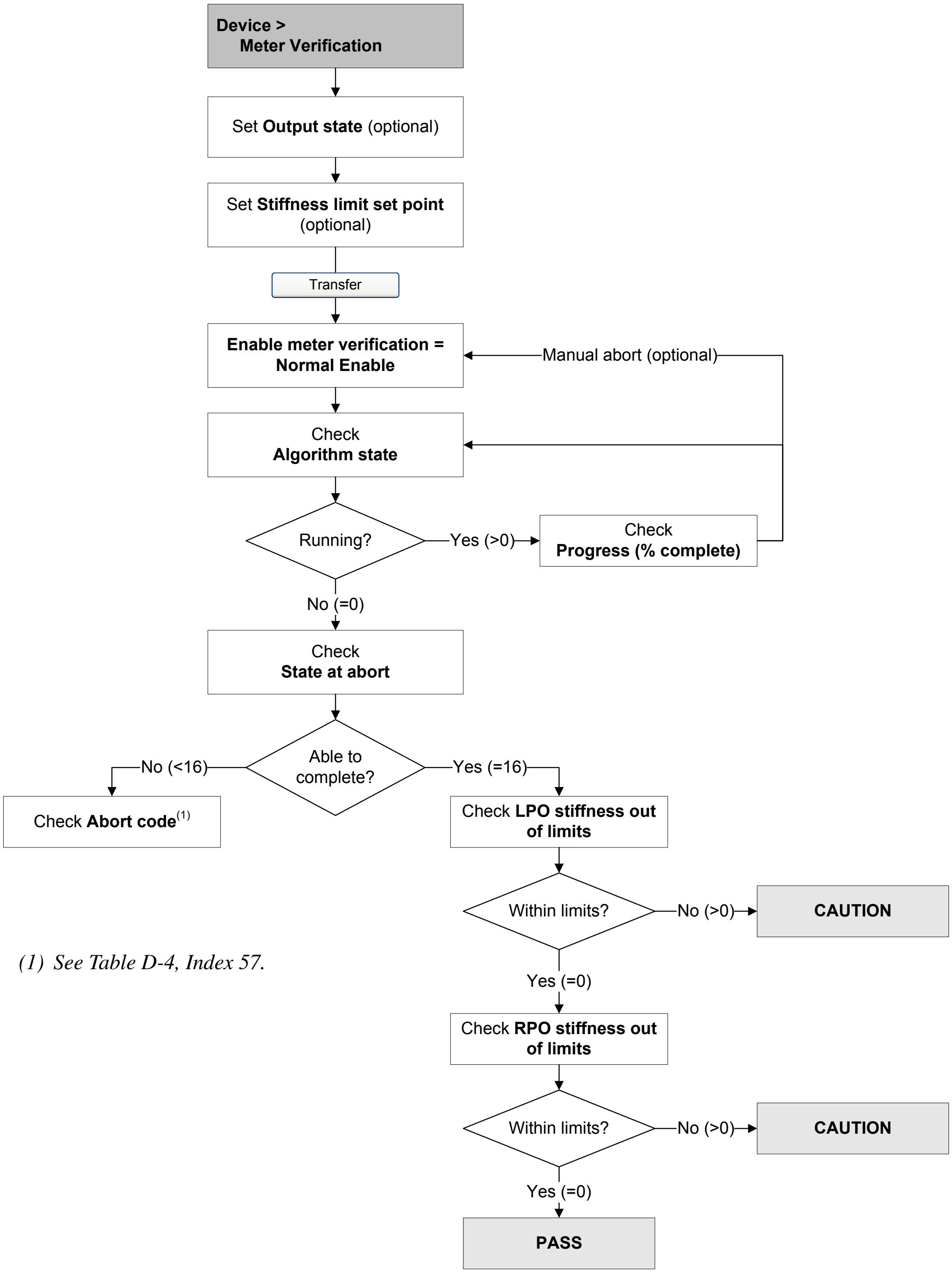
Figure 10-2 Meter verification procedure – Display menu



(1) Either Unstable Flow or Unstable Drive Gain may be displayed, indicating that the standard deviation of the flow or drive gain is outside limits.

(2) Represents the percentage completion of the procedure.

Figure 10-3 Meter verification procedure – EDD



(1) See Table D-4, Index 57.

Figure 10-4 Meter verification procedure – PROFIBUS bus parameters

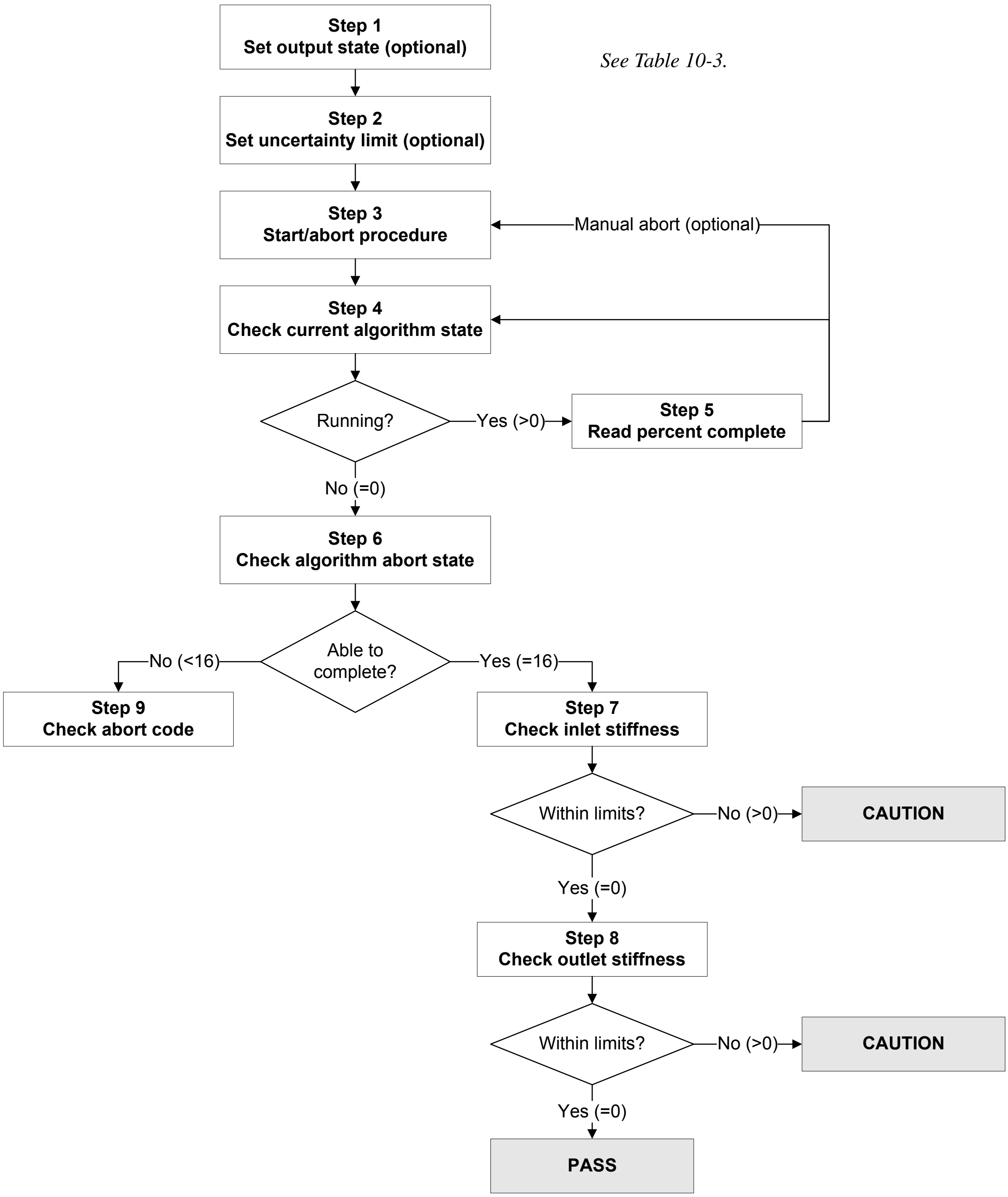


Table 10-3 PROFIBUS bus parameters interface for meter verification

Step number	Step description	Interface(1)
1	Set output state	Diagnostic block (Slot 3) Index 54
2	Set uncertainty limit	Diagnostic block (Slot 3) Index 55
3	Start/abort procedure	Diagnostic block (Slot 3) Index 53
4	Check current algorithm state	Diagnostic block (Slot 3) Index 56
5	Read percent complete	Diagnostic block (Slot 3) Index 61
6	Check algorithm abort state	Diagnostic block (Slot 3) Index 58
7	Check inlet stiffness	Diagnostic block (Slot 3) Index 59
8	Check outlet stiffness	Diagnostic block (Slot 3) Index 60
9	Read abort code	Diagnostic block (Slot 3) Index 57

(1) For detailed information, see Table D-4.

10.3.3 Running Smart Meter Verification

To run a Smart Meter Verification test:

- Using ProLink II, see Figure 10-5.
- Using the display, see Figures 10-6 and 10-7.
- Using a PROFIBUS host with the EDD, refer to Figure C-7 and follow the procedure illustrated in Figure 10-8.
- Using PROFIBUS bus parameters, use the Diagnostic block (see Table D-4) and follow the procedure illustrated in Figure 10-9.

Note: If you start a Smart Meter Verification test using ProLink II, the EDD, or PROFIBUS bus parameters, and the outputs are set to Last Measured Value or Fault, the transmitter display shows the following message:

SENSOR
VERFY/*x*%

Figure 10-5 Smart Meter Verification test – ProLink II

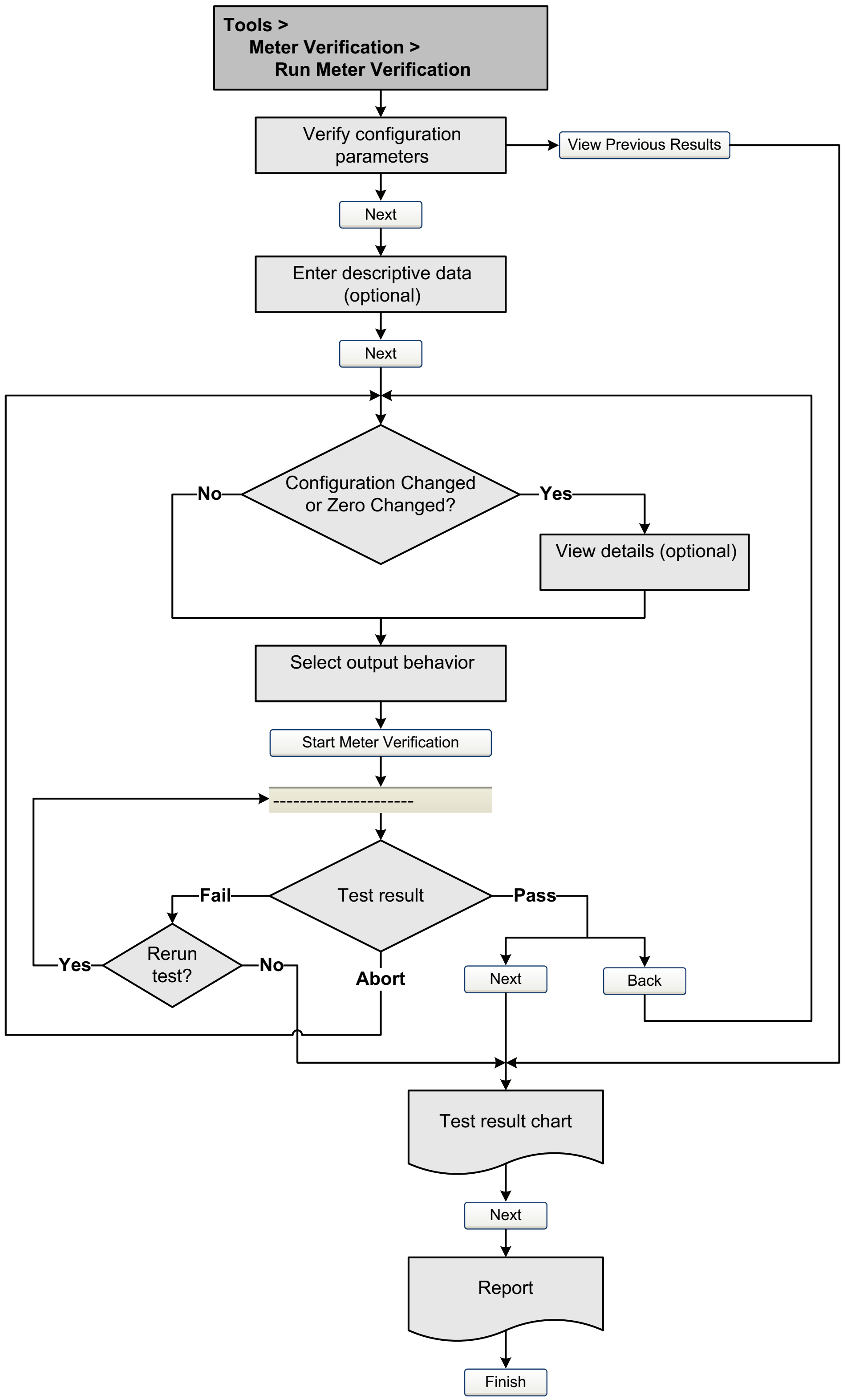


Figure 10-6 Smart Meter Verification top-level menu – Display

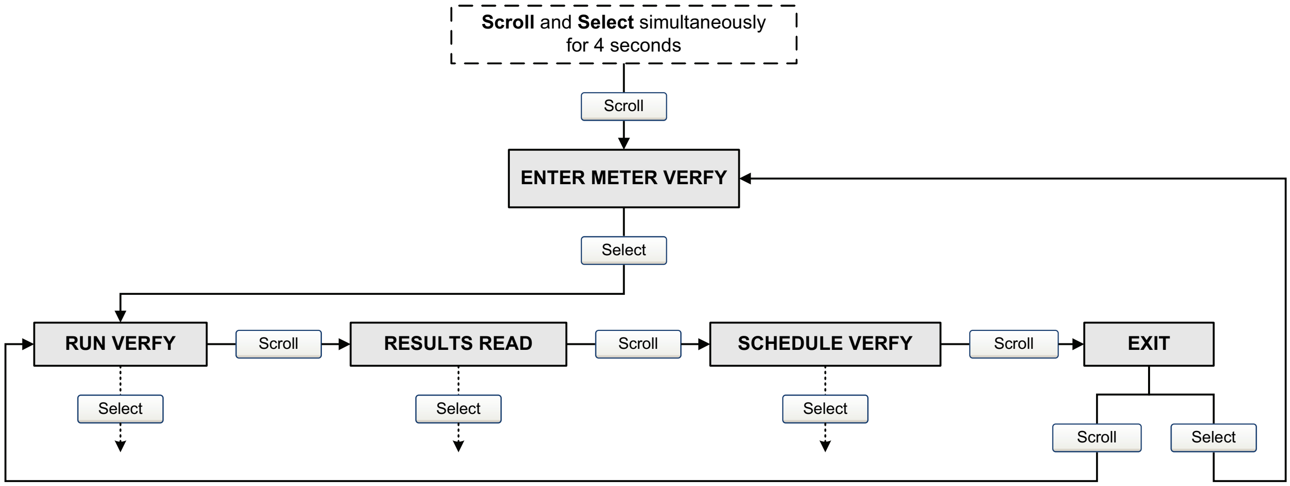


Figure 10-7 Smart Meter Verification test – Display

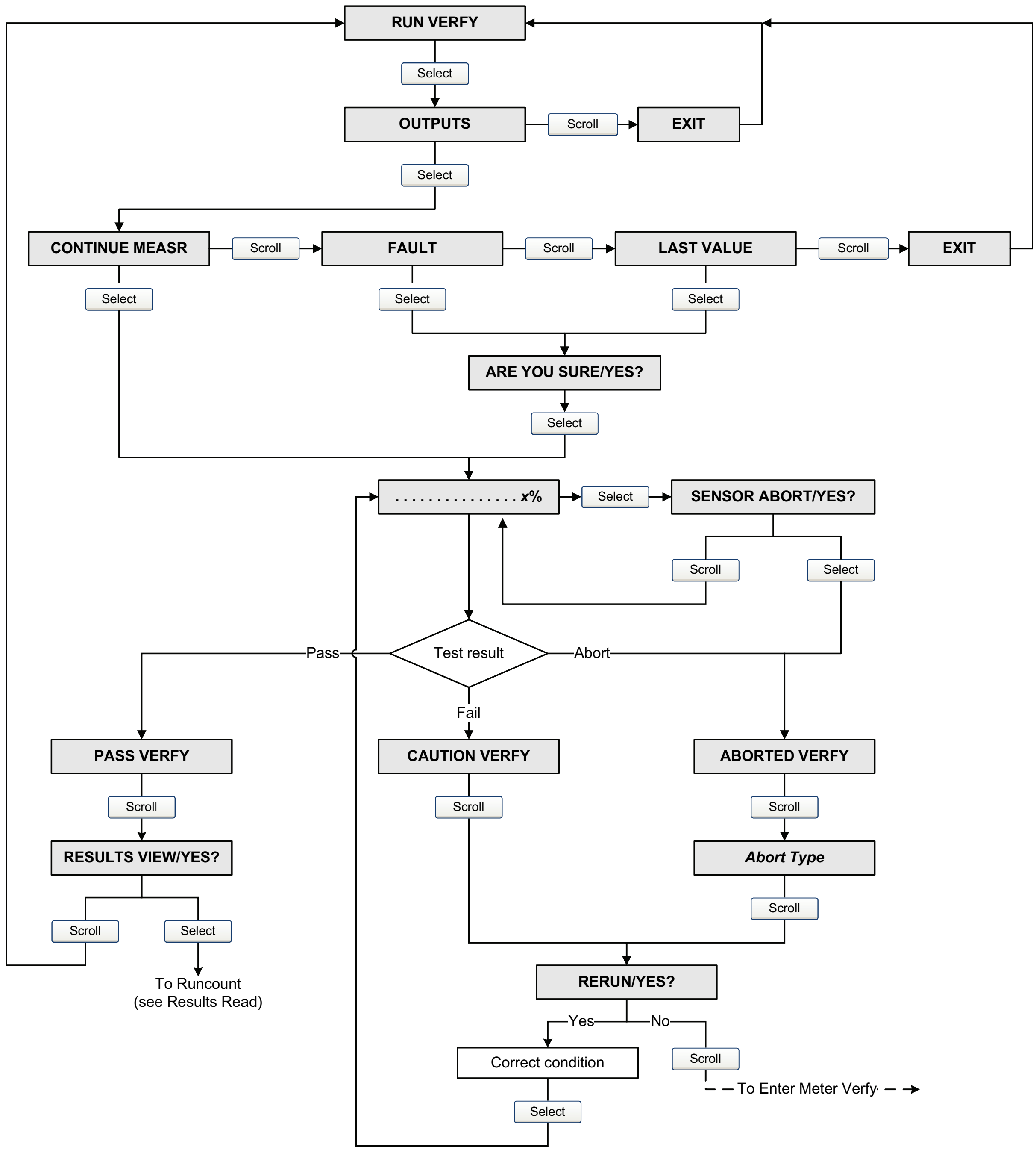


Figure 10-8 Smart Meter Verification test – EDD

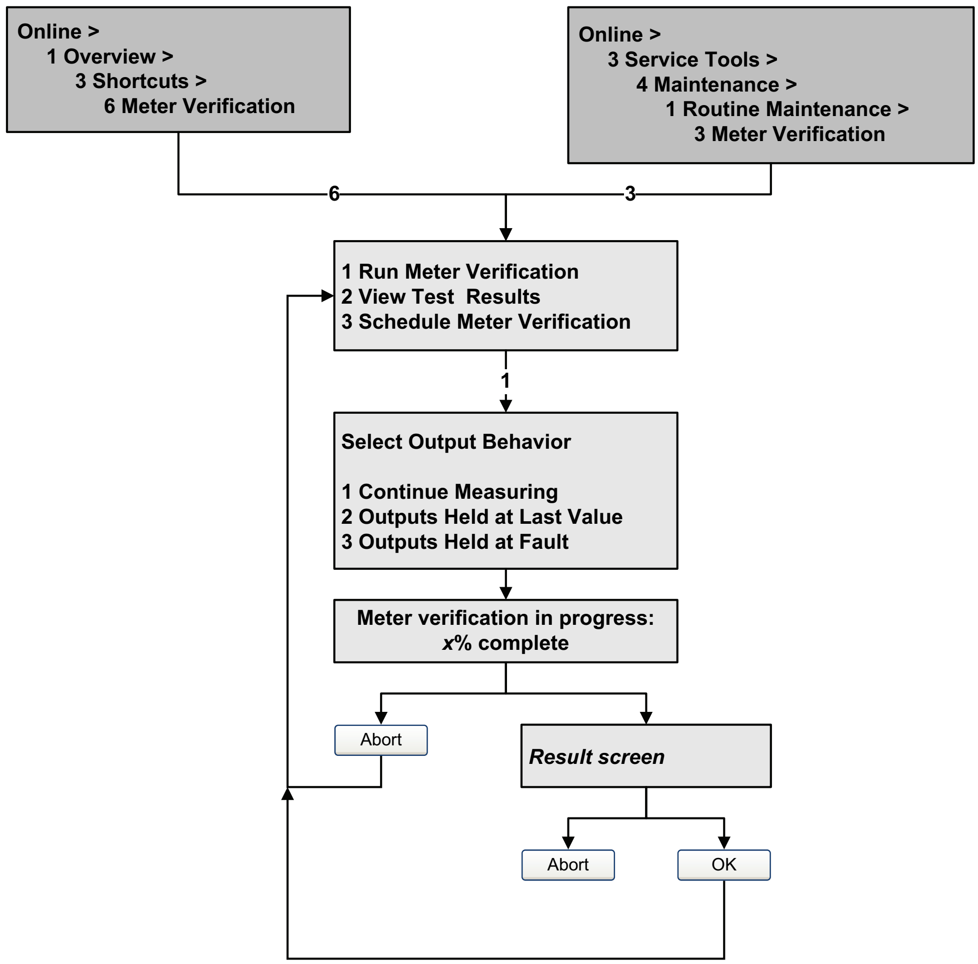


Figure 10-9 Smart Meter Verification test – PROFIBUS bus parameters

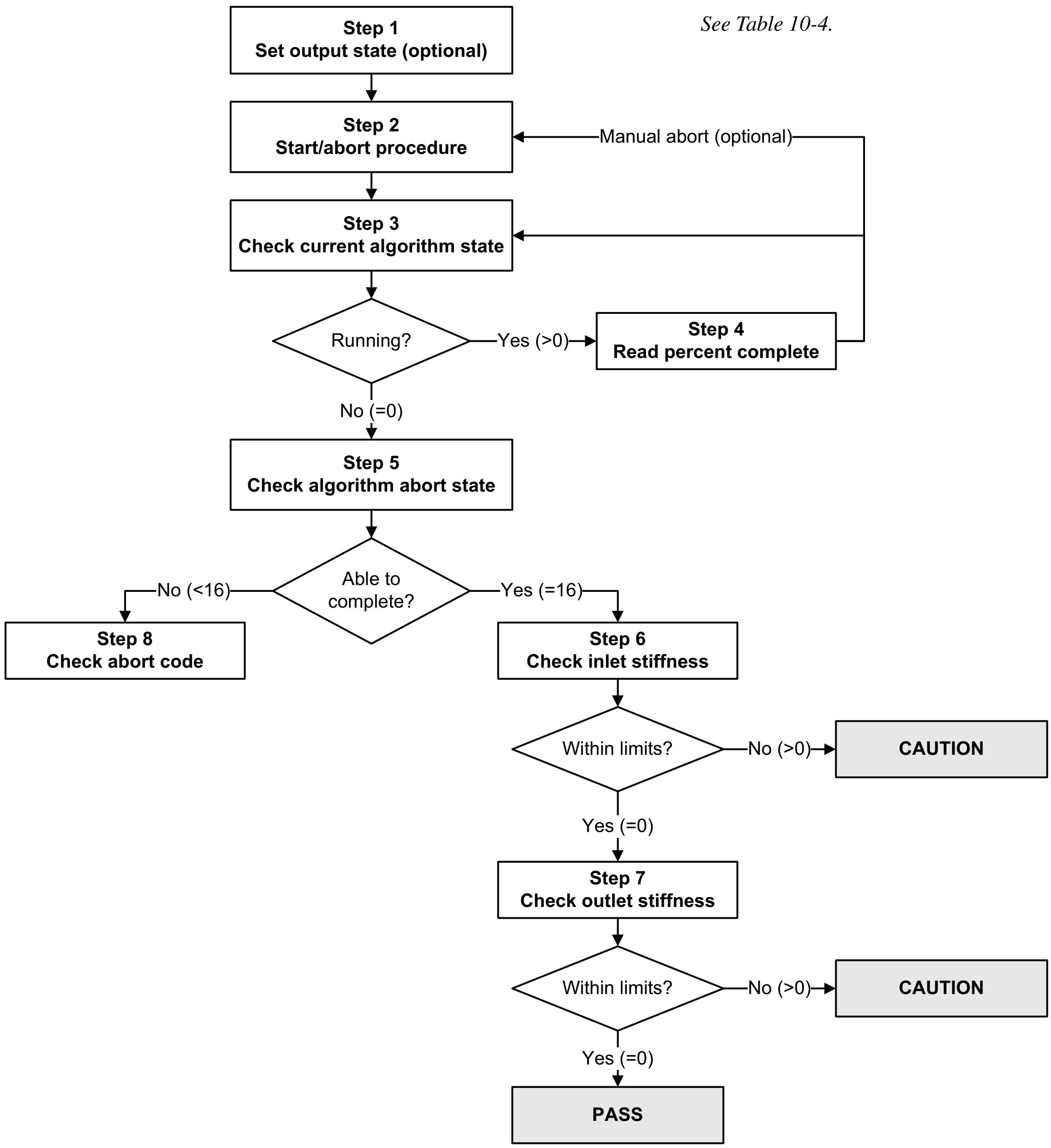


Table 10-4 PROFIBUS bus parameters test interface for Smart Meter Verification

Step number	Step description	Interface(1)
1	Set output state	Diagnostic block (Slot 3)
	• To Fault or Last Measured Value	Index 54
	• To Continue Measurement	Index 53

Table 10-4 PROFIBUS bus parameters test interface for Smart Meter Verification *continued*

Step number	Step description	Interface(1)
2	Start/abort test	Diagnostic block (Slot 3)
	• Fault or Last Measured Value	Index 53
	• Continue Measurement	Not applicable (test started by previous step)
3	Check current algorithm state	Diagnostic block (Slot 3) Index 56
4	Read percent complete	Diagnostic block (Slot 3) Index 61
5	Check algorithm abort state	Diagnostic block (Slot 3) Index 58
6	Check inlet stiffness	Diagnostic block (Slot 3) Index 59
7	Check outlet stiffness	Diagnostic block (Slot 3) Index 60
8	Read abort code	Diagnostic block (Slot 3) Index 57

(1) For detailed information, see Table D-4.

10.3.4 Reading and interpreting meter verification test results

Pass/Fail/Abort

When the meter verification test is completed, the result is reported as Pass, Fail or Caution (depending on the tool you are using), or Abort:

- *Pass* – The test result is within the specification uncertainty limit. In other words, the stiffness of the left and right pickoffs match the factory values plus or minus the specification uncertain limit. If transmitter zero and configuration match factory values, the sensor will meet factory specifications for flow and density measurement. It is expected that meters will pass meter verification every time the test is run.
- *Fail/Caution* – The test result is not within the specification uncertainty limit. Micro Motion recommends that you immediately repeat the meter verification test. If you were using Smart Meter Verification, with outputs set to Continue Measurement, change the setting to Last Measured Value or Fault.
  - If the meter passes the second test, the first Fail/Caution result can be ignored.
  - If the meter fails the second test, the flow tubes may be damaged. Use your process knowledge to determine the possibilities for damage and the appropriate actions for each. These actions might include removing the meter from service and physically inspecting the tubes. At minimum, you should perform a flow validation and a density calibration.
- *Abort* – A problem occurred with the meter verification test (e.g., process instability). Abort codes are listed and defined in Table 10-5, and suggested actions are provided for each code.

Table 10-5 **Meter verification abort codes**

Abort code	Description	Suggested action
1	User-initiated abort	None required. Wait for 15 seconds before starting another test.
3	Frequency drift	Ensure that temperature, flow, and density are stable, and rerun the test.
5	High drive gain	Ensure that flow is stable, minimize entrained gas, and rerun the test.
8	Unstable flow	Review the suggestions for stable flow in Section 10.3.1 and rerun the test.
13	No factory reference data for meter verification test performed on air	Contact Micro Motion customer service and provide the abort code.
14	No factory reference data for meter verification test performed on water	Contact Micro Motion customer service and provide the abort code.
15	No configuration data for meter verification	Contact Micro Motion customer service and provide the abort code.
Other	General abort.	Repeat the test. If the test aborts again, contact Micro Motion customer service and provide the abort code.

Detailed test data with ProLink II

For each test, the following data is stored on the transmitter:

- Powered-on hours at the time of the test (Smart Meter Verification)
- Test result
- Stiffness of the left and right pickoffs, shown as percentage variation from the factory value. If the test aborted, 0 is stored for these values.
- Abort code, if applicable

ProLink II stores additional descriptive information for each test in a database on the local PC, including:

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

If you are using Smart Meter Verification and you run a meter verification test from ProLink II, ProLink II first checks for new test results on the transmitter and synchronizes the local database if required. During this step, ProLink II displays the following message:

Synchronizing x out of y
Please wait

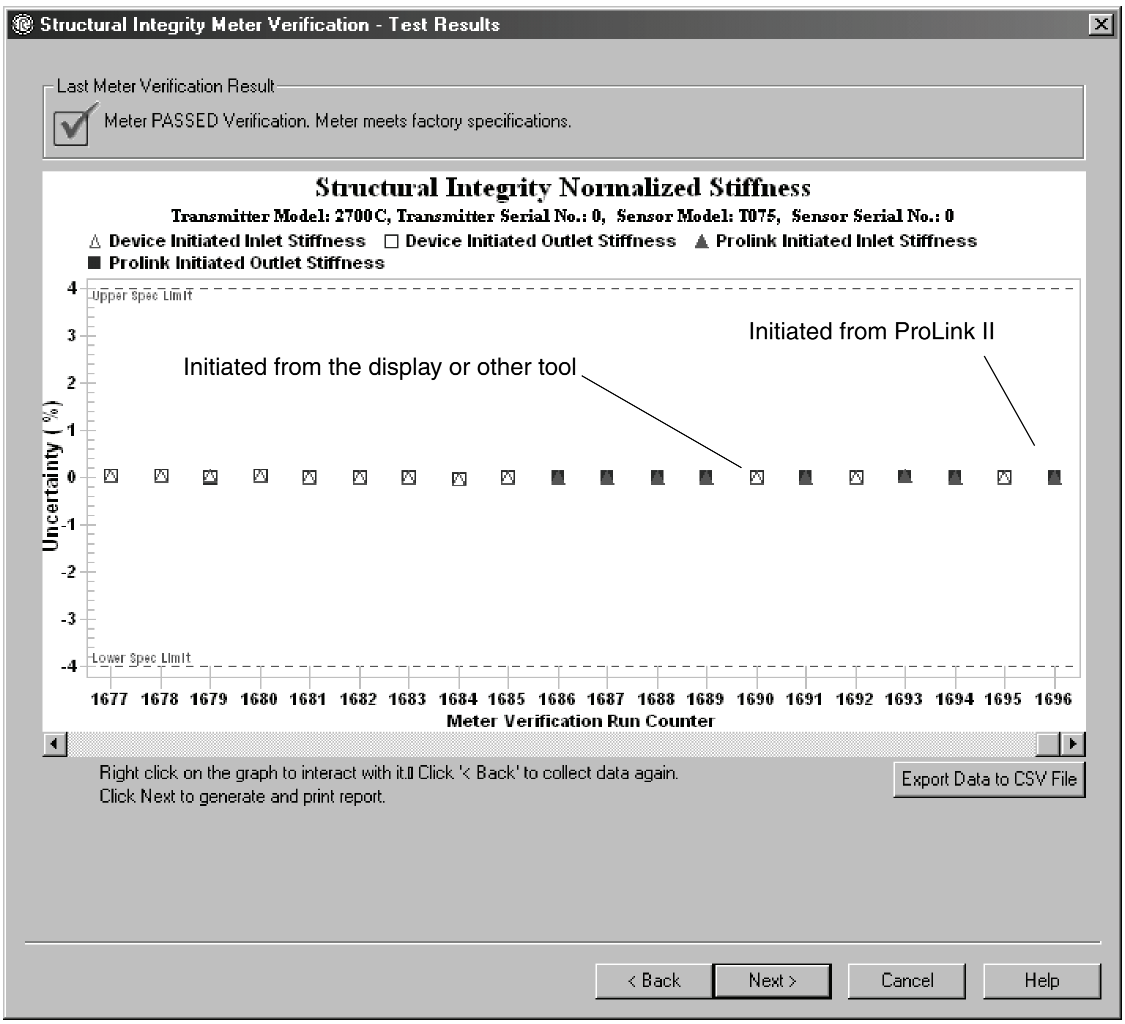
Note: If you request an action while synchronization is in process, ProLink II displays a message asking whether or not you want to complete synchronization. If you choose No, the ProLink II database may not include the latest test results from the transmitter.

Test results are available at the end of each test, in the following forms:

- A test result chart (see Figure 10-10).
- A test report that includes the descriptive information for the current test, the test result chart, and background information about meter verification. You can export this report to an HTML file or print it to the default printer.

Note: To view the chart and the report for previous tests without running a test, click View Previous Test Results and Print Report from the first meter verification panel. See Figure 10-5. Test reports are available only for tests initiated from ProLink II.

Figure 10-10 Test result chart



The test result chart shows the results for all tests in the ProLink II database, plotted against the specification uncertainty limit. The inlet stiffness and the outlet stiffness are plotted separately. This helps to distinguish between local and uniform changes to the sensor tubes.

This chart supports trend analysis, which can be helpful in detecting meter problems before they become severe.

Note the following:

- The test result chart may not show all test results, and test counters may not be continuous. ProLink II stores information about all tests initiated from ProLink II and all tests available on the transmitter when the test database is synchronized. However, the transmitter stores only the twenty most recent test results. To ensure a complete result set, always use ProLink II to initiate the tests, or synchronize the ProLink II database before overwriting occurs.
- The chart uses different symbols to differentiate between tests initiated from ProLink II and tests initiated using a different tool. A test report is available only for tests that were initiated from ProLink II.
- You can double-click the chart to manipulate the presentation in a variety of ways (change titles, change fonts, colors, borders and gridlines, etc.), and to export the data to additional formats (including "to printer").

You can export this chart to a CSV file for use in external applications.

Detailed test data with the display

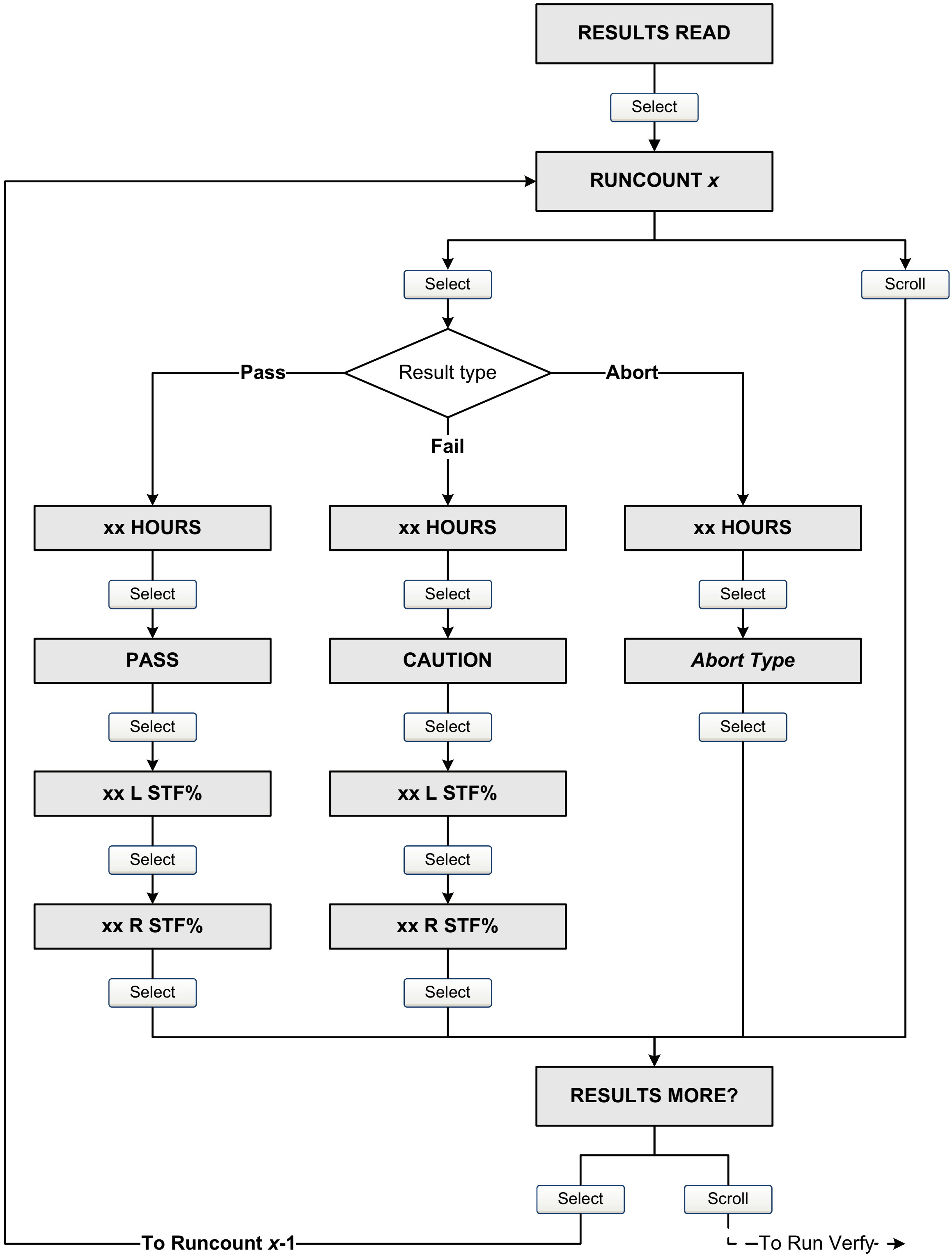
Note: Requires Smart Meter Verification. No detailed test data is available with the original version of the meter verification application.

For each Smart Meter Verification test, the following data is stored on the transmitter:

- Powered-on hours at the time of the test
- Test result
- Stiffness of the left and right pickoffs, shown as percentage variation from the factory value. If the test aborted, 0 is stored for these values.
- Abort code, if applicable

To view this data, see Figures 10-6 and 10-11.

Figure 10-11 **Meter verification test data – Display**



Detailed test data with the EDD

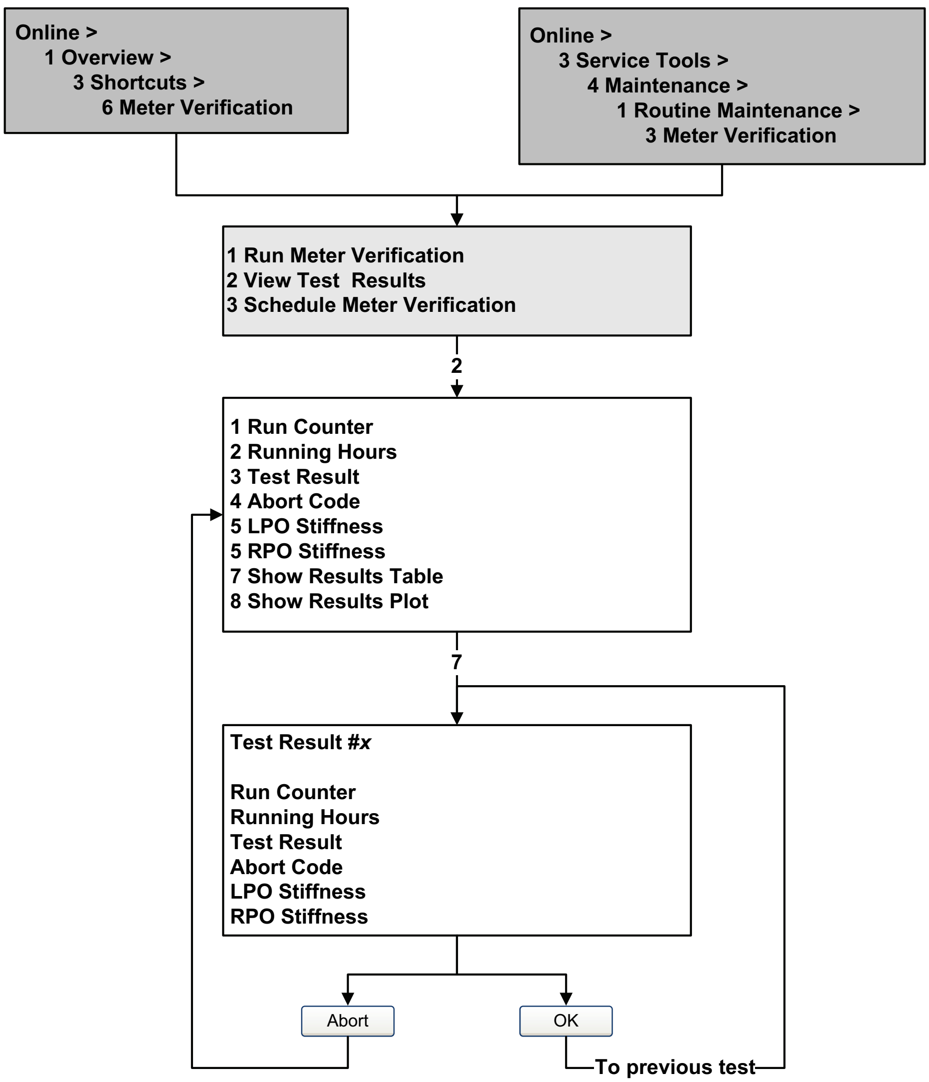
Note: Requires Smart Meter Verification. No detailed test data is available with the original version of the meter verification application.

For each Smart Meter Verification test, the following data is stored on the transmitter:

- Powered-on hours at the time of the test
- Test result
- Stiffness of the left and right pickoffs, shown as percentage variation from the factory value. If the test aborted, 0 is stored for these values.
- Abort code, if applicable

To view this data, see Figure 10-12.

Figure 10-12 Meter verification test data – EDD



Detailed test data with PROFIBUS bus parameters

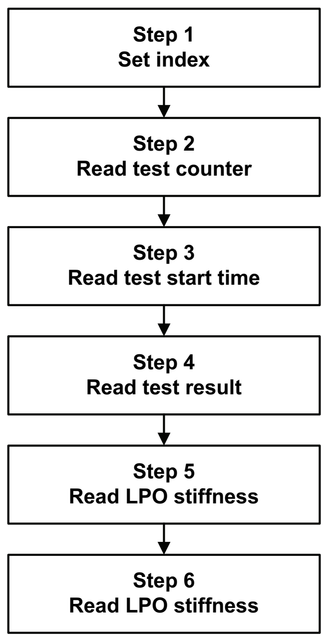
Note: Requires Smart Meter Verification. No detailed test data is available with the original version of the meter verification application.

For each Smart Meter Verification test, the following data is stored on the transmitter:

- Powered-on hours at the time of the test
- Test result
- Stiffness of the left and right pickoffs, shown as percentage variation from the factory value. If the test aborted, 0 is stored for these values.
- Abort code, if applicable

To view this data, see Figure 10-13.

Figure 10-13 Meter verification test data – PROFIBUS bus parameters



See Table 10-6.

Table 10-6 PROFIBUS bus parameters test data interface for Smart Meter Verification

Step number	Step description	Interface[(1)]
1	Set index	Diagnostic block (Slot 3) Index 87
2	Read test counter	Diagnostic block (Slot 3) Index 88
3	Read test start time	Diagnostic block (Slot 3) Index 89
4	Read test result	Diagnostic block (Slot 3) Index 90
5	Read LPO stiffness	Diagnostic block (Slot 3) Index 91
6	Read RPO stiffness	Diagnostic block (Slot 3) Index 92

(1) For detailed information, see Table D-4.

10.3.5 Setting up automatic or remote execution of the meter verification test

Note: Requires Smart Meter Verification. Scheduling is not available with the original version of the meter verification application.

There are three ways to execute a Smart Meter Verification test automatically:

- Define it as an event action
- Set up a one-time automatic execution
- Set up a recurring execution

You can use these methods in any combination. For example, you can specify that a Smart Meter Verification test will be executed three hours from now, every 24 hours starting now, and every time a specific discrete event occurs.

- To define meter verification as an event action, see Section 8.6.
- To set up a one-time automatic execution, set up a recurring execution, view the number of hours until the next scheduled test, or delete a schedule:
  - With ProLink II, click **Tools > Meter Verification > Schedule Meter Verification**.
  - With the display, see Figures 10-6 and 10-14.
  - With the EDD, see Figure 10-15.
  - With PROFIBUS bus parameters, see Figure 10-16.

Note the following:

- If you are setting up a one-time automatic execution, specify the start time as a number of hours from the present time. For example, if the present time is 2:00 and you specify 3.5 hours, the test will be initiated at 5:30.
- If you are setting up a recurring execution, specify the number of hours to elapse between executions. The first test will be initiated when the specified number of hours has elapsed, and testing will be repeated at the same interval until the schedule is deleted. For example, if the present time is 2:00 and you specify 2 hours, the first test will be initiated at 4:00, the next at 6:00, and so on.
- If you delete the schedule, both the one-time execution and the recurring execution settings are deleted.

Figure 10-14 Smart Meter Verification scheduler – Display

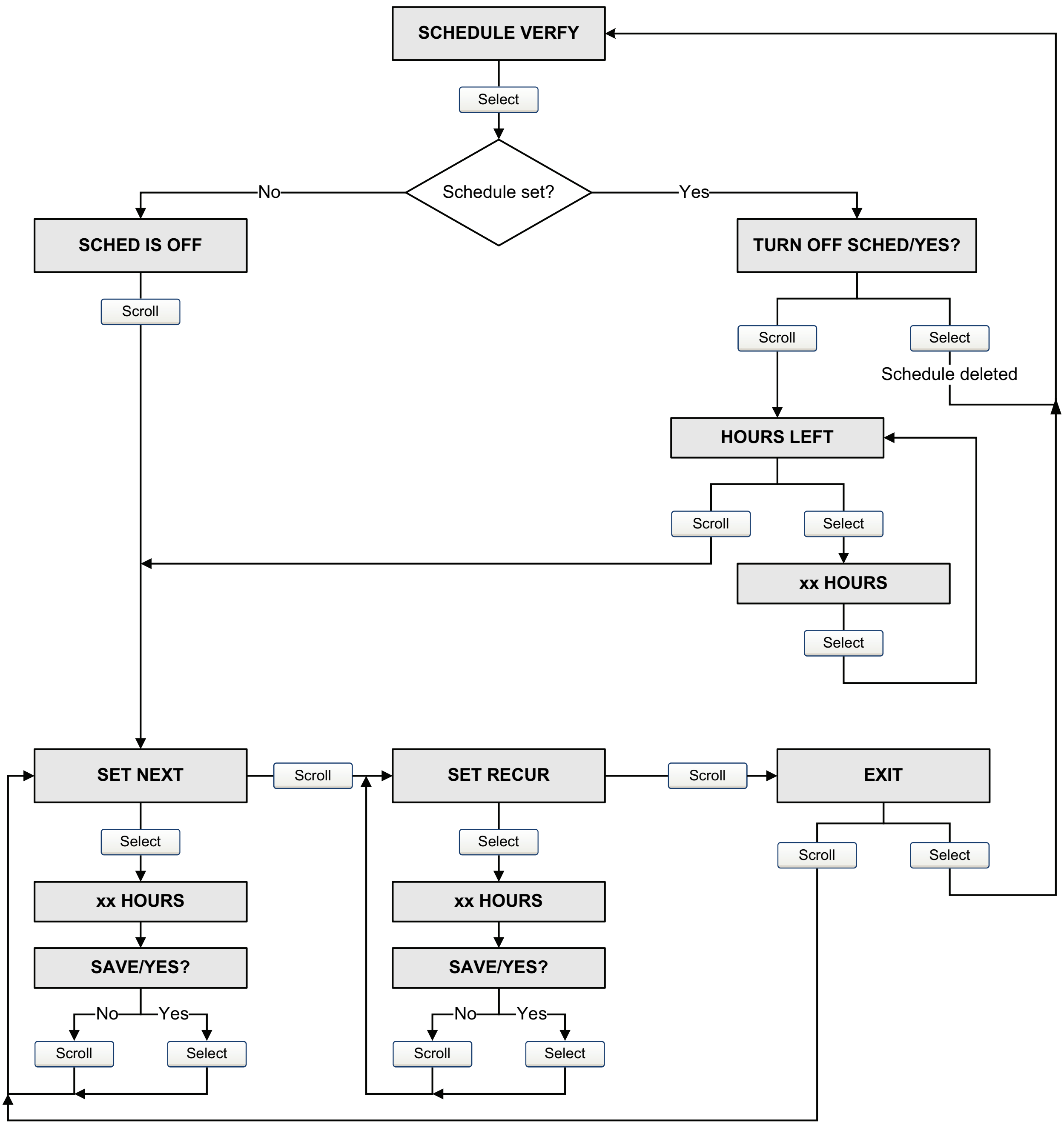


Figure 10-15 Smart Meter Verification scheduler – EDD

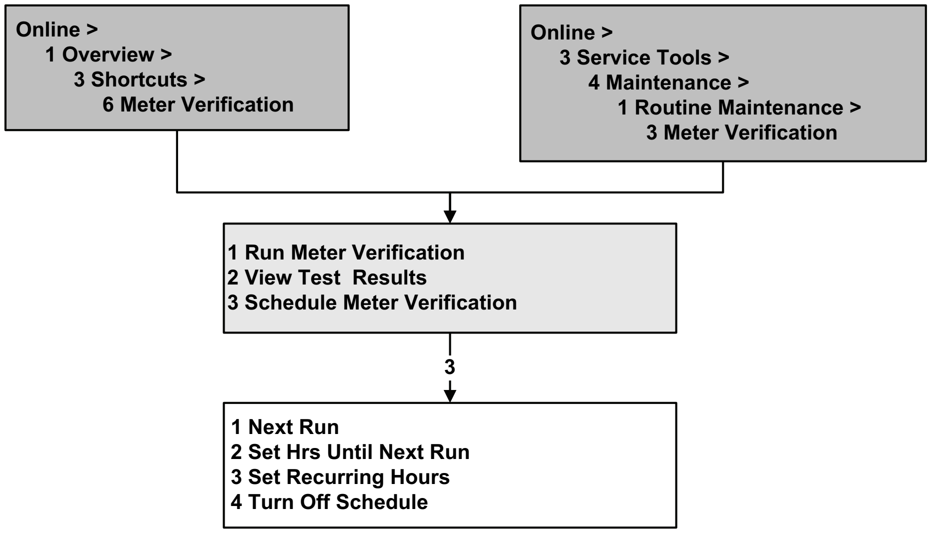
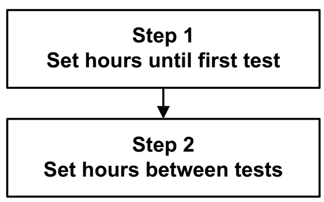


Figure 10-16 Smart Meter Verification scheduler – PROFIBUS bus parameters



See Table 10-7.

Table 10-7 PROFIBUS bus parameters scheduler interface for Smart Meter Verification

Step number	Step description	Interface(1)
1	Set hours until first test	Diagnostic block (Slot 3) Index 93
2	Set hours between tests	Diagnostic block (Slot 3) Index 94

(1) For detailed information, see Table D-4.

10.4 Performing meter validation

To perform meter validation, measure a sample of the process fluid and compare the measurement with the flowmeter's reported value.

Use the following formula to calculate a meter factor:

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

Valid values for meter factors range from **0.8** to **1.2**. If the calculated meter factor exceeds these limits, contact Micro Motion customer service.

To configure meter factors:

- Using ProLink II, see Figure C-2.
- Using the display menus, see Figure C-16.
- Using a PROFIBUS host with the EDD, see Figure C-8.
- Using PROFIBUS bus parameters, use the Measurement block, Indices 15, 16, and 17 (see Table D-2).

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

10.5 Performing zero calibration

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

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

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

For most applications, the default zero time is appropriate.

Note: Do not zero the flowmeter if a high severity alarm is active. Correct the problem, then zero the flowmeter. You may zero the flowmeter if a low severity alarm is active. See Section 7.6 for information on viewing transmitter status and alarms.

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

- Restore prior zero, available only from ProLink II and only during the current zero procedure. Once you have closed the Calibration dialog box or disconnected from the transmitter, you can no longer restore the prior zero.
- Restore factory zero, available via:
  - The display (see Figure C-16)
  - ProLink II, in the Calibration dialog box (see Figure C-1)
  - A PROFIBUS host with the EDD (see Figure C-7)
  - PROFIBUS bus parameters (Calibration block, Index 42; see Table D-3).

If desired, you can use one of these functions to return the meter to operation while you are troubleshooting the cause of the zero failure (see Section 11.8).

10.5.1 Preparing for zero

To prepare for the zero procedure:

1. Apply power to the flowmeter. Allow the flowmeter to warm up for approximately 20 minutes.
2. Run the process fluid through the sensor until the sensor temperature reaches the normal process operating temperature.
3. Close the shutoff valve downstream from the sensor.
4. Ensure that the sensor is completely filled with fluid.
5. Ensure that the process flow has completely stopped.

⚠ CAUTION

If fluid is flowing through the sensor during zero calibration, the 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.

10.5.2 Zero procedure

To zero the flowmeter:

- Using the zero button, see Figure 10-17.
- Using the display menu, see Figure 10-18. For a complete illustration of the display zero menu, see Figure C-16.
- Using ProLink II, see Figure 10-19.
- Using a PROFIBUS host with the EDD, use the Zero Calibration window in the Device menu. See Figure C-16.
- Using PROFIBUS bus parameters, see Figure 10-21.

Note the following:

- If the transmitter was ordered with a display:
  - The zero button is not available.
  - 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 8.9.5.
  - You cannot change the zero time with the display. If you need to change the zero time, you must use ProLink II or PROFIBUS protocol.
- If the transmitter was ordered without a display, the zero button is available.
  - You cannot change the zero time with the zero button. If you need to change the zero time, you must use ProLink II or PROFIBUS protocol.
  - The zero button is located on the user interface board, beneath the transmitter housing cover (see Figure 3-1). For instructions on removing the transmitter housing cover, see Section 3.3.
  - To press the zero button, use a fine-pointed object that will fit into the opening (0.14 in or 3.5 mm). Hold the button down until the status LED on the user interface module begins to flash yellow.
- During the zero procedure, the status LED on the user interface module flashes yellow.

Figure 10-17 Zero button – Flowmeter zero procedure

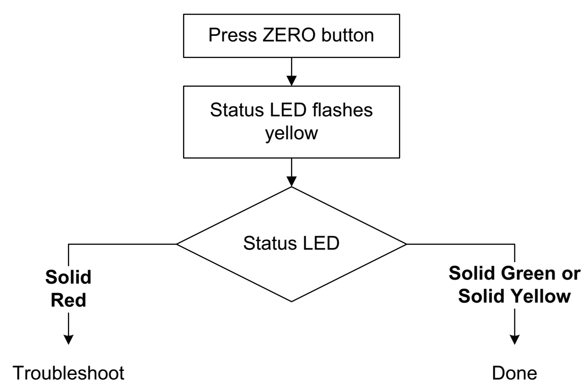


Figure 10-18 **Display menu – Flowmeter zero procedure**

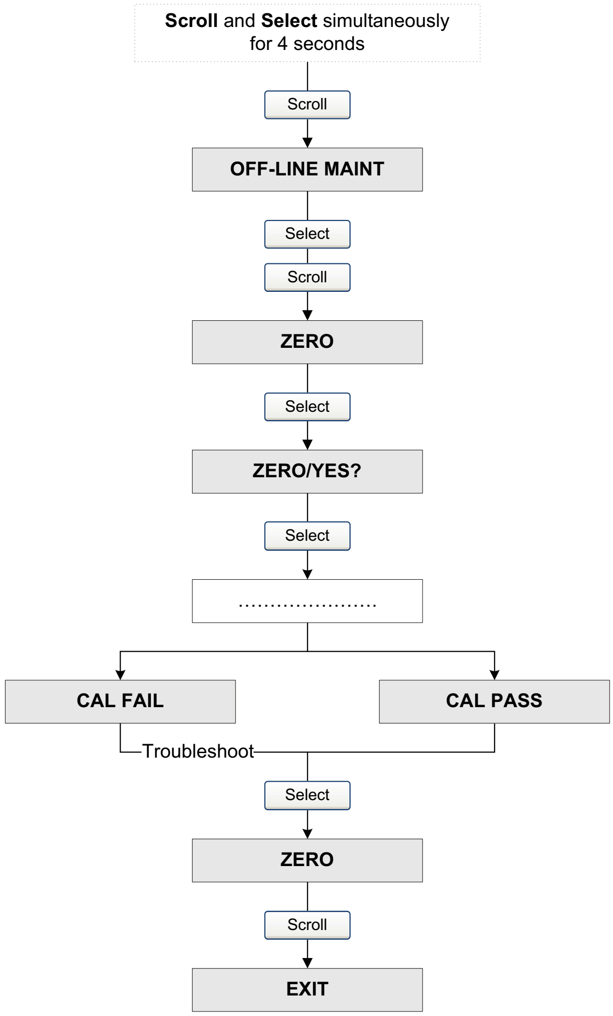


Figure 10-19 **ProLink II – Flowmeter zero procedure**

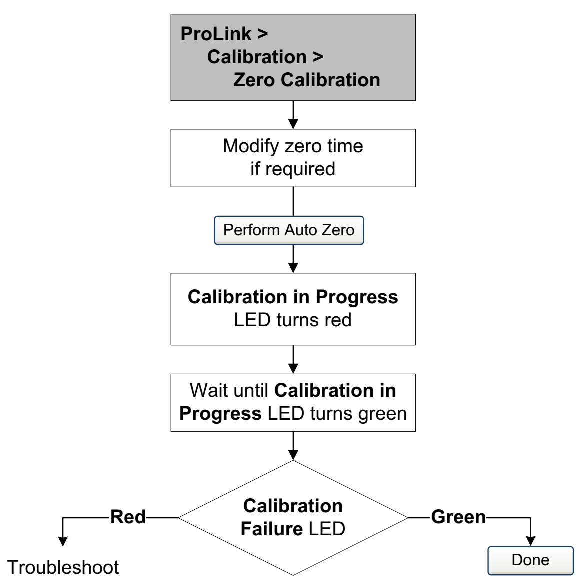


Figure 10-20 **PROFIBUS host with EDD – Flowmeter zero procedure**

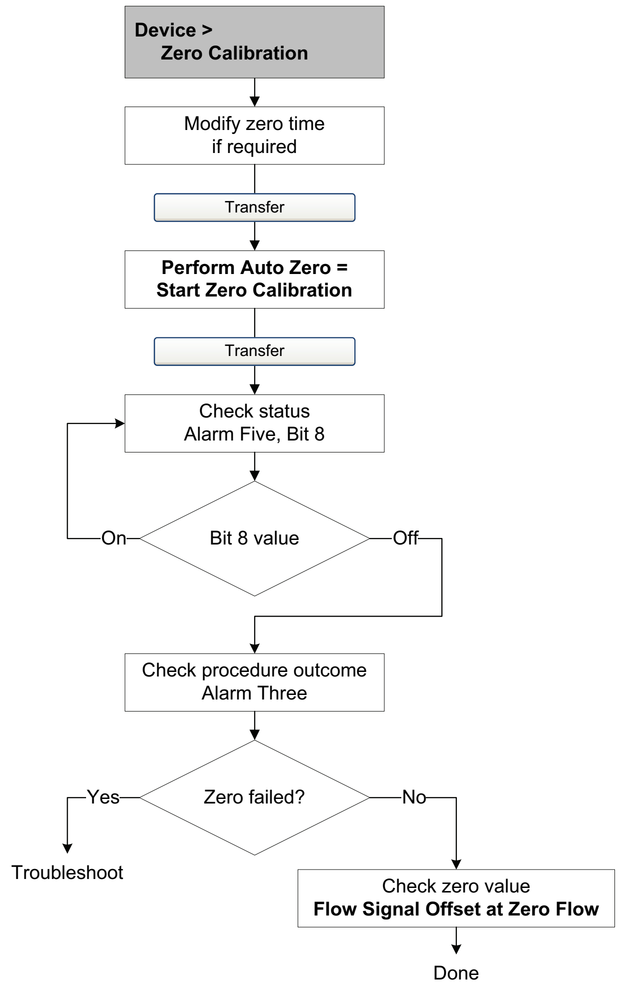
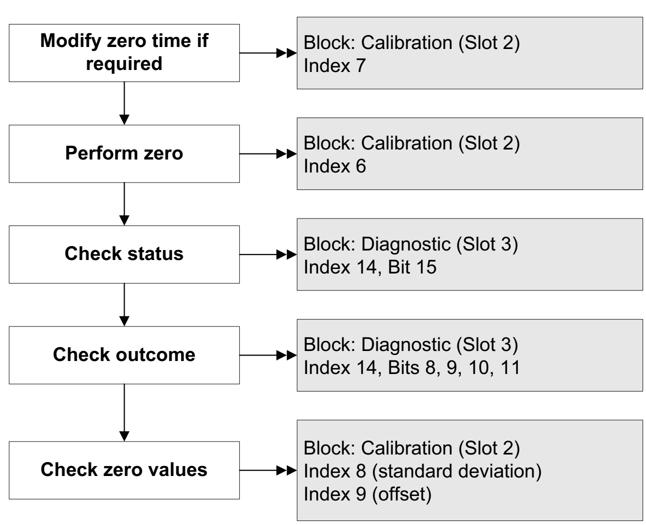


Figure 10-21 **PROFIBUS bus parameters – Flowmeter zero procedure**



10.6 Performing density calibration

Density calibration includes the following calibration points:

- All sensors:
  - D1 calibration (low-density)
  - D2 calibration (high-density)
- T-Series sensors only:
  - D3 calibration (optional)
  - D4 calibration (optional)

For T-Series sensors, the optional D3 and D4 calibrations could improve the accuracy of the density measurement. If you choose to perform the D3 and D4 calibration:

- Do not perform the D1 or D2 calibration.
- Perform D3 calibration if you have one calibrated fluid.
- Perform both D3 and D4 calibrations if you have two calibrated fluids (other than air and water).

The calibrations that you choose must be performed without interruption, in the order listed here.

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

You can calibrate for density with ProLink II, a PROFIBUS host with the EDD, or PROFIBUS bus parameters.

10.6.1 Preparing for density calibration

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

Sensor requirements

During density calibration, the sensor must be completely filled with the calibration fluid, and flow through the sensor must be at the lowest rate allowed by your application. This is usually accomplished by closing the shutoff valve downstream from the sensor, then filling the sensor with the appropriate fluid.

Density calibration fluids

D1 and D2 density calibration require a D1 (low-density) fluid and a D2 (high-density) fluid. You may use air and water. If you are calibrating a T-Series sensor, the D1 fluid must be air and the D2 fluid must be water.

> ⚠ **CAUTION**
>
> **For T-Series sensors, the D1 calibration must be performed on air and the D2 calibration must be performed on water.**

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For D3 density calibration, the D3 fluid must meet the following requirements:

- Minimum density of 0.6 g/cm^3
- Minimum difference of 0.1 g/cm^3 between the density of the D3 fluid and the density of water. The density of the D3 fluid may be either greater or less than the density of water

For D4 density calibration, the D4 fluid must meet the following requirements:

- Minimum density of 0.6 g/cm^3
- Minimum difference of 0.1 g/cm^3 between the density of the D4 fluid and the density of the D3 fluid. The density of the D4 fluid must be greater than the density of the D3 fluid
- Minimum difference of 0.1 g/cm^3 between the density of the D4 fluid and the density of water. The density of the D4 fluid may be either greater or less than the density of water

10.6.2 Density calibration procedures

To perform a D1 and D2 density calibration:

- With ProLink II, see Figure 10-22.
- With a PROFIBUS host with the EDD, see Figure 10-23.
- With PROFIBUS bus parameters, see Figure 10-24.

To perform a D3 density calibration or a D3 and D4 density calibration:

- With ProLink II, see Figure 10-25.
- With a PROFIBUS host with the EDD, see Figure 10-26.
- With PROFIBUS bus parameters, see Figure 10-27.

Figure 10-22 D1 and D2 density calibration – ProLink II

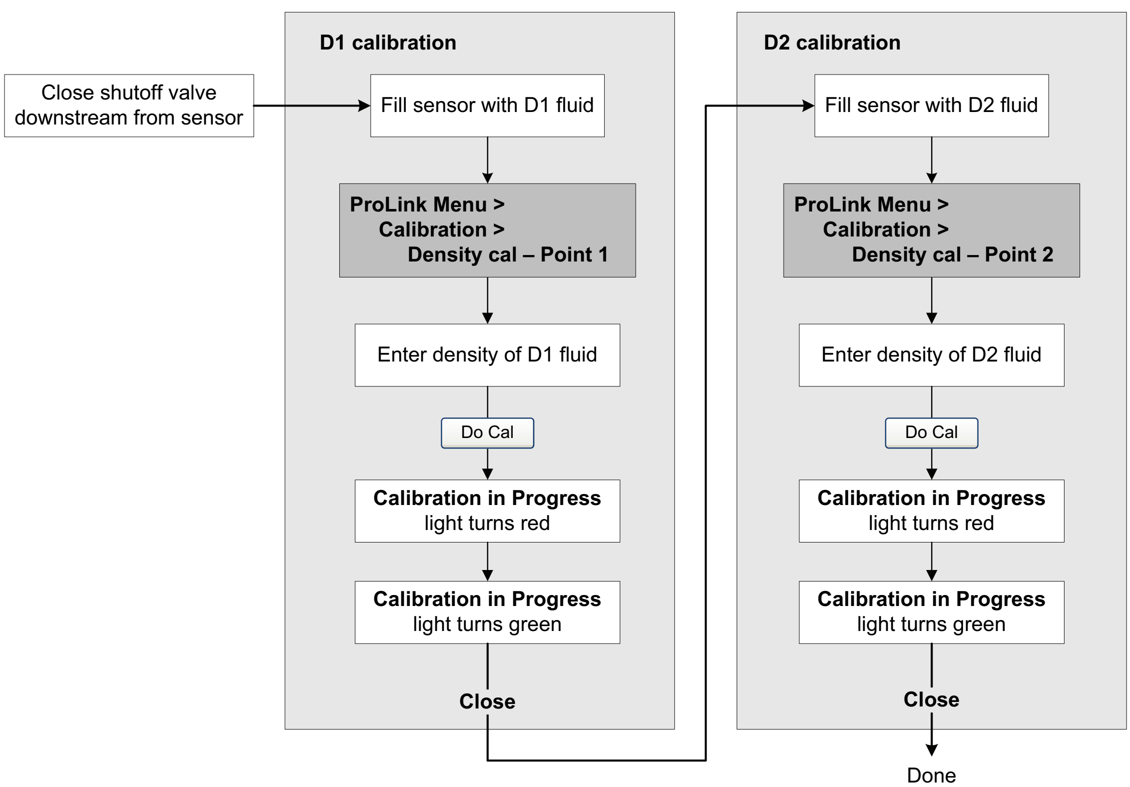
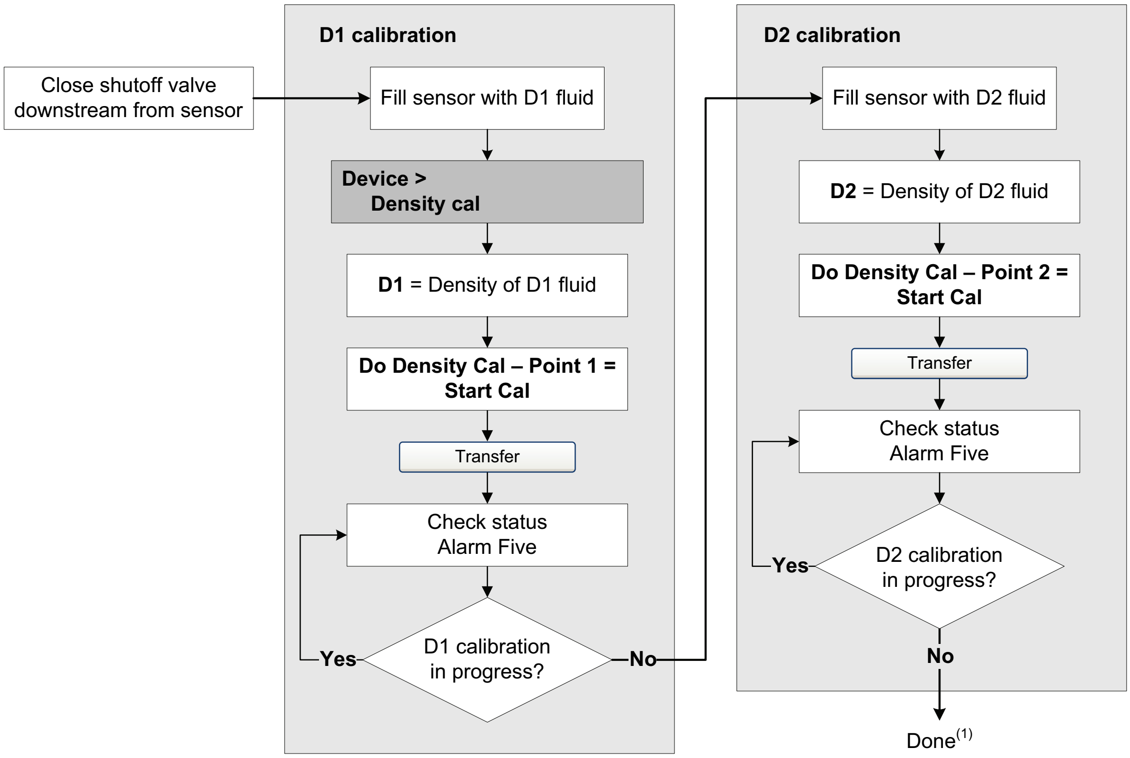


Figure 10-23 **D1 and D2 density calibration – PROFIBUS host with EDD**



(1) K1 and K2 values are displayed in the Density section of the Configuration Parameters menu. You may need to reload values from the transmitter to see the results of the density calibration.

Figure 10-24 **D1 and D2 density calibration – PROFIBUS bus parameters**

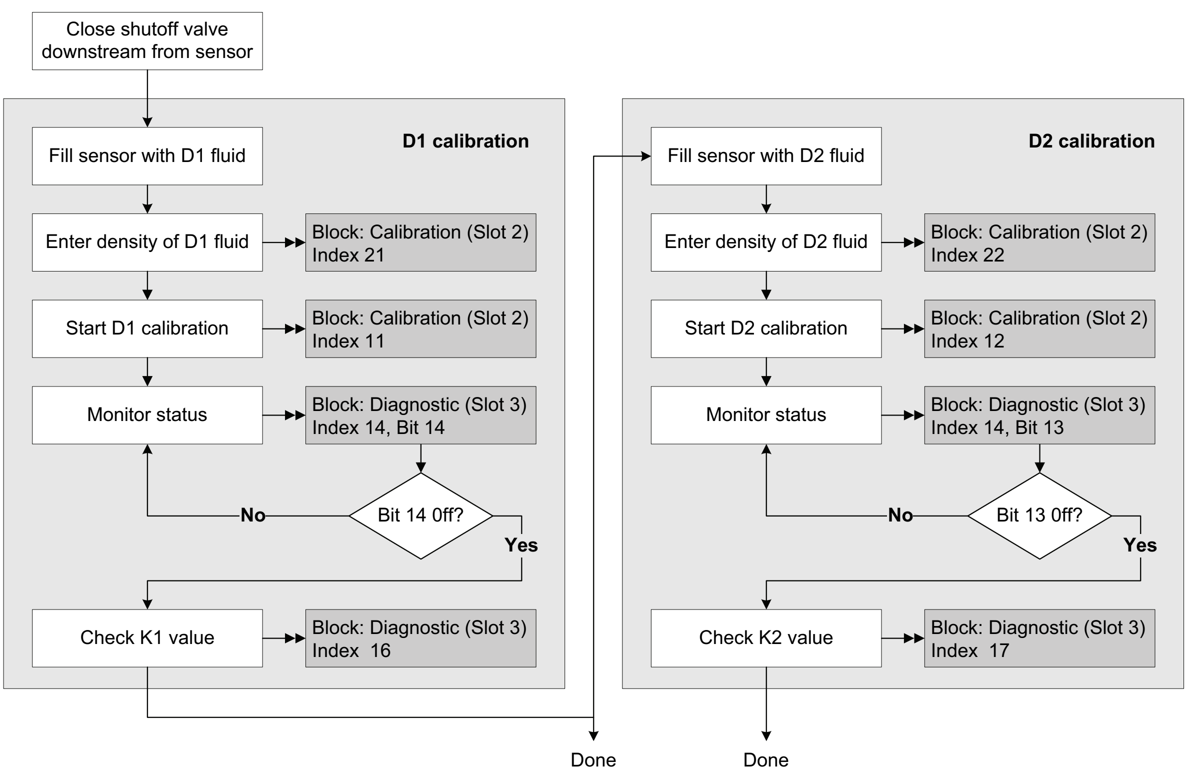


Figure 10-25 D3 or D3 and D4 density calibration – ProLink II

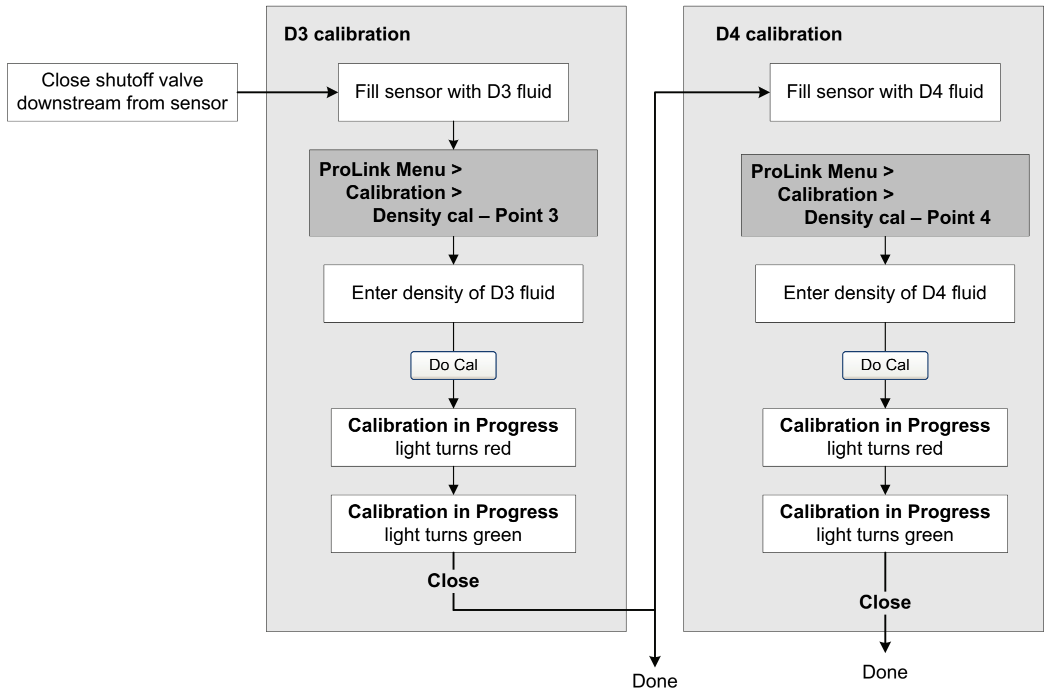
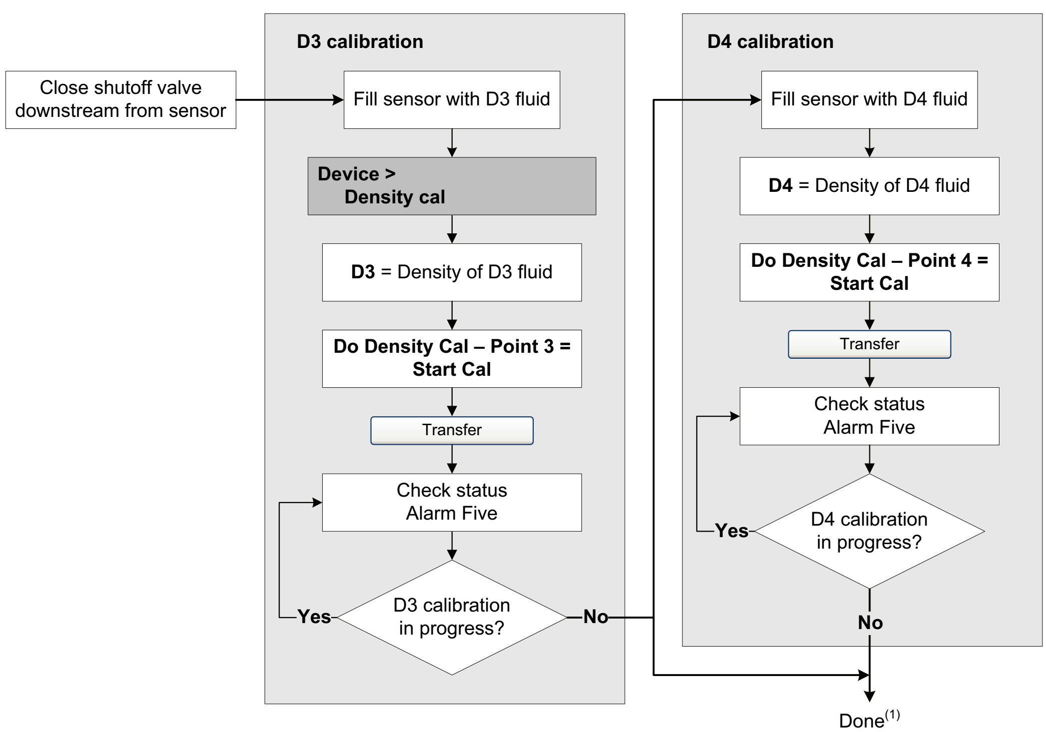
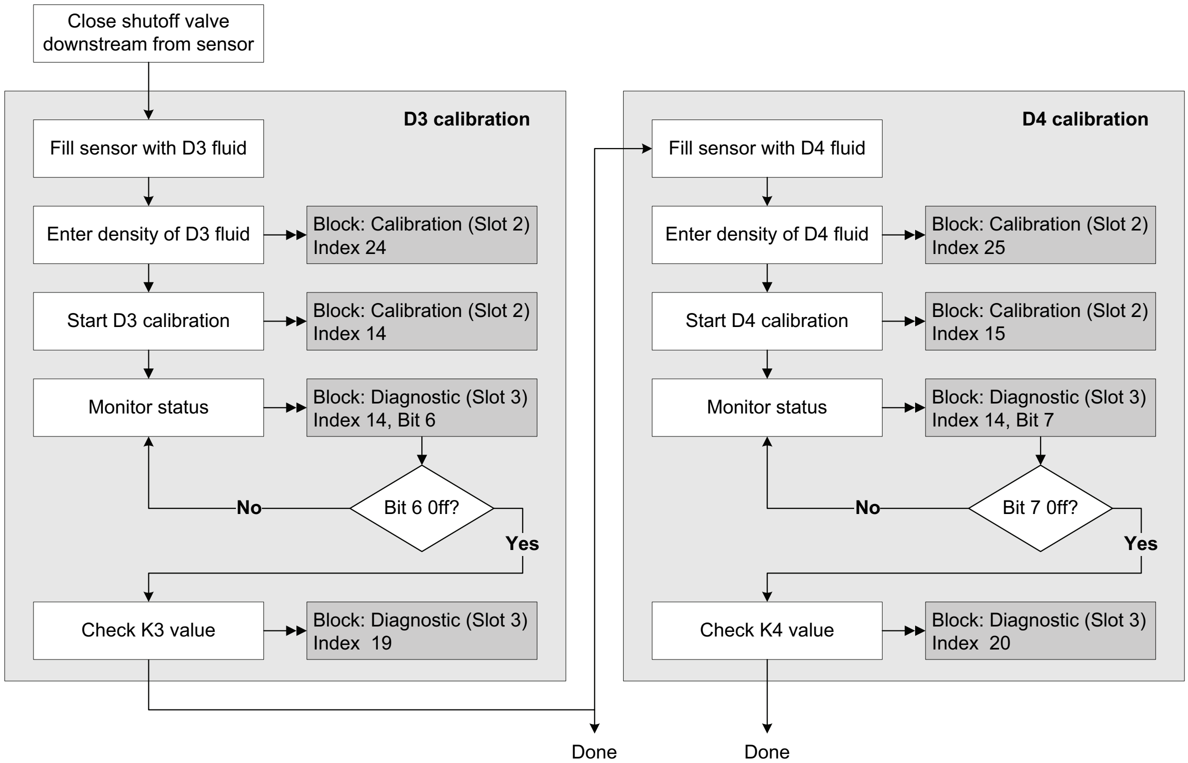


Figure 10-26 D3 or D3 and D4 density calibration – PROFIBUS host with EDD



(1) *K3 and K4 values are displayed in the Density section of the Configuration Parameters menu. You may need to reload values from the transmitter to see the results of the density calibration.*

Figure 10-27 **D3 or D3 and D4 density calibration – PROFIBUS bus parameters**

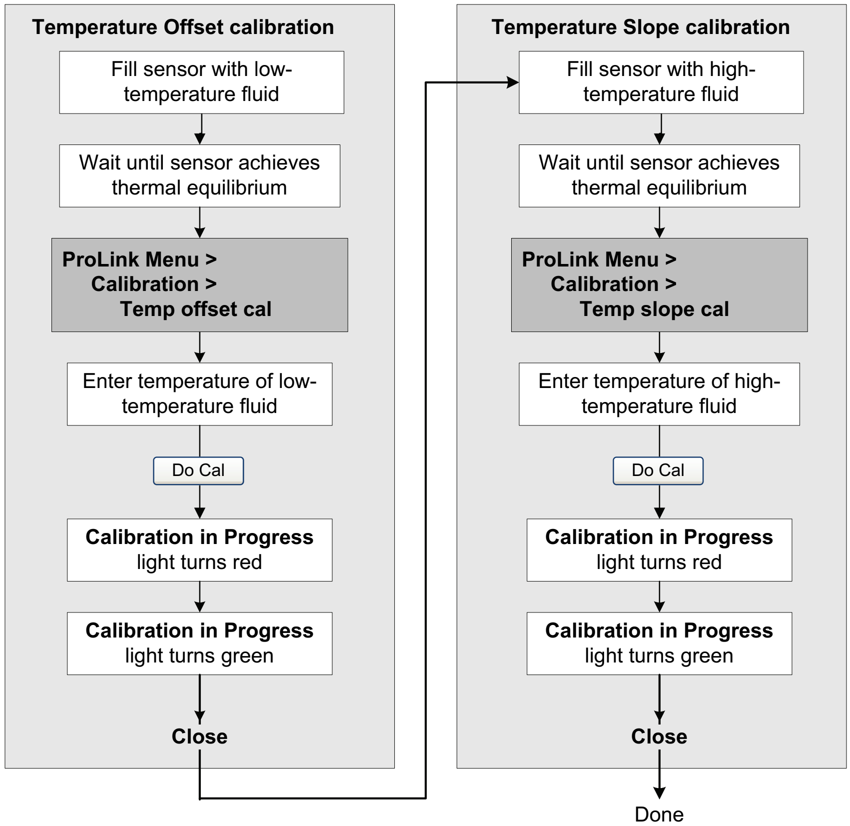


10.7 Performing temperature calibration

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

To perform temperature calibration, you must use ProLink II. See Figure 10-28.

Figure 10-28 **Temperature calibration – ProLink II**



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 procedures provided in this chapter assume that you have established communication with the Model 2400S DP transmitter and that you are complying with all applicable safety requirements.

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

⚠ WARNING

Using the service port clips to communicate with the transmitter in a hazardous area can cause an explosion.

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

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	*Checking the communication device*
Section 11.7	*Diagnosing wiring problems*
Section 11.7.1	*Checking the power supply wiring*
Section 11.7.2	*Checking PROFIBUS wiring*
Section 11.7.3	*Checking grounding*
Section 11.8	*Zero or calibration failure*
Section 11.9	*Fault conditions*
Section 11.10	*Simulation mode*

Table 11-1 Troubleshooting topics and locations *continued*

Section	Topic
Section 11.11	*Transmitter LEDs*
Section 11.12	*Status alarms*
Section 11.13	*Checking process variables*
Section 11.14	*Checking slug flow*
Section 11.15	*Checking the sensor tubes*
Section 11.16	*Checking the flow measurement configuration*
Section 11.17	*Checking the characterization*
Section 11.18	*Checking the calibration*
Section 11.19	*Restoring a working configuration*
Section 11.20	*Checking the test points*
Section 11.21	*Checking sensor circuitry*

11.3 Micro Motion customer service

To speak to a customer service representative, contact the Micro Motion customer service department. Contact information is provided in Section 1.10.

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 is not receiving power, all three LEDs on the user interface will be off.

1. Check the power supply to the transmitter, as described in Section 11.7.1.
2. Check the grounding, as described in Section 11.7.3.

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, the wiring may be faulty or the communication device may be incompatible. Check the wiring and the communication device:

- For ProLink II and Pocket ProLink, see Section 11.6 and Chapter 4.
- For a PROFIBUS host, see Section 11.6, Section 11.7.2, and Chapter 5. Ensure that the PROFIBUS host is configured to use the appropriate node address.

If you are trying to communicate via the IrDA port, ensure that the port is enabled and that there is no active connection via the service port clips. See Section 8.10.2.

11.6 Checking the communication device

Ensure that your communication device is compatible with your transmitter.

ProLink II

ProLink II v2.5 or later is required. To check the version of ProLink II:

1. Start ProLink II.
2. Click **Help > About ProLink**.

Verify that ProLink II can connect to other devices using the same connection type (e.g., service port). If you cannot connect to other devices, see the ProLink II manual for troubleshooting assistance.

Pocket ProLink

Pocket ProLink v1.3 or later is required. To check the version of Pocket ProLink:

1. Start Pocket ProLink.
2. Tap the Information icon (the question mark) at the bottom of the main screen.

PROFIBUS host

The Model 2400S DP transmitter is compatible with all PROFIBUS hosts. Check that your PROFIBUS host is correctly configured and can make a connection to other devices on the network.

11.7 Diagnosing wiring problems

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

⚠ WARNING

Removing the transmitter housing cover in explosive atmospheres while the device is powered can subject the transmitter to environmental conditions that can cause an explosion.

Before removing the transmitter housing cover in explosive atmospheres, be sure to remove power from the device and wait five minutes.

11.7.1 Checking the power supply wiring

To check the power supply wiring:

1. Follow appropriate procedures to ensure that the process of checking the power supply wiring does not interfere with existing measurement and control loops.
2. Power down the transmitter.
3. If the transmitter is in a hazardous area, wait five minutes.
4. Referring to Figure B-1:
   a. Loosen the four captive transmitter housing cover screws and remove the transmitter housing cover.
   b. Loosen the two captive user interface screws.
   c. Gently lift the user interface module, disengaging it from the connector on the transmitter.
5. Referring to Figure B-2:
   a. Loosen the Warning flap screw.
   b. Lift the Warning flap.
6. Ensure that the power supply wires are connected to the correct terminals. See Figure B-2.

7. Verify that the power supply wires are making good contact, and are not clamped to the wire insulation.
8. 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.
9. 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. See your transmitter installation manual for power supply requirements.

11.7.2 Checking PROFIBUS wiring

To check the PROFIBUS wiring:

1. Follow appropriate procedures to ensure that the process of checking the PROFIBUS wiring does not interfere with existing measurement and control loops.
2. Referring to Figure B-1:
    a. Loosen the four captive transmitter housing cover screws and remove the transmitter housing cover.
    b. Loosen the two captive user interface screws.
    c. Gently lift the user interface module, disengaging it from the connector on the transmitter.
3. Visually inspect the PROFIBUS cable and wiring. Ensure that the wires are inserted into the correct terminals (see Figure B-2), contact is good at both ends, the cable is not crimped, and the cable covering is intact. Replace the cable if appropriate.
4. Verify that the internal termination resistor switch is set correctly for your installation. See Figure 3-1 or 3-2.

11.7.3 Checking grounding

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

11.8 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 11.12 for specific remedies for status alarms indicating calibration failure.

11.9 Fault conditions

If a fault is reported, determine the exact nature of the fault by checking the status alarms (see Section 7.6). Once you have identified the status alarm(s) associated with the fault condition, refer to Section 11.12.

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

- Zero failure
- Stopped internal totalizer

11.10 Simulation mode

Simulation allows you to define arbitrary values for mass flow, temperature, and density. Simulation mode has several uses:

- It can help determine if a problem is located in the transmitter or elsewhere in the system. For example, signal oscillation or noise is a common occurrence. The source could be the PROFIBUS host, the meter, improper grounding, or a number of other factors. By setting up simulation to output a flat signal, you can determine the point at which the noise is introduced.
- It can be used to analyze system response or to tune the loop.

If simulation mode is active, the simulated values are stored in the same memory locations used for process data from the sensor. Therefore, the simulated values will be used throughout transmitter functioning. For example, simulation will affect:

- All mass flow, temperature, or density values shown on the display or reported via digital communications
- The mass total and inventory values
- All volume calculations and data, including reported values, volume total, and volume inventory
- All related values logged by Data Logger (a ProLink II utility)

Accordingly, do not enable simulation when your process cannot tolerate these effects, and be sure to disable simulation when you have finished testing.

Note: Unlike actual mass flow and density values, the simulated values are not temperature-compensated.

Simulation does not change any diagnostic values.

Simulation mode is available only via ProLink II. To set up simulation, refer to Figure C-3 and follow the steps below:

1. Enable simulation mode.
2. For mass flow:
   a. Specify the type of simulation you want: fixed value, sawtooth (triangular wave), or sine wave.
   b. Enter the required values.
      - If you specified fixed value simulation, enter a fixed value.
      - If you specified sawtooth or sine wave simulation, enter a minimum value, maximum value, and wave period. Minimum and maximum values are entered in the current measurement units; the wave period is entered in seconds.
3. Repeat Step 2 for temperature and density.

To use simulation mode for problem location, enable simulation mode and check the signal at various points between the transmitter and the receiving device.

11.11 Transmitter LEDs

The user interface module includes three LEDs:

- A status LED. See Table 7-3 for information on status LED behavior. If the status LED indicates an alarm condition:
    a. View the alarm code using the procedures described in Section 7.6.
    b. Identify the alarm (see Section 11.12).
    c. Correct the condition.
    d. If desired, acknowledge the alarm using the procedures described in Section 7.7.
- A network LED. See Table 7-1 for information on the behavior of the network LED. The network LED indicates the state of the device on the network, and does not indicate device status. Troubleshooting should focus on the network rather than the device.
- A software address LED. See Table 7-2 for information on the behavior of the software address LED. You may need to set the node address for the Model 2400S DP transmitter, or you may need to configure the PROFIBUS host to use the existing node address.

11.12 Status alarms

Status alarm codes are reported on the LCD panel (for transmitters that have displays), and status alarms can be viewed with ProLink II or a PROFIBUS host. All possible status alarms are listed in Table 11-2, along with the PROFIBUS host or ProLink II message, possible causes, and suggested remedies.

You may find it useful to acknowledge all alarms before beginning the troubleshooting procedures. This will remove inactive alarms from the list and allow you to focus on active alarms.

Table 11-2 Status alarms and remedies

Alarm code	Message[(1)]	Cause	Suggested remedy
A001	EEprom Checksum Error (Core Processor)	An uncorrectable checksum mismatch has been detected	• Cycle power to the flowmeter. • The flowmeter might need service. Contact Micro Motion.
	(E)EPROM Checksum Error (CP)		
A002	RAM Test Error (Core Processor)	ROM checksum error or a RAM location cannot be written to	• Cycle power to the flowmeter. • The flowmeter might need service. Contact Micro Motion.
	RAM Error (CP)		
A003	Sensor Not Responding (No Tube Interrupt)	Continuity failure of drive circuit, LPO, or RPO, or LPO-RPO mismatch when driving	• Check for slug flow. See Section 11.14. • Check the test points. See Section 11.20. • Check the sensor circuitry. See Section 11.21. • Check sensor tubes for plugging. • If the problem persists, contact Micro Motion.
	Sensor Failure		
A004	Temperature sensor out of range	Combination of A016 and A017	• Check the sensor RTD circuitry. See Section 11.21. • Verify that process temperature is within range of sensor and transmitter. • If the problem persists, contact Micro Motion.
	Temperature Sensor Failure		

Table 11-2 **Status alarms and remedies** *continued*

Alarm code	Message(1)	Cause	Suggested remedy
A005	Input Over-Range Input Overrange	The measured flow has exceeded the maximum flow rate of the sensor ($\Delta T > 200\ \mu s$)	• If other alarms are present (typically, A003, A006, A008, A102, or A105), resolve those alarm conditions first. If the A005 alarm persists, continue with the suggestions here. • Verify process and check for slug flow. See Section 11.14. • Check the test points. See Section 11.20. • Check the sensor circuitry. See Section 11.21. • Check the sensor tubes for erosion. See Section 11.15. • If the problem persists, contact Micro Motion.
A006	Transmitter Not Characterized Not Configured	Combination of A020 and A021	• Check the characterization. Specifically, verify the FCF and K1 values. See Section 6.2. • If the problem persists, contact Micro Motion.
A008	Density Outside Limits Density Overrange	The measured density has exceeded 0–10 g/cm^3	• If other alarms are present (typically, A003, A006, A102, or A105), resolve those alarm conditions first. If the A008 alarm persists, continue with the suggestions here. • Verify process. Check for air in the flow tubes, tubes not filled, foreign material in tubes, or coating in tubes (see Section 11.15). • Check for slug flow. See Section 11.14. • Check the sensor circuitry. See Section 11.21. • Verify calibration factors in transmitter configuration. See Section 6.2. • Check the test points. See Section 11.20. • If the problem persists, contact Micro Motion.
A009	Transmitter Initializing/Warming Up Transmitter Initializing/Warming Up	Transmitter in power-up mode	• Allow the flowmeter to warm up (approximately 30 seconds). The error should disappear once the flowmeter is ready for normal operation. • If alarm does not clear, make sure that the sensor is completely full or completely empty. • Check the sensor circuitry. See Section 11.21.
A010	Calibration Failure Calibration Failure	Mechanical zero: The resulting zero was greater than 3 μs Temperature/Density calibrations: many possible causes	• If alarm appears during a transmitter zero, ensure that there is no flow through the sensor, then retry. • Cycle power to the flowmeter, then retry. • If appropriate, restore the factory zero to return the flowmeter to operation.
A011	Excess Calibration Correction, Zero too Low Zero Too Low	See A010	• Ensure that there is no flow through the sensor, then retry. • Cycle power to the flowmeter, then retry. • If appropriate, restore the factory zero to return the flowmeter to operation.
A012	Excess Calibration Correction, Zero too High Zero Too High	See A010	• Ensure that there is no flow through the sensor, then retry. • Cycle power to the flowmeter, then retry. • If appropriate, restore the factory zero to return the flowmeter to operation.

Table 11-2 Status alarms and remedies *continued*

Alarm code	Message[(1)]	Cause	Suggested remedy
A013	Process too Noisy to Perform Auto Zero Zero Too Noisy	See A010	• Remove or reduce sources of electromechanical noise, then retry. Sources of noise include: - Mechanical pumps - Pipe stress at sensor - Electrical interference - Vibration effects from nearby machinery • Cycle power to the flowmeter, then retry. • If appropriate, restore the factory zero to return the flowmeter to operation.
A014	Transmitter Failed Transmitter Failed	Many possible causes	• Cycle power to the flowmeter. • The transmitter might need service. Contact Micro Motion.
A016	Line RTD Temperature Out-Of-Range Line RTD Temperature Out-of-Range	The value computed for the resistance of the Line RTD is outside limits	• Check the sensor RTD circuitry. See Section 11.21. • Verify that process temperature is within range of sensor and transmitter. • If the problem persists, contact Micro Motion.
A017	Meter RTD Temperature Out-Of-Range Meter RTD Temperature Out-of-Range	The value computed for the resistance of the Meter/Case RTD is outside limits	• Check the sensor RTD circuitry. See Section 11.21. • Verify that process temperature is within range of sensor and transmitter. • Check the characterization. Specifically, verify the FCF and K1 values. See Section 6.2. • If the problem persists, contact Micro Motion.
A020	Calibration Factors Unentered Calibration Factors Unentered (FlowCal)	The flow calibration factor and/or K1 has not been entered since the last master reset	• Check the characterization. Specifically, verify the FCF and K1 values. See Section 6.2. • If the problem persists, contact Micro Motion.
A021	Unrecognized/ Unentered Sensor Type Incorrect Sensor Type (K1)	The sensor is recognized as a straight tube but the K1 value indicates a curved tube, or vice versa	• Check the characterization. Specifically, verify the FCF and K1 values. See Section 6.2. • Check the sensor RTD circuitry. See Section 11.21. • If the problem persists, contact Micro Motion.
A029	Internal Communication Failure PIC/Daughterboard Communication Failure	Transmitter electronics failure	• Cycle power to the flowmeter. • Contact Micro Motion.
A030	Hardware/Software Incompatible Incorrect Board Type	The loaded software is not compatible with the programmed board type	• Contact Micro Motion.
A031	Undefined Low Power	The transmitter is not receiving enough power	• Check power supply to transmitter. See Section 11.7.1.
A032[(2)]	Meter Verification Fault Alarm Meter Verification/Outputs In Fault	Meter verification in progress, with outputs set to fault	• Allow the procedure to complete. • If desired, abort the procedure and restart with outputs set to last measured value.
A032[(3)]	Outputs Fixed during Meter Verification Meter Verification In Progress and Outputs Fixed	Meter verification in progress, with outputs set to Fault or Last Measured Value.	• Allow the procedure to complete. • If desired, abort the procedure and restart with outputs set to Continue Measurement.

Table 11-2 Status alarms and remedies *continued*

Alarm code	Message(1)	Cause	Suggested remedy
A033	Sensor OK, Tubes Stopped by Process Sensor OK, Tubes Stopped by Process	No signal from LPO or RPO, suggesting that sensor tubes are not vibrating	• Verify process. Check for air in the flow tubes, tubes not filled, foreign material in tubes, or coating in tubes (see Section 11.15).
A034(3)	Meter Verification Failed Meter Verification Failed	Test results were not within acceptable limits.	Rerun the test. If the test fails again, see Section 10.3.4.
A035(3)	Meter Verification Aborted Meter Verification Aborted	The test did not complete, possibly due to manual abort.	If desired, read the abort code, see Section 10.3.4, and perform the appropriate action.
A102	Drive Over-Range/ Partially Full Tube Drive Overrange/ Partially Full Tube	The drive power (current/voltage) is at its maximum	• Excessive drive gain. See Section 11.20.3. • Check the sensor circuitry. See Section 11.21. • If this is the only active alarm, it can be ignored. If desired, reconfigure the alarm severity to Ignore (see Section 8.8).
A104	Calibration-In- Progress Calibration in Progress	A calibration procedure is in progress	• Allow the flowmeter to complete calibration. • For zero calibration procedures, you may abort the calibration, set the zero time parameter to a lower value, and restart the calibration.
A105	Slug Flow Slug Flow	The density has exceeded the user-defined slug (density) limits	• See Section 11.14.
A107	Power Reset Occurred Power Reset Occurred	The transmitter has been restarted	• No action required. • If desired, reconfigure the alarm severity to Ignore (see Section 8.8).
A116	API Temperature Out-of-Limits API: Temperature Outside Standard Range	Process temperature is outside API-defined extrapolation limits	• Verify process. • Verify API reference table and temperature configuration. See Section 8.14.
A117	API Density Out-of-Limits API: Density Outside Standard Range	Process density is outside API-defined extrapolation limits	• Verify process. • Verify API reference table and density configuration. See Section 8.14.
A120	ED: Unable to fit curve data ED: Unable to Fit Curve Data	Configured values for density curve do not meet accuracy requirements	• Verify enhanced density configuration. See Section 8.15.
A121	ED: Extrapolation alarm ED: Extrapolation Alarm	Enhanced density calculations are outside the configured data range	• Verify process temperature. • Verify process density. • Verify enhanced density configuration. • If desired, reconfigure the alarm severity to Ignore (see Section 8.8).
A131(2)	Meter Verification Info Alarm Meter Verification/Outputs at Last Value	Meter verification in progress, with outputs set to last measured value	• Allow the procedure to complete. • If desired, abort the procedure and restart with outputs set to fault.
A131(3)	Meter Verification in Progress Meter Verification in Progress	Meter verification in progress, with outputs set to continue reporting process data.	• Allow the procedure to complete.

Table 11-2 Status alarms and remedies *continued*

Alarm code	Message(1)	Cause	Suggested remedy
A132	Simulation Mode Active	Simulation mode is enabled	• Disable simulation mode. See Section 11.10.
	Simulation Mode Active		
A133	PIC UI EEPROM Error	EEPROM data on the user interface module is corrupt	• Contact Micro Motion.
	PIC UI EEPROM Error		

(1) Depending on the method you are using to view the alarm, different messages may be displayed. This table shows two possible message versions. The ProLink II version is displayed in the second message of each pair.
(2) Applies only to systems with the original version of the meter verification application.
(3) Applies only to systems with Smart Meter Verification.

11.13 Checking process variables

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

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

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

Unusual values for process variables may indicate a variety of different problems. Table 11-3 lists several possible problems and suggested remedies.

Table 11-3 Process variables problems and remedies

Symptom	Cause	Suggested remedy
Steady non-zero flow rate under no-flow conditions	Misaligned piping (especially in new installations)	• Correct the piping.
	Open or leaking valve	• Check or correct the valve mechanism.
	Bad sensor zero	• Rezero the flowmeter or restore the factory zero or prior zero. See Section 10.5.

Table 11-3 Process variables problems and remedies *continued*

Symptom	Cause	Suggested remedy
Erratic non-zero flow rate under no-flow conditions	Leaking valve or seal	• Check pipeline.
	Slug flow	• See Section 11.14.
	Plugged flow tube	• Check drive gain and tube frequency. Purge the flow tubes.
	Incorrect sensor orientation	• Sensor orientation must be appropriate to process fluid. See the installation manual for your sensor.
	Wiring problem	• Check the sensor circuitry. See Section 11.21.
	Vibration in pipeline at rate close to sensor tube frequency	• Check environment and remove source of vibration.
	Damping value too low	• Check configuration. See Section 8.4.
	Mounting stress on sensor	• Check sensor mounting. Ensure: - Sensor is not being used to support pipe. - Sensor is not being used to correct pipe misalignment. - Sensor is not too heavy for pipe.
	Sensor cross-talk	• Check environment for sensor with similar (±0.5 Hz) tube frequency.
Erratic non-zero flow rate when flow is steady	Slug flow	• See Section 11.14.
	Damping value too low	• Check configuration. See Section 8.4.
	Plugged flow tube	• Check drive gain and tube frequency. Purge the flow tubes.
	Excessive or erratic drive gain	• See Section 11.20.3
	Output wiring problem	• Verify wiring between transmitter and receiving device. See the installation manual for your transmitter.
	Problem with receiving device	• Test with another receiving device.
	Wiring problem	• Check the sensor circuitry. See Section 11.21.
Inaccurate flow rate	Bad flow calibration factor	• Verify characterization. See Section 6.2.
	Inappropriate measurement unit	• Check configuration. See Section 11.16.
	Bad sensor zero	• Rezero the flowmeter or restore the factory zero or prior zero. See Section 10.5.
	Bad density calibration factors	• Verify characterization. See Section 6.2.
	Bad flowmeter grounding	• See Section 11.7.3.
	Slug flow	• See Section 11.14.
	Wiring problem	• Check the sensor circuitry. See Section 11.21.

Table 11-3 Process variables problems and remedies *continued*

Symptom	Cause	Suggested remedy
Inaccurate density reading	Problem with process fluid	• Use standard procedures to check quality of process fluid.
	Bad density calibration factors	• Verify characterization. See Section 6.2.
	Wiring problem	• Check the sensor circuitry. See Section 11.21.
	Bad flowmeter grounding	• See Section 11.7.3.
	Slug flow	• See Section 11.14.
	Sensor cross-talk	• Check environment for sensor with similar (±0.5 Hz) tube frequency.
	Plugged flow tube	• Check drive gain and tube frequency. Purge the flow tubes.
	Incorrect sensor orientation	• Sensor orientation must be appropriate to process fluid. See the installation manual for your sensor.
	RTD failure	• Check for alarm conditions and follow troubleshooting procedure for indicated alarm.
	Physical characteristics of sensor have changed	• Check for corrosion, erosion, or tube damage. See Section 11.15.
Temperature reading significantly different from process temperature	RTD failure	• Check for alarm conditions and follow troubleshooting procedure for indicated alarm. • Verify “Use external temperature” configuration and disable if appropriate. See Section 9.3.
Temperature reading slightly different from process temperature	Sensor leaking heat	• Insulate the sensor.
Unusually high density reading	Plugged flow tube	• Check drive gain and tube frequency. Purge the flow tubes.
	Incorrect K2 value	• Verify characterization. See Section 6.2.
Unusually low density reading	Slug flow	• See Section 11.14.
	Incorrect K2 value	• Verify characterization. See Section 6.2.
Unusually high tube frequency	Sensor erosion	• Contact Micro Motion.
Unusually low tube frequency	Plugged flow tube, corrosion, or erosion	• Purge the flow tubes. • Perform meter verification. See Section 11.15.
Unusually low pickoff voltages	Several possible causes	• See Section 11.20.4.
Unusually high drive gain	Several possible causes	• See Section 11.20.3.

11.14 Checking slug flow

A slug flow alarm is posted whenever the measured process density is outside the configured slug flow limits (i.e., density is higher or lower than the configured normal range). Slug flow is typically caused by gas in a liquid process or liquid in a gas process. See Section 8.7 for a discussion of slug flow functionality.

If slug flow occurs:

- Check the process for cavitation, flashing, or leaks.
- Change the sensor orientation.
- Monitor density.
- If desired, enter new slug flow limits (see Section 8.7).
  - Raising the low slug flow limit or lowering the high slug flow limit will increase the possibility of slug flow conditions.
  - Lowering the low slug flow limit or raising the high slug flow limit will decrease the possibility of slug flow conditions.
- If desired, increase slug duration (see Section 8.7).

11.15 Checking the sensor tubes

Corrosion, erosion, or damage to the sensor tubes can affect process measurement. To check for these conditions, perform the meter verification procedure, if available. See Chapter 10. If the meter verification procedure is not available, perform a visual inspection, or perform a density calibration and check for a shift in the K1 and K2 values. Contact Micro Motion customer service.

11.16 Checking the flow measurement configuration

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.

11.17 Checking the characterization

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

If you discover that any of the characterization data are wrong, perform a complete characterization. See Section 6.2.

11.18 Checking the calibration

Improper calibration can cause the transmitter to report unexpected process variable values. If the transmitter appears to be operating correctly but sends unexpected process variable values, an improper calibration may be the cause.

Micro Motion calibrates every transmitter at the factory. Therefore, you should suspect improper calibration only if the transmitter has been calibrated after it was shipped from the factory. Before performing a calibration, consider meter validation or meter verification and select the appropriate procedure (see Section 10.2). Contact Micro Motion customer service for assistance.

11.19 Restoring a working configuration

At times it may be easier to start from a known working configuration than to troubleshoot the existing configuration. To do this, you can:

- Restore a configuration file saved via ProLink II, if one is available. See Figure C-1.
- Restore the factory configuration. To do this:
  - Using ProLink II, see Figure C-2. ProLink II v2.6 or higher is required.
  - Using a PROFIBUS host and the EDD, see Figure C-10.
  - Using PROFIBUS bus parameters, use the Diagnostic Block, Index 51 (see Table D-4).

Both of these actions will overwrite the existing configuration. Ensure that the existing configuration is appropriately documented or saved.

11.20 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.

11.20.1 Obtaining the test points

To obtain the test point values:

- With the display, configure the required test points as display variables. See Section 8.9.3.
- With ProLink II:
  a. Click **ProLink** > **Diagnostic Information**.
  b. Observe or record the values displayed for **Tube Frequency**, **Left Pickoff**, **Right Pickoff**, and **Drive Gain**.
- With a PROFIBUS host with the EDD, use the Meter Diagnostics window in the Device menu (see Figure C-7).
- With PROFIBUS bus parameters, read Indices 32, 33, 35, and 36 in the Diagnostic block (see Table D-4).

11.20.2 Evaluating the test points

Use the following guidelines to evaluate the test points:

- If the drive gain is erratic, negative, or saturated, refer to Section 11.20.3.
- If the value for the left or right pickoff does not equal the appropriate value from Table 11-4, based on the sensor flow tube frequency, refer to Section 11.20.4.
- If the values for the left and right pickoffs equal the appropriate values from Table 11-4, based on the sensor flow tube frequency, record your troubleshooting data and contact the Micro Motion customer service department.

Table 11-4 Sensor pickoff values

Sensor[1]	Pickoff value
ELITE® CMF sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
F025, F050, F100 sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
F200 sensors	2.0 mV peak-to-peak per Hz based on sensor flow tube frequency
H025, H050, H100 sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
H200 sensors	2.0 mV peak-to-peak per Hz based on sensor flow tube frequency
R025, R050, or R100 sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
R200 sensors	2.0 mV peak-to-peak per Hz based on sensor flow tube frequency
T-Series sensors	0.5 mV peak-to-peak per Hz based on sensor flow tube frequency
CMF400 I.S. sensors	2.7 mV peak-to-peak per Hz based on sensor flow tube frequency

(1) If your sensor is not listed, contact Micro Motion.

11.20.3 Drive gain problems

Problems with drive gain can appear in several different forms:

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

See Table 11-5 for a list of possible problems and remedies.

Table 11-5 Drive gain problems, causes, and remedies

Cause	Possible remedy
Excessive slug flow	• See Section 11.14.
Cavitation or flashing	• Increase inlet or back pressure at the sensor. • If a pump is located upstream from the sensor, increase the distance between the pump and sensor.
Plugged flow tube	• Purge the flow tubes.
Mechanical binding of sensor tubes	• Ensure sensor tubes are free to vibrate. Possible problems include: - Pipe stress. Check for pipe stress and eliminate if present. - Lateral tube shift due to hammer effect. If this is a possibility, contact Micro Motion. - Warped tubes caused by overpressurization. If this is a possibility, contact Micro Motion.
Incorrect sensor type configured	• Verify sensor type configuration, then verify sensor characterization. See Section 6.2.
Open drive or left pickoff sensor coil	• Contact Micro Motion.
Drive board or module failure, cracked flow tube, or sensor imbalance	• Contact Micro Motion.

11.20.4 Low pickoff voltage

Low pickoff voltage can be caused by several problems. See Table 11-6.

Table 11-6 Low pickoff voltage causes and remedies

Cause	Possible remedy
Slug flow	• See Section 11.14.
No tube vibration in sensor	• Check for plugging.
Moisture in the sensor electronics	• Eliminate the moisture in the sensor electronics.
Damaged sensor	• Ensure sensor is free to vibrate (no mechanical binding). Possible problems include: - Pipe stress. Check for pipe stress and eliminate if present. - Lateral tube shift due to hammer effect. If this is a possibility, contact Micro Motion. - Warped tubes caused by overpressurization. If this is a possibility, contact Micro Motion. • Test sensor circuitry. See Section 11.21. • Contact Micro Motion.

11.21 Checking sensor circuitry

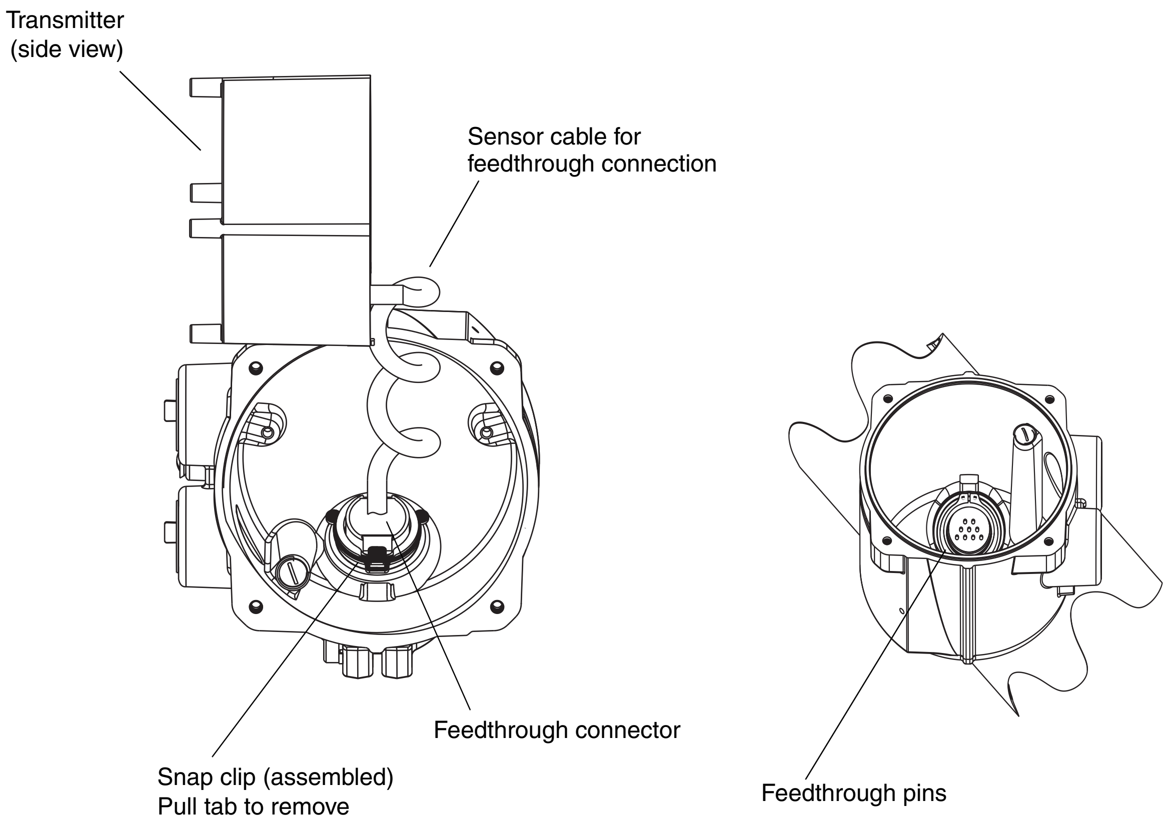
Problems with sensor circuitry can cause several alarms, including sensor failure and a variety of out-of-range conditions. Testing involves:

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

Note: To check the sensor circuitry, you must remove the transmitter from the sensor. Before performing this test, ensure that all other applicable diagnostics have been performed. Diagnostic capabilities of the Model 2400S transmitter have been greatly enhanced, and may provide more useful information than these tests.

1. Follow appropriate procedures to ensure that the process of checking the sensor circuitry does not interfere with existing measurement and control loops.
2. Power down the transmitter.
3. If the transmitter is in a hazardous environment, wait five minutes.
4. Check the sensor cable and sensor connection:
   a. Referring to Figure B-1, loosen the four captive transmitter housing cover screws and remove the transmitter housing cover.
   b. Loosen the two captive user interface screws.
   c. Gently lift the user interface module, disengaging it from the connector on the transmitter.
   d. Referring to Figure B-2, disconnect the PROFIBUS cable and the power wires.
   e. Two captive screws (2.5 mm hex head) hold the transmitter in the housing. Loosen the screws and gently lift the transmitter away from the housing. Allow the transmitter to hang temporarily.
   f. Ensure that the cable is fully plugged in and making a good connection. If it was not, reseat the cable, reassemble the transmitter and sensor, and check operation.
   g. If the problem is not resolved, unplug the cable from the feedthrough by removing the snap clip (see Figure 11-1), then pulling the connector away from the feedthrough. Set the transmitter aside.
   h. Check the cable for any signs of damage. If the cable is damaged, contact Micro Motion.

Figure 11-1 Accessing the feedthrough pins



5. Using a digital multimeter (DMM), check the sensor internal resistances for each flowmeter circuit. Table 11-7 defines the flowmeter circuits and the resistance range for each. Refer to Figure 11-2 to identify the feedthrough pins. For each circuit, place the DMM leads on the pin pairs and record the values.

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

In this test:

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

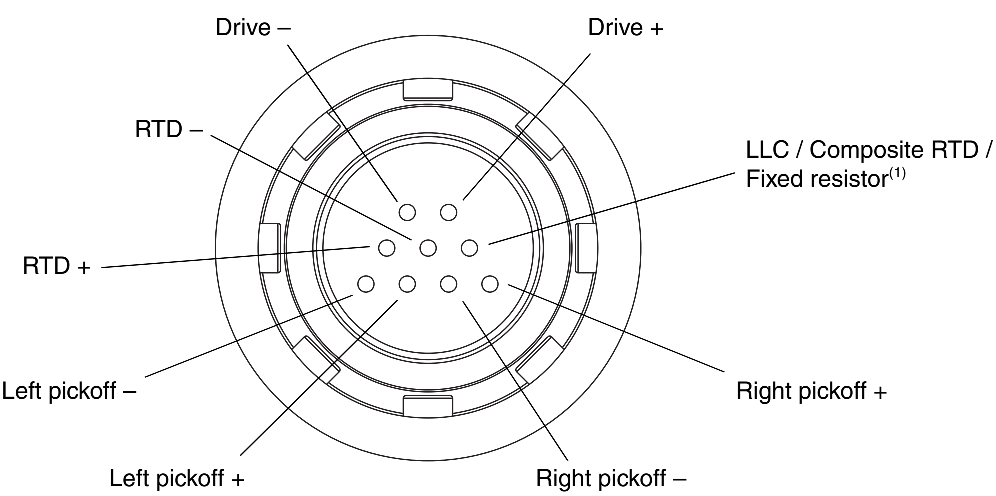
If a problem appears, or if any resistance is out of range, contact Micro Motion.

Table 11-7 Nominal resistance ranges for flowmeter circuits

Circuit	Pin pairs	Nominal resistance range(1)
Drive	Drive + and –	8–1500 Ω
Left pickoff	Left pickoff + and –	16–1000 Ω
Right pickoff	Right pickoff + and –	16–1000 Ω
Flow tube temperature sensor	RTD + and RTD –	100 Ω at 0 °C + 0.38675 Ω / °C
LLC/RTD		
• T-Series sensors	RTD – and composite RTD	300 Ω at 0 °C + 1.16025 Ω / °C
• CMF400 I.S. sensors	RTD – and fixed resistor	39.7–42.2 Ω
• F300 sensors • H300 sensors • F025A, F050A, F100A sensors • CMFS sensors	RTD – and fixed resistor	44.3–46.4 Ω
• All other sensors	RTD – and LLC	0

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

Figure 11-2 Feedthrough pins



(1) Functions as fixed resistor for the following sensors: F300, H300, F025A, F050A, F100A, CMF400 I.S., CMFS. Functions as composite RTD for T-Series sensors. For all other sensors, functions as lead length compensator (LLC).

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

   With the DMM set to its highest range, there should be infinite resistance on each lead. If there is any resistance at all, there is a short to case or a short between pins. See Table 11-8 for possible causes and solutions. If the problem is not resolved, contact Micro Motion.

Table 11-8 Sensor and cable short to case causes and remedies

Cause	Possible remedy
Moisture inside the transmitter housing	• Make sure that the transmitter housing is dry and no corrosion is present.
Liquid or moisture inside the sensor case	• Contact Micro Motion.
Internally shorted feedthrough (sealed passage for wiring from sensor to transmitter)	• Contact Micro Motion.

To return to normal operation:

1. Follow appropriate procedures to ensure that reconnecting the transmitter does not interfere with existing measurement and control loops.
2. Reach inside the transmitter housing and install the transmitter's sensor connection onto the feedthrough:
   a. Rotate the connector until it engages the pins.
   b. Push down until the connector shoulder is flush with the feedthrough notch.
   c. Replace the snap clip by sliding the clip tab over the connector shoulder (see the instruction label on the component).
3. Replace the transmitter in the transmitter housing, and tighten the screws.
4. Reconnect the power wires, lower the Warning flap, and tighten the Warning flap screw.
5. Reconnect the PROFIBUS cable to the PROFIBUS terminals on the transmitter.
6. Plug the user interface module onto the transmitter. There are four possible positions; select the position that is most convenient.
7. Tighten the user interface screws.
8. Replace the transmitter housing cover on the user interface module, and tighten the screws.
9. Power up the transmitter.

Appendix A
Default Values and Ranges

A.1 Overview

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

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

A.2 Most frequently used defaults and ranges

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

Table A-1 Transmitter default values and ranges

Type	Setting	Default	Range	Comments
Flow	Flow direction	Forward		
	Flow damping	0.64 sec	0.0–40.96 sec	User-entered value is corrected to nearest lower value in list of preset values. For gas applications, Micro Motion recommends a minimum value of 2.56.
	Flow calibration factor	1.00005.13		For T-Series sensors, this value represents the FCF and FT factors concatenated. See Section 6.2.2.
	Mass flow units	g/s		
	Mass flow cutoff	0.0 g/s		Recommended setting: • Standard use – 0.2% of the sensor's rated maximum flowrate • Empty-full-empty batching – 2.5% of the sensor's maximum flowrate
	Volume flow type	Liquid volume		
	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	1.28 sec	0.0–40.96 sec	User-entered value is corrected to nearest value in list of preset values.
	Density units	g/cm^3		
	Density cutoff	0.2 g/cm^3	0.0–0.5 g/cm^3	
	D1	0.00000		
	D2	1.00000		
	K1	1000.00		
	K2	50,000.00		
	FD	0.00000		
	Temp Coefficient	4.44		
Slug flow	Slug flow low limit	0.0 g/cm^3	0.0–10.0 g/cm^3	
	Slug flow high limit	5.0 g/cm^3	0.0–10.0 g/cm^3	
	Slug duration	0.0 sec	0.0–60.0 sec	
Temperature	Temperature damping	4.8 sec	0.0–38.4 sec	User-entered value is corrected to nearest lower value in list of preset values.
	Temperature units	Deg C		
	Temperature calibration factor	1.00000T0.0000		
Pressure	Pressure units	PSI		
	Flow factor	0.00000		
	Density factor	0.00000		
	Cal pressure	0.00000		
T-Series sensor	D3	0.00000		
	D4	0.00000		
	K3	0.00000		
	K4	0.00000		
	FTG	0.00000		
	FFQ	0.00000		
	DTG	0.00000		
	DFQ1	0.00000		
	DFQ2	0.00000		
Events 1–5	Type	Low		
	Variable	Density		
	Setpoint	0.0		
	Setpoint units	g/cm^3		

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

Type	Setting	Default	Range	Comments
Display	Backlight on/off	On		
	Backlight intensity	63	0–63	
	Update period	200 milliseconds	100–10,000 milliseconds	
	Variable 1	Mass flow rate		
	Variable 2	Mass total		
	Variable 3	Volume flow rate		
	Variable 4	Volume total		
	Variable 5	Density		
	Variable 6	Temperature		
	Variable 7	Drive gain		
	Variable 8–15	None		
	Display totalizer start/stop	Disabled		
	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		
Digital communi-cations	PROFIBUS-DP node address	126		
	IrDA port enabled/disabled	Disabled		
	IrDA port write-protect	Read-only		
	Modbus address	1		
	Modbus ASCII support	Enabled		
	Floating-point byte order	3–4 1–2		
	Fault action	None		
	Fault timeout	0 seconds	0.0–60.0 sec	

Compensation
Measurement Performance
Troubleshooting
Defaults

Appendix B
Transmitter Components

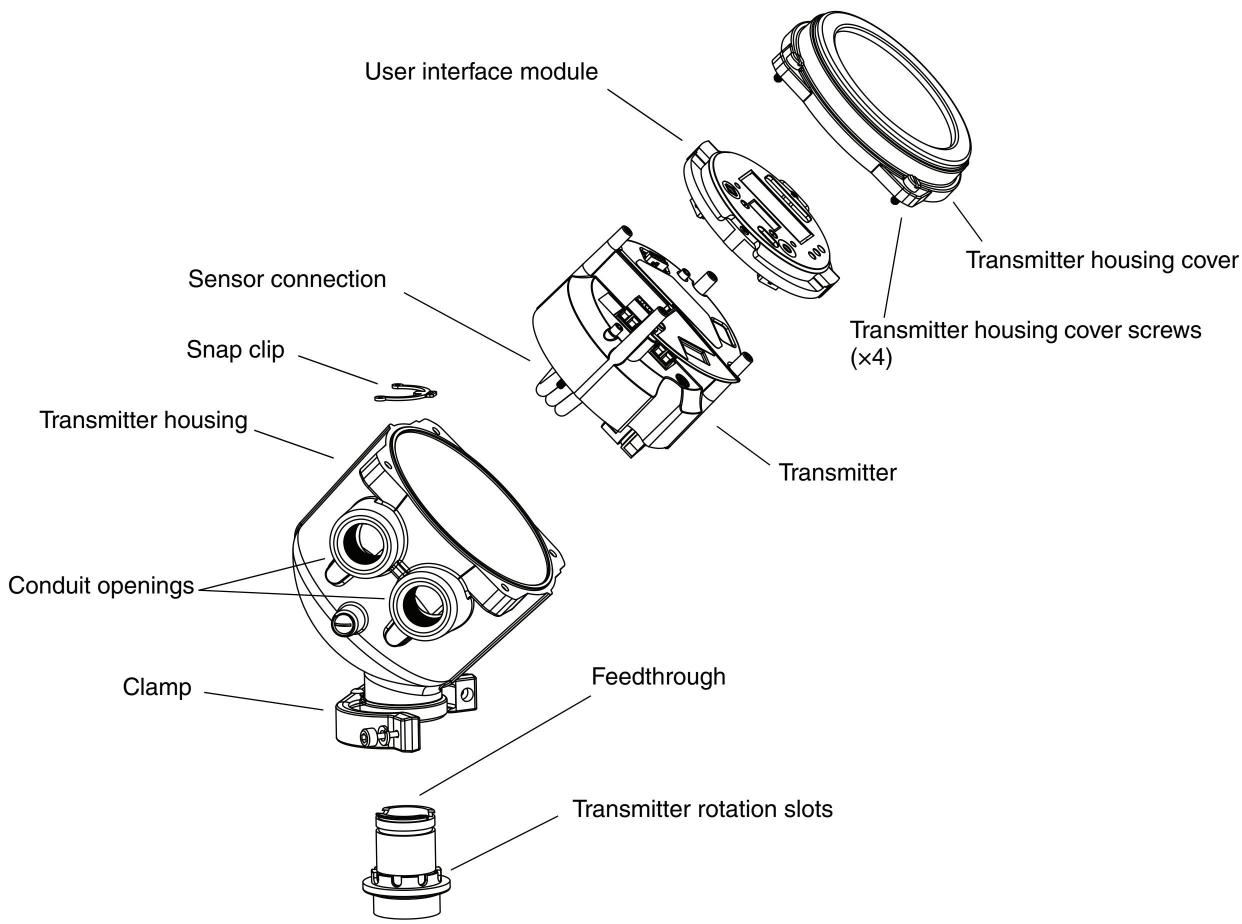
B.1 Overview

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

B.2 Transmitter components

The Model 2400S DP transmitter is mounted on a sensor. Figure B-1 provides an exploded view of the Model 2400S DP transmitter and its components.

Figure B-1 **Model 2400S DP transmitter – Exploded view**



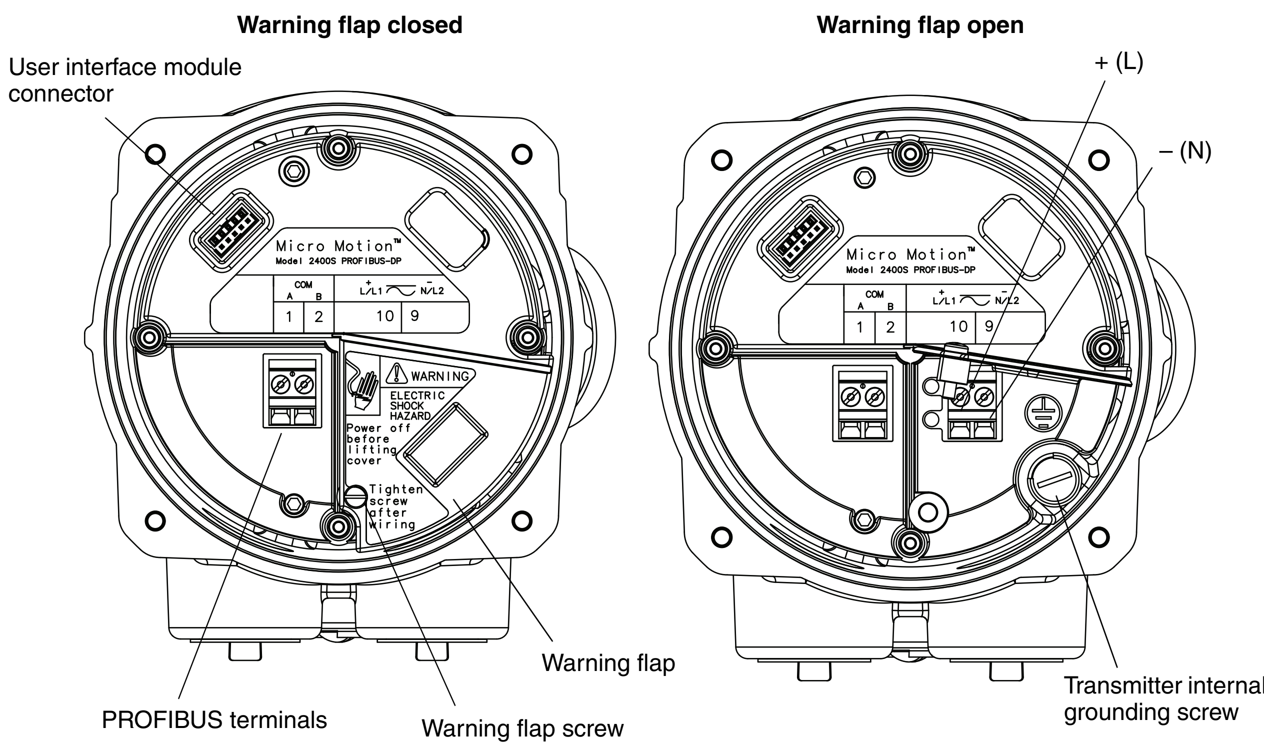
B.3 Terminals and connectors

Figure B-2 shows the terminals and connectors that are beneath the user interface module:

- To access the PROFIBUS connector, you must remove the transmitter housing cover and the user interface module.
- To access the power supply terminals or the grounding screw, you must remove the transmitter housing cover and the user interface module, loosen the Warning flap screw, and open the Warning flap.

For detailed instructions, see the manual entitled *Micro Motion Model 2400S Transmitters: Installation Manual*.

Figure B-2 Terminals



Appendix C
Menu Flowcharts – Model 2400S DP Transmitters

C.1 Overview

This appendix provides the following menu flowcharts for the Model 2400S DP transmitter:

- ProLink II menus
  - Main menu – see Figure C-1
  - Configuration menu – see Figures C-2 and C-3
- EDD menus
  - Main menu – see Figure C-4
  - View menu – see Figure C-5
  - Device menu – see Figures C-6 and C-7
  - Configuration menu – see Figures C-8 through C-11
  - Specialist menu – see Figure C-12
- Display menus
  - Off-line menu: Top level – see Figure C-13
  - Off-line maintenance: Version information – see Figure C-14
  - Off-line maintenance: Configuration – see Figure C-15
  - Off-line maintenance: Zero – see Figure C-16
  - Off-line maintenance: Meter verification – see Figure C-17

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

For meter verification and calibration procedures, see Chapter 10.

C.2 Version information

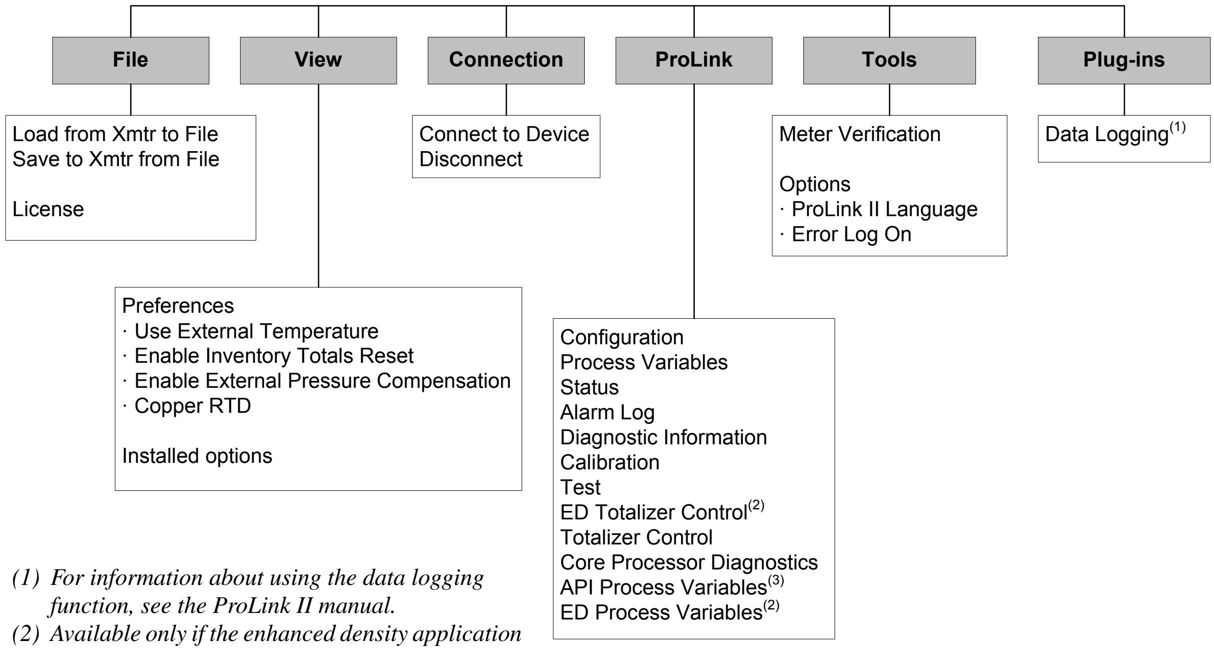
These menu flowcharts are based on:

- Transmitter software v1.10
- ProLink II v2.5
- EDD rev1

Menus may vary slightly for different versions of these components.

C.3 ProLink II menu flowcharts

Figure C-1 ProLink II main menu



(1) *For information about using the data logging function, see the ProLink II manual.*
(2) *Available only if the enhanced density application is installed.*
(3) *Available only if the petroleum measurement application is installed.*

Figure C-2 ProLink II configuration menu

ProLink > Configuration

Flow
- Flow direction
- Flow damp
- Flow cal
- Mass flow cutoff
- Mass flow units
- Vol flow cutoff(1)
- Vol flow units(1)
- Vol flow type
- Std gas vol flow cutoff(2)
- Std gas vol flow units(2)
- Std gas density(2)

Gas wizard(2)

- Mass factor
- Dens factor
- Vol factor

Density
- Density units
- Density damping
- Slug high limit
- Slug low limit
- Slug duration
- Low density cutoff
- K1
- K2
- FD
- D1
- D2
- Temp coeff (DT)

Temperature
- Temp units
- Temp cal factor
- Temp damping
- External temperature

Pressure
- Flow factor
- Dens factor
- Cal pressure
- Pressure units
- External pressure

continued

Sensor
- Sensor s/n
- Sensor model num
- Sensor matl
- Liner matl
- Flange

Sensor Limits(3)

Mass flow
- Lower sensor limit
- Upper sensor limit
- Min span

Volume flow
- Lower sensor limit
- Upper sensor limit
- Min span

Density
- Lower sensor limit
- Upper sensor limit
- Min span

Temperature
- Lower sensor limit
- Upper sensor limit
- Min span

T Series
- FTG
- FFQ
- DTG
- DFQ1
- DFQ2
- K3
- D3
- D4
- K4

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

Digital comm settings
- Fault setting
- Modbus address
- Disable Modbus ASCII
- Enable IrDA comm
- Enable write protect IrDA port

I&M functions(4)
- Tag
- Tag location

Last measured value timeout

Restore factory configuration(4)

(1) Displayed only if Vol Flow Type is set to Liquid Volume.
(2) Displayed only if Vol Flow Type is set to Standard Gas Volume.
(3) All values on this panel are read-only, and are displayed only for informational purposes.
(4) Requires ProLink II v2.6 or later.

Diagrams
Menus
Bus Parameters
Display Codes

Figure C-3 ProLink II configuration menu *continued*

ProLink > Configuration

Display

· Var1
· Var2
· …
· Var 15

Display precision
· Var
· Number of decimals

Display options
· Display start/stop totalizers
· Display totalizer reset
· Display auto scroll
· Display offline menu
· Display offline password
· Display alarm menu
· Display ack all alarms
· Display back light on/off

· Offline password
· Auto scroll rate
· Update period
· Backlight intensity

· Display language

Discrete events

· Event name
· Event type
· Process variable
· Low setpoint
· High setpoint

Discrete input(1)

· Start sensor zero
· Reset mass total
· Reset volume total
· Reset all totals
· Start/stop all totalization
· Reset gas standard volume total
· Reset API reference volume total
· Reset ED reference volume total
· Reset ED net mass total
· Reset ED net volume total
· Increment current ED curve

Alarm

· Alarm
· Severity

Sensor simulation

Enable simulation mode

Mass flow
· Wave form
· Fixed value
· Period
· Minimum
· Maximum

Density
· Wave form
· Fixed value
· Period
· Minimum
· Maximum

Temperature
· Fixed value
· Period
· Minimum
· Maximum

API setup(2)

· Table type
· Units

ED setup(3)

Global config
· Active curve
· Derived variable
· Lock/unlock ED curves

Curve specific config
· Curve configured
· Curve name
· Reference temperature
· Water reference temperature
· Water reference density
· Trim slope
· Trim offset

Extrapolation
· Alarm limit
· Enable density low
· Enable density high
· Enable temperature low
· Enable temperature high

Concentration
· Units
· Special unit string

ED curve(3)

Process fluid density at specified temperature and concentration
· Curve being configured
· Curve fit max order
· Temperature isotherms
· Concentration

Curve fit results
· Accuracy

Process fluid density at reference temperature and specified concentration
· Reference temperature
· Concentration

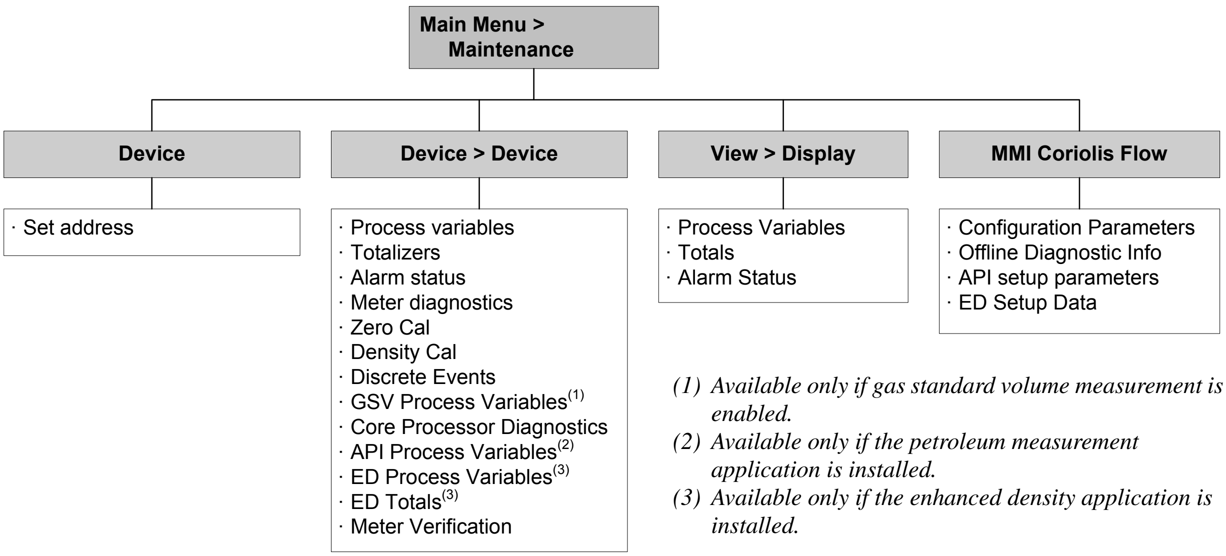
(1) Used to assign events to actions, even though the Model 2400S DP transmitter does not provide a discrete input.
(2) Available only if the petroleum measurement application is installed.
(3) Available only if the enhanced density application is installed.

C.4 EDD menu flowcharts

If you connect as a Maintenance user, the I&M functions menu (see Figure C-12) is not available. All other EDD menus are available.

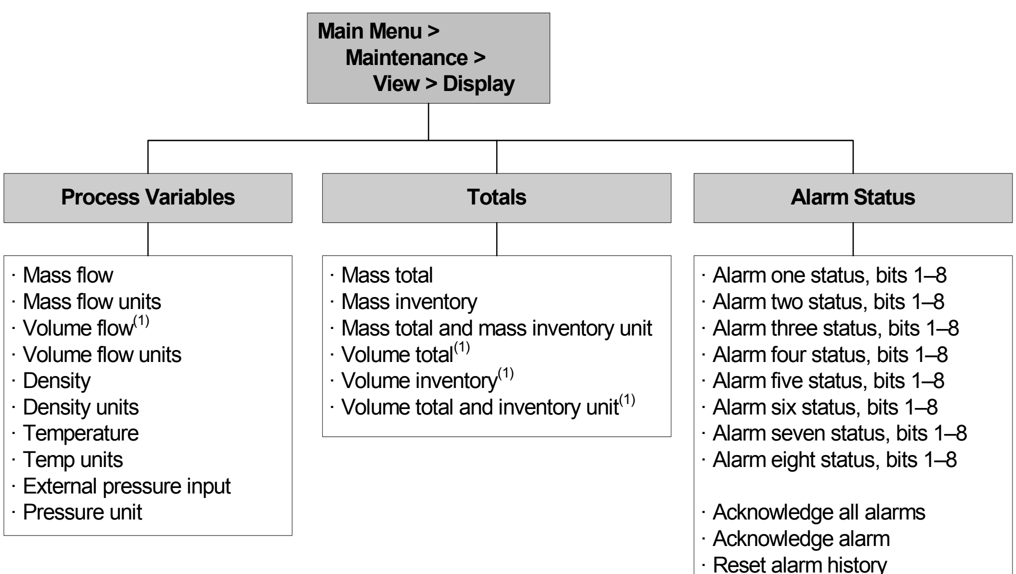
If you connect as a Specialist user, all EDD menus are available.

Figure C-4 EDD – Main menu



(1) Available only if gas standard volume measurement is enabled.
(2) Available only if the petroleum measurement application is installed.
(3) Available only if the enhanced density application is installed.

Figure C-5 EDD – View menu



(1) Liquid volume only.

Figure C-6 EDD – Device menu

(1) Liquid volume only.
(2) Available only if gas standard volume is enabled.
(3) Available only if the petroleum measurement application is installed.
(4) Available only if the enhanced density application is installed.

Figure C-7 **EDD – Device menu** *continued*

Device > Device

Meter Diagnostics

- Drive gain
- Tube frequency
- Live zero
- Left pickoff voltage
- Right pickoff voltage

Core Processor Diagnostics

- Temperature unit
- Board temperature
- Maximum electronics temperature
- Minimum electronics temperature
- Average electronics temperature
- Maximum sensor temperature
- Minimum sensor temperature
- Average sensor temperature
- Drive current
- RTD cable resistance
- Line RTD resistance
- Case RTD resistance
- Power cycles
- Power on time
- Input voltage
- Actual target amplitude

Zero Calibration

- Mass flow
- Mass flow unit
- Perform auto zero
- Restore factory zero
- Zero time
- Flow signal offset at zero flow
- Standard deviation
- Manual zero
- Zero failed value

- Alarm one status, bits 1–8
- Alarm two status, bits 1–8
- Alarm three status, bits 1–8
- Alarm four status, bits 1–8
- Alarm five status, bits 1–8
- Alarm six status, bits 1–8
- Alarm seven status, bits 1–8
- Alarm eight status, bits 1–8

Density Calibration

- Mass flow
- Mass flow unit

- D1
- Do density cal-Point 1

- D2
- Do density cal-Point 2

- FD value
- Do density cal-Flowing density

- D3 (T-Series only)
- Do density cal-Point 3

- D4 (T-Series only)
- Do density cal-Point 4

- Alarm one status, bits 1–8
- Alarm two status, bits 1–8
- Alarm three status, bits 1–8
- Alarm four status, bits 1–8
- Alarm five status, bits 1–8
- Alarm six status, bits 1–8
- Alarm seven status, bits 1–8
- Alarm eight status, bits 1–8

Meter Verification

Meter verification setup
- Enable meter verification
- Output state
- Stiffness limit set point

Meter verification parameters
- Algorithm state
- Abort code
- State at abort
- LPO stiffness out of limits
- RPO stiffness out of limits
- Progress (% complete)

Meter verification data set selection
- Current data means >
  - Stiffness LPO
  - Stiffness RPO
  - Damping
  - Mass LPO
  - Mass RPO
- Current data standard deviation >
  - Stiffness LPO
  - Stiffness RPO
  - Damping
  - Mass LPO
  - Mass RPO
- Factory cal air means >
  - Stiffness LPO
  - Stiffness RPO
  - Damping
  - Mass LPO
  - Mass RPO
- Factory cal water means >
  - Stiffness LPO
  - Stiffness RPO
  - Damping
  - Mass LPO
  - Mass RPO

Figure C-8 EDD – Configuration menu

MMI Coriolis Flow DP >
MMI Coriolis Flow >
Configuration Parameters

Flow
· GSV

Temperature
· External temperatuare

Density
· T-Series

Pressure
· Pressure configuration values
· Pressure compensation values

Discrete event parameters

Discrete event action code and assignment

Alarm
· Alarm status parameters
· Alarm history parameters

Device
· Transmitter options
· Digital comm settings

Sensor

Sensor limits
· Mass flow
· Volume flow
· Density
· Temperature

Display
· Display options
· Display parameters
  · Display precision
  · Display language

Offline diagnostic info

> Configuration Parameters

>> Flow
Flow direction
Flow damping
Flow calibration factor
Mass flow units
Mass flow cutoff
Volume flow units(1)
Volume flow cutoff(1)
Mass factor
Density factor
Volume factor
Flow temperature coefficient

>>> GSV parameters
Enable gas std volume flow and total

>>>> GSV process variables(2)
Gas std density
Gas std volume flow units
Gas std volume total and inventory units
Gas std volume flow cutoff

>> Temperature
Temperature units
Temperature damping
Temperature calibration offset
Temperature calibration slope

>>> External temperature
External temperature input
Enable external temp for API or ED

>> Density
Density units
Density damping
Slug low limit
Slug high limit
Slug duration
Low density cutoff
K1
K2
FD
D1
D2
DTC
FD value

>> T-Series
FTG
FFQ
DTG
DFQ1
DFQ2
K3
D3
K4
D4
...

(1) Liquid volume only.
(2) Available only if gas standard volume is enabled.

Figure C-9 EDD – Configuration menu *continued*

MMI Coriolis Flow DP >
MMI Coriolis Flow >
Configuration Parameters

Flow
· GSV

Temperature
· External temperatuare

Density
· T-Series

Pressure
· Pressure configuration values
· Pressure compensation values

Discrete event parameters

Discrete event action code and assignment

Alarm
· Alarm status parameters
· Alarm history parameters

Device
· Transmitter options
· Digital comm settings

Sensor

Sensor limits
· Mass flow
· Volume flow
· Density
· Temperature

Display
· Display options
· Display parameters
  · Display precision
  · Display language

Offline diagnostic info

> Configuration Parameters
…

>> Pressure
>>> Pressure configuration values
Enable pressure compensation
Pressure unit
External pressure input

>>> Pressure compensation values
Flow factor
Density factor
Calibration pressure

>> Discrete event parameters
Discrete event index
Discrete event type
Low setpoint (A)
High setpoint (B)
Discrete event process variable code

>> Discrete event action code and assignment
Discrete event action code
Discrete event assignment

>> Alarm
Fault action
Last measured value fault timeout

>>> Alarm status parameters
Alarm n index
Alarm n severity
Alarm n status
Alarm n count
Alarm n last posted
Alarm n last cleared

>>> Alarm history parameters
Alarm log history index
Alarm n number
Alarm n status change
Alarm n time stamp of status change
...

Figure C-10 EDD – Configuration menu *continued*

MMI Coriolis Flow DP >
MMI Coriolis Flow >
Configuration Parameters

Flow
· GSV

Temperature
· External temperatuare

Density
· T-Series

Pressure
· Pressure configuration values
· Pressure compensation values

Discrete event parameters

Discrete event action code and assignment

Alarm
· Alarm status parameters
· Alarm history parameters

Device
· Transmitter options
· Digital comm settings

Sensor

Sensor limits
· Mass flow
· Volume flow
· Density
· Temperature

Display
· Display options
· Display parameters
 · Display precision
 · Display language

Offline diagnostic info

> Configuration Parameters
…

>> Device
ETO
Transmitter serial #
Software rev
Board rev

>>> Transmitter options
Enabled features

>>> Digital comm settings
Enable IrDA communication
Enable write protect IrDA port

>> Sensor
Sensor serial number
Sensor model
Sensor type code
Sensor material
Sensor liner
Flange type

>> Sensor limits
>>> Mass flow
Lower sensor limit
Upper sensor limit
Minimum span

>>> Volume flow
Lower sensor limit
Upper sensor limit
Minimum span

>>> Density
Lower sensor limit
Upper sensor limit
Minimum span

>>> Temperature
Lower sensor limit
Upper sensor limit
Minimum span

>> Display
>>> Display options
Display totalizer reset
Display start/stop totalizers
Display auto scroll
Display offline menu
Display offline password
Display backlight on/off
Display alarm menu
Display ack all alarms

>>> Display parameters
Display offline password
Display auto scroll rate
Display update period
Display backlight intensity
Display variable 1–15

>>>> Display precision
LDO process variable
Number of decimals

>>>> Display language
Display language selection

>> Offline diagnostic info
Restore factory configuration
Reset power on time

Figure C-11 EDD – Configuration menu: API setup and ED setup

MMI Coriolis Flow DP >
MMI Coriolis Flow >
Configuration Parameters

Flow

Temperature

Density

Pressure

Discrete event parameters

Discrete event action code and assignment

Alarm

Device

Sensor

Sensor limits

Display

Offline diagnostic info

API setup parameters(1)

ED setup data(2)
· ED global configuration
· ED curve specific configuration
  · Extrapolation
  · Concentration
· ED curve data
  · Curve fit results
  · Maximum curve fit order

> Configuration
...

>> API setup parameters(1)
API reference temperature
API thermal expansion coefficient
API2540 CTL table type

>> ED setup data(2)
>>> ED global configuration
Active calculation curve
Derived variable
Lock/unlock ED curves
Reset all curve information

>>> ED curve specific config
Curve configured
Curve n name
Curve n long name
Curve n reference temperature
Curve n water reference temperature
Curve n water reference density
Curve n trim slope
Curve n trim offset

>>>> ED extrapolation
Curve n alarm limit
Enable density low
Enable density high
Enable temperature low
Enable temperature high

>>>> ED concentration
Curve n concentration units

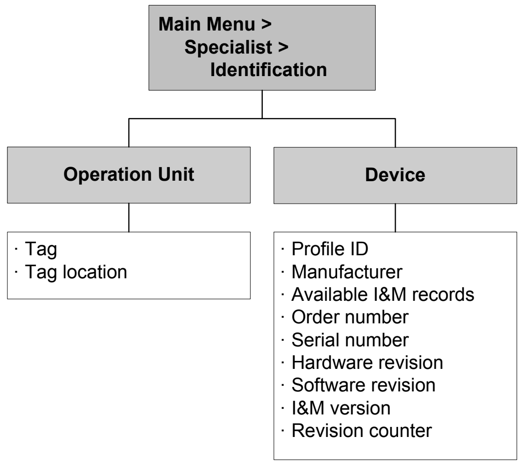
>>> ED curve data
Curve temperature isotherm index (X-axis)
Curve concentration index (Y-axis)
Curve n (6*5) temp isotherm X Value (X-axis)
Curve n (6*5) density @ temp isotherm X, concentration Y
Curve n (6*5) coeff @ temp isotherm X, concentration Y
Curve n (6*5) concentration Y value (label for Y-axis)
Curve n (5*1) density @ concentration Y (at ref. temp.)
Curve n (5*1) coeff @ concentration Y (at ref. temp.)
Curve n (5*1) concentration Y value (Y-axis)

>>>> Curve fit results
Curve n fit results
Curve n curve fit expected accuracy

>>>> Maximum curve fit order
Maximum fit order for 5*5 curve

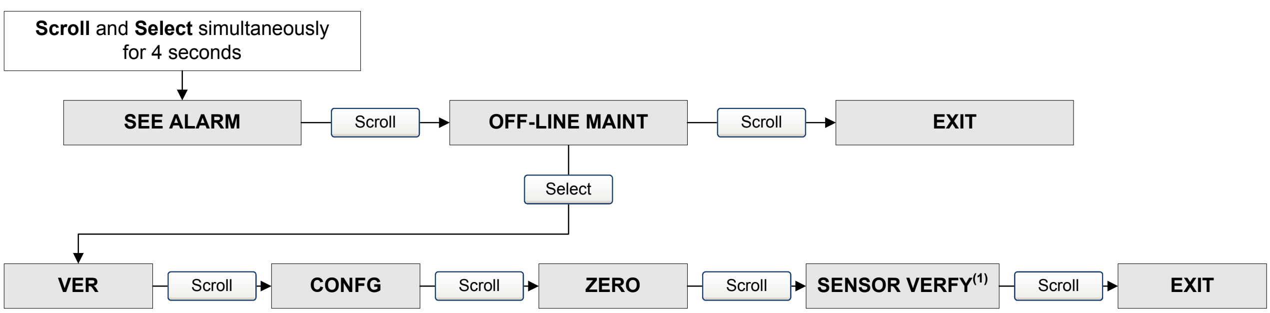
(1) Available only if the petroleum measurement application is installed.
(2) Available only if the enhanced density application is installed.

Figure C-12 EDD Specialist menu – Identification



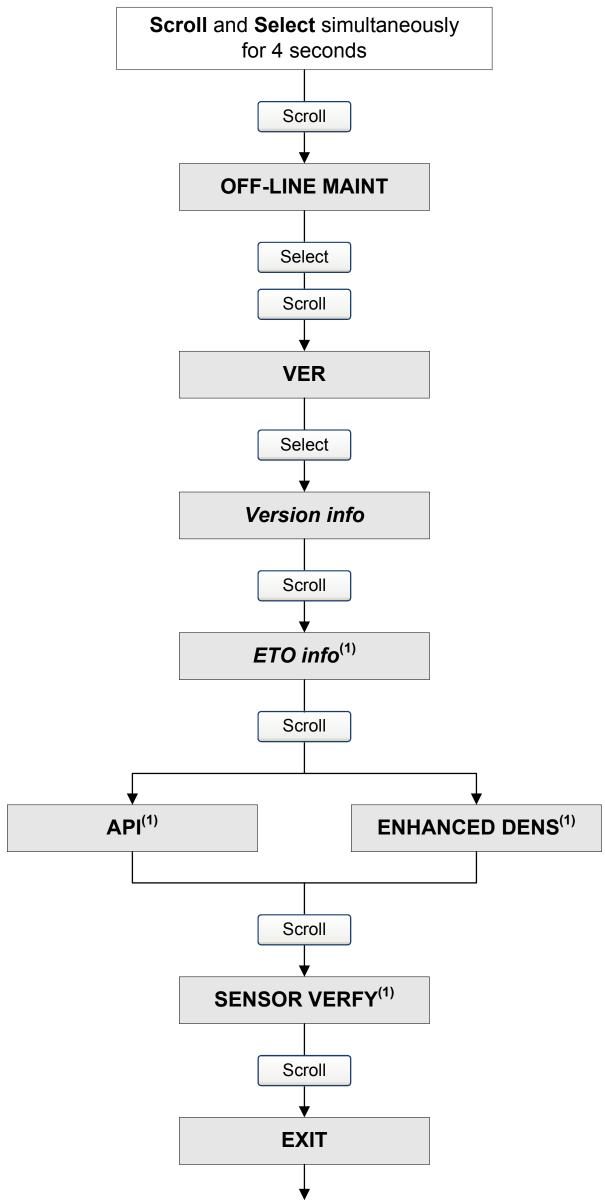
C.5 Display menu flowcharts

Figure C-13 Display menu – Off-line menu, top level



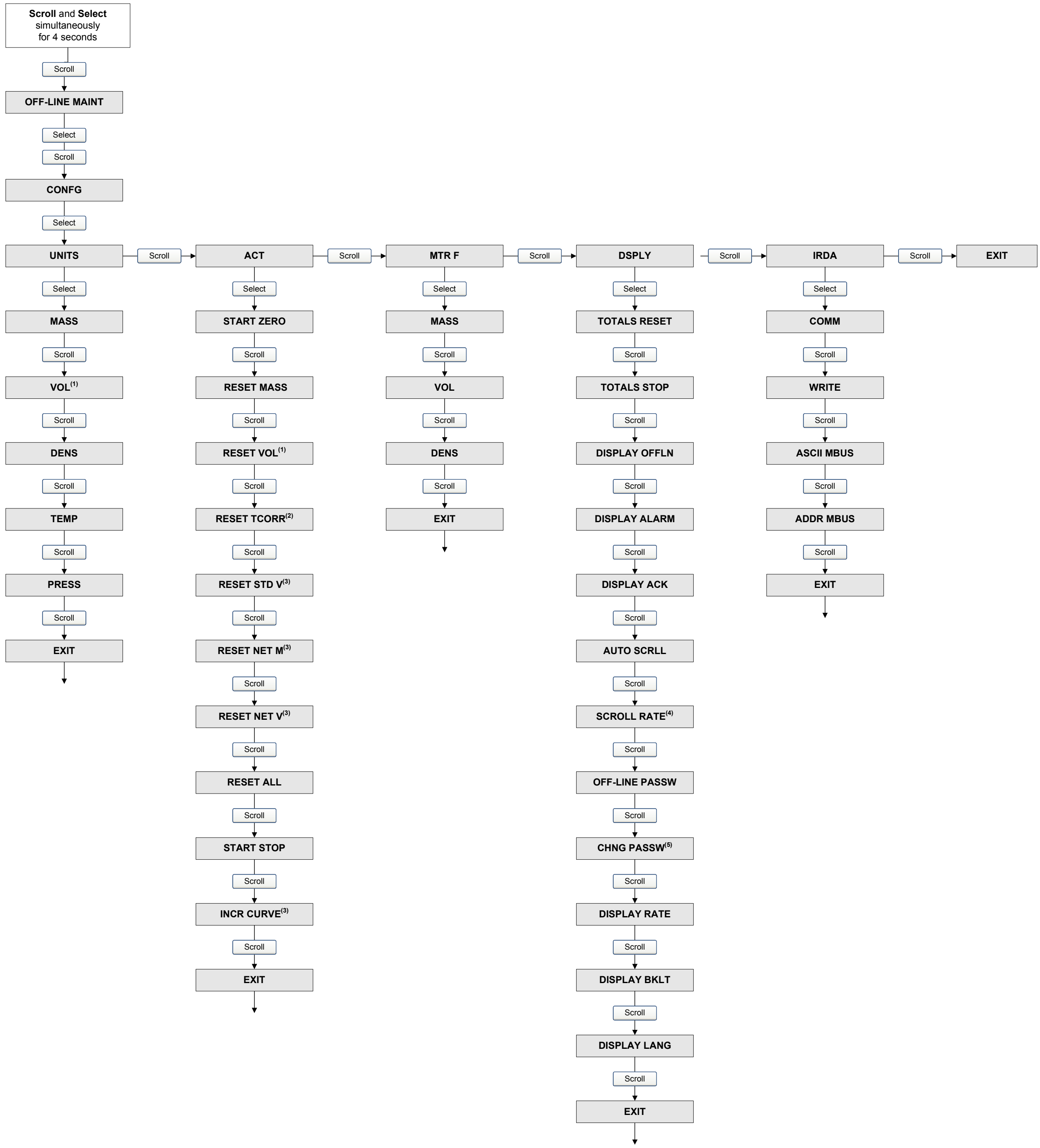
(1) This option is displayed only if the meter verification software is installed on the transmitter.

Figure C-14 Display menu – Off-line maintenance – Version information



(1) The option is displayed only if the corresponding Engineering To Order (ETO) or application is installed on the transmitter.

Figure C-15 Display menu – Off-line maintenance – Configuration



(1) Either Vol or GSV is displayed.
(2) Displayed only if the petroleum measurement application is installed.
(3) Displayed only if the enhanced density application is installed.
(4) Displayed only if Auto Scroll is enabled.
(5) Displayed only Off-Line Password is enabled.

Figure C-16 **Display menu – Off-line maintenance – Zero**

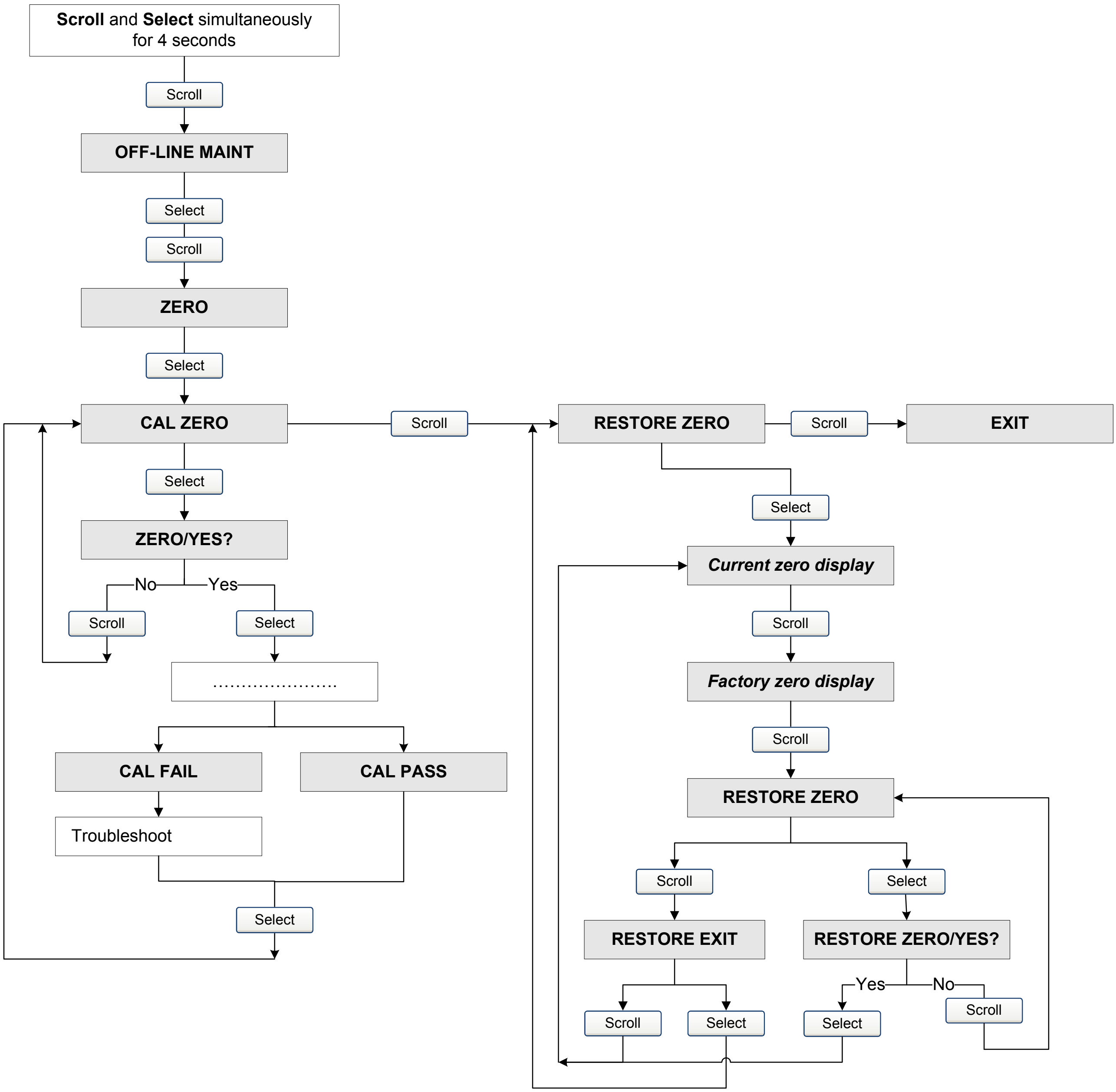
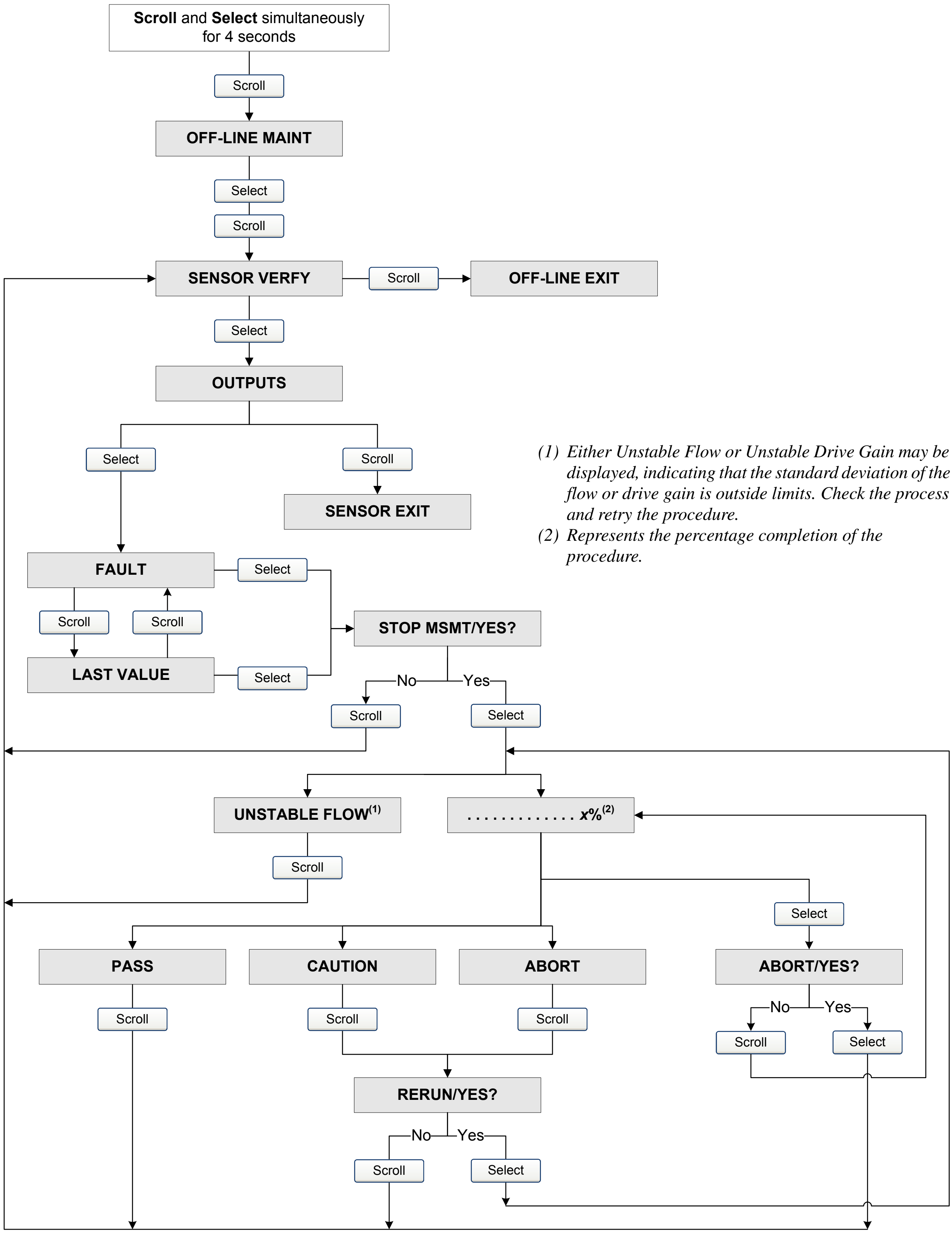


Figure C-17 Display menu – Off-line maintenance – Meter verification



(1) *Either Unstable Flow or Unstable Drive Gain may be displayed, indicating that the standard deviation of the flow or drive gain is outside limits. Check the process and retry the procedure.*
(2) *Represents the percentage completion of the procedure.*

Diagrams

Menus

Bus Parameters

Display Codes

Appendix D
PROFIBUS Bus Parameters

D.1 Overview

This appendix documents the bus parameters that are included in the PROFIBUS blocks. The following blocks are documented:

- Measurement block (Slot 1) – see Table D-2
- Calibration block (Slot 2) – see Table D-3
- Diagnostic block (Slot 3) – see Table D-4
- Device information block (Slot 4) – see Table D-5
- Local display block (Slot 5) – see Table D-6
- API block (Slot 6) – see Table D-7
- Enhanced density block (Slot 7) – see Table D-8
- I&M functions block (Slot 0) – see Table D-9

The following codes are documented:

- Totalizer and inventory measurement unit codes – see Tables D-10 through D-12
- Process variable codes – see Table D-13
- Alarm index codes – see Table D-14

Note: For measurement unit codes used for process variables, see Section 6.3.

For each block, all parameters contained in the block are listed. For each parameter, the following are documented:

- Index – the index of the parameter within the block
- Name – the name used for this parameter in the code
- Data type – the data type of the parameter (see Section D.2)
- Memory class – the class of memory required by the parameter, and the update rate (in Hz) if applicable:
  - D = dynamic store (cyclic data – parameter updated periodically)
  - S = static store (acyclic data – parameter changed on a deliberate write)
  - N = nonvolatile parameter (retained across power cycles)
- Access
  - R = Read-only
  - R/W = Read/write

D.2 PROFIBUS-DP data types and data type codes

Table D-1 documents the data types and data type codes used with the PROFIBUS bus parameters.

Table D-1 PROFIBUS-DP data types

Data type	Size (bytes)	Description	Range	Code
Boolean	1	True/false	• 0 = False • 1 = True	BOOL
Integer8	1	8-bit signed integer value	–128 to +127	INT8
Unsigned8	1	8-bit unsigned integer value	0 to 255	USINT8
Integer16	2	16-bit signed integer value	–32768 to +32767	INT16
Unsigned16	2	16-bit unsigned integer value	0 to 65535	USINT16
Integer32	4	32-bit signed integer value	–2147483648 to +2147483647	INT32
Unsigned32	4	32-bit unsigned integer	0 to 4294967296	USINT32
FLOAT	4	An IEEE single precision floating point number	–3.8E38 to +3.8E38	FLOAT
OCTET STRING	Up to 128 bytes	A character array of ASCII characters	N/A	STRING
BIT_ENUMERATED	Up to 128 bytes	An enumerated value where each bit represents a different enumeration	N/A	B_ENUM

D.3 Measurement block (Slot 1)

Table D-2 Measurement block (Slot 1)

Index	Name	Data type	Memory class	Access	Comments
4	SNS_MassFlow	FLOAT	D (20 Hz)	R	Current value of mass flow process variable
5	SNS_MassFlowUnits	USINT16	S	R/W	Mass flow measurement unit See Table 6-2 for codes
6	SNS_Temperature	FLOAT	D (20 Hz)	R	Current value of temperature process variable
7	SNS_TemperatureUnits	USINT16	S	R/W	Temperature measurement unit See Table 6-6 for codes
8	SNS_Density	FLOAT	D (20 Hz)	R	Current value of density process variable
9	SNS_DensityUnits	USINT16	S	R/W	Density measurement unit See Table 6-5 for codes
10	SNS_VolFlow	FLOAT	D (20 Hz)	R	Current value of liquid volume flow process variable
11	SNS_VolumeFlowUnits	USINT16	S	R/W	Liquid volume flow measurement unit See Table 6-3 for codes
12	SNS_DampingFlowRate	FLOAT	S	R/W	Flow damping value 0.0 to 60.0 sec
13	SNS_DampingTemp	FLOAT	S	R/W	Temperature damping value 0.0 to 80.0 sec
14	SNS_DampingDensity	FLOAT	S	R/W	Density damping value 0.0 to 60.0 sec
15	SNS_MassMeterFactor	FLOAT	S	R/W	Mass flow meter factor 0.8 to 1.2

Table D-2 Measurement block (Slot 1) *continued*

Index	Name	Data type	Memory class	Access	Comments
16	SNS_DensMeterFactor	FLOAT	S	R/W	Density meter factor 0.8 to 1.2
17	SNS_VolMeterFactor	FLOAT	S	R/W	Volume flow meter factor 0.8 to 1.2
18	SNS_MassFlowCutoff	FLOAT	S	R/W	Mass flow cutoff 0 to sensor limit
19	SNS_VolumeFlowCutoff	FLOAT	S	R/W	Volume flow cutoff 0 to sensor limit
20	SNS_LowDensityCutoff	FLOAT	S	R/W	Density cutoff 0.0 to 0.5
21	SNS_FlowDirection	USINT16	S	R/W	• 0 = Forward Only • 1 = Reverse Only • 2 = Bidirectional • 3 = Absolute Value • 4 = Negate/Forward Only • 5 = Negate/ Bidirectional
22	SNS_StartStopTotals	USINT16	---	R/W	• 0x0000 = Stop totalizers • 0x0001 = Start totalizers
23	SNS_ResetAllTotal	USINT16	---	R/W	• 0x0000 = No action • 0x0001 = Reset
24	SNS_ResetAll Inventories	USINT16	---	R/W	• 0x0000 = No action • 0x0001 = Reset
25	SNS_ResetMassTotal	USINT16	---	R/W	• 0x0000 = No action • 0x0001 = Reset
26	SNS_ResetLineVolTotal	USINT16	---	R/W	Liquid volume totalizer • 0x0000 = No action • 0x0001 = Reset
27	SNS_MassTotal	FLOAT	D (20 Hz)	R	Current value of mass total
28	SNS_VolTotal	FLOAT	D (20 Hz)	R	Current value of liquid volume total
29	SNS_MassInventory	FLOAT	D (20 Hz)	R	Current value of mass inventory
30	SNS_VolInventory	FLOAT	D (20 Hz)	R	Current value of liquid volume inventory
31	SNS_MassTotalUnits	USINT16	S	R	Mass total/inventory measurement unit See Table D-10 for codes
32	SNS_VolTotalUnits	USINT16	S	R	Liquid volume total/inventory measurement unit See Table D-11 for codes
33	SNS_EnableGSV[(1)]	USINT16	S	R/W	Enable gas standard volume flow measurement • 0x0000 = disabled • 0x0001 = enabled
34	SNS_GSV_GasDens	FLOAT	S	R/W	Standard density of the gas
35	SNS_GSV_VolFlow	FLOAT	D (20 Hz)	R	Current value of gas standard volume flow process variable
36	SNS_GSV_VolTot	FLOAT	D (20 Hz)	R	Current value of gas standard volume total
37	SNS_GSV_VolInv	FLOAT	D (20 Hz)	R	Current value of gas standard volume inventory
38	SNS_GSV_FlowUnits	USINT16	S	R/W	Gas standard volume flow measurement unit See Table 6-4 for codes

Table D-2 Measurement block (Slot 1) *continued*

Index	Name	Data type	Memory class	Access	Comments
39	SNS_GSV_TotalUnits	USINT16	S	R	Gas standard volume total/inventory measurement unit See Table D-12 for codes
40	SNS_GSV_FlowCutoff	FLOAT	S	R/W	Gas standard volume flow cutoff => 0.0
41	SNS_ResetGSVolTotal	USINT16	S	R/W	• 0x0000 = No action • 0x0001 = Reset
42	SNS_ResetAPIGSVInv	USINT16	S	R/W	• 0x0000 = No action • 0x0001 = Reset
43	SNS_ResetMassInv	USINT16	S	R/W	• 0x0000 = No action • 0x0001 = Reset
44	SNS_ResetVolInv	USINT16	S	R/W	• 0x0000 = No action • 0x0001 = Reset

(1) If gas standard volume flow is enabled, liquid volume flow is disabled, and vice versa.

D.4 Calibration block (Slot 2)

Table D-3 Calibration block (Slot 2)

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
4	SNS_FlowCalGain	FLOAT	S	R/W	Flow calibration factor (6-character string)
5	SNS_FlowCalTemp Coeff	FLOAT	S	R/W	Temperature coefficient for flow (4-character string)
6	SNS_FlowZeroCal	USINT16	---	R/W	• 0x0000 = Abort zero calibration • 0x0001 = Start zero calibration
7	SNS_MaxZeroingTime	USINT16	S	R/W	Zero time Range: 5–300 seconds
8	SNS_AutoZeroStdDev	FLOAT	S	R	Standard deviation of auto zero
9	SNS_AutoZeroValue	FLOAT	S	R/W	Present flow signal offset at zero flow, in µsec
10	SNS_FailedCal	FLOAT	S	R	Zero value if calibration fails
11	SNS_K1Cal	USINT16	---	R/W	• 0x0000 = None • 0x0001 = Start D1 Cal
12	SNS_K2Cal	USINT16	---	R/W	• 0x0000 = None • 0x0001 = Start D2 Cal
13	SNS_FdCal	USINT16	---	R/W	• 0x0000 = None • 0x0001 = Start FD Cal
14	SNS_TseriesD3Cal	USINT16	---	R/W	• 0x0000 = None • 0x0001 = Start D3 Cal
15	SNS_TseriesD4Cal	USINT16	---	R/W	• 0x0000 = None • 0x0001 = Start D4 Cal
16	SNS_K1	FLOAT	S	R/W	Density calibration constant 1 (µsec)
17	SNS_K2	FLOAT	S	R/W	Density calibration constant 2 (µsec)
18	SNS_FD	FLOAT	S	R/W	Flowing density calibration constant (µsec)
19	SNS_TseriesK3	FLOAT	S	R/W	Density calibration constant 3 (µsec)
20	SNS_TseriesK4	FLOAT	S	R/W	Density calibration constant 4 (µsec)

Table D-3 Calibration block (Slot 2) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
21	SNS_D1	FLOAT	S	R/W	Density of D1 calibration fluid
22	SNS_D2	FLOAT	S	R/W	Density of D2 calibration fluid
23	SNS_CalValForFD	FLOAT	S	R/W	Density of flowing density calibration fluid
24	SNS_TseriesD3	FLOAT	S	R/W	Density of D3 calibration fluid
25	SNS_TseriesD4	FLOAT	S	R/W	Density of D4 calibration fluid
26	SNS_DensityTempCoeff	FLOAT	S	R/W	Density temperature coefficient
27	SNS_TSeriesFlow TGCO	FLOAT	S	R/W	T-Series FTG value
28	SNS_TSeriesFlow FQCO	FLOAT	S	R/W	T-Series FFQ value
29	SNS_TSeriesDens TGCO	FLOAT	S	R/W	T-Series DTG value
30	SNS_TSeriesDens FQCO1	FLOAT	S	R/W	T-Series DFQ1 value
31	SNS_TSeriesDens FQCO2	FLOAT	S	R/W	T-Series DFQ2 value
32	SNS_TempCalOffset	FLOAT	S	R/W	Temperature calibration offset
33	SNS_TempCalSlope	FLOAT	S	R/W	Temperature calibration slope
34	SNS_EnableExtTemp	USINT16	S	R/W	Use external temperature for API and ED: • 0x0000 = Disabled • 0x0001 = Enabled
35	SNS_ExternalTempInput	FLOAT	S	R/W	External temperature value
36	SNS_EnablePresComp	Method	S	R/W	Pressure compensation: • 0x0000 = Disabled • 0x0001 = Enabled
37	SNS_ExternalPresInput	FLOAT	D (20)	R/W	Exernal pressure value
38	SNS_PressureUnits	USINT16	S	R/W	Pressure measurement unit See Table 6-7 for codes
39	SNS_FlowPresComp	FLOAT	S	R/W	Pressure correction factor for flow
40	SNS_DensPresComp	FLOAT	S	R/W	Pressure correction factor for density
41	SNS_FlowCalPres	FLOAT	S	R/W	Flow calibration pressure
42	SNS_FlowZeroRestore		S	R/W	Restore factory zero: • 0x0000 = No action • 0x0001 = Restore
43	DB_SNS_AutoZero Factory		S	R	Factory value for flow signal offset at zero flow, in µsec

D.5 Diagnostic block (Slot 3)

Table D-4 Diagnostic block (Slot 3)

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
1	SNS_SlugDuration	FLOAT	S	R/W	Slug duration Unit: seconds Range: 0 to 60 seconds
2	SNS_SlugLo	FLOAT	S	R/W	Slug low limit Unit: g/cm^3 Range: 0–10 g/cm^3
3	SNS_SlugHi	FLOAT	S	R/W	Slug high limit Unit: g/cm^3 Range: 0–10 g/cm^3
4	UNI_PCIndex	USINT16	S	R/W	Discrete event index 0, 1, 2, 3, 4
5	SNS_PC_Action	USINT16	S	R/W	Discrete event type • 0 = Greater than Setpoint A • 1 = Less than Setpoint A • 2 = In Range (A=<*x*<=B) • 3 = Out of Range (A>=*x* or B<=*x*)
6	SNS_PC_SetPointA	FLOAT	S	R/W	Value of Setpoint A
7	SNS_PC_SetPointB	FLOAT	S	R/W	Value of Setpoint B
8	SNS_PC_PVCode	USINT16	S	R/W	Discrete event process variable See Table D-13 for codes
9	SNS_PC_Status	B_ENUM	D (20 Hz)	R	Discrete event status • 0x0001 = DE_0 active • 0x0002 = DE_1 active • 0x0004 = DE_2 active • 0x0008 = DE_3 active • 0x0010 = DE_4 active • Bits 5 to 15 undefined
10	SNS_StatusWords1	B_ENUM	D (20 Hz)	R	• 0x0001 = Core EEPROM checksum error • 0x0002 = Core RAM test error • 0x0004 = Not Used • 0x0008 = Sensor failure • 0x0010 = Temperature out of range • 0x0020 = Calibration failed • 0x0040 = Other failure • 0x0080 = Transmitter initializing • 0x0100 = Not Used • 0x0200 = Not Used • 0x0400 = Simulation mode active (A132) • 0x0800 = Not Used • 0x1000 = Watchdog error • 0x2000 = Not Used • 0x4000 = Not Used • 0x8000 = Fault

Table D-4 Diagnostic block (Slot 3) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
11	SNS_StatusWords2	B_ENUM	D (20 Hz)	R	• 0x0001 = Not Used • 0x0002 = Not Used • 0x0004 = Not Used • 0x0008 = Not Used • 0x0010 = Density out of range • 0x0020 = Drive out of range • 0x0040 = PIC\Daughterboard communications failure • 0x0080 = Not Used • 0x0100 = Non-volatile memory error (CP) • 0x0200 = RAM error (CP) • 0x0400 = Sensor failure • 0x0800 = Temperature out of range • 0x1000 = Input out of range • 0x2000 = Not used • 0x4000 = Transmitter not characterized • 0x8000 = Not Used
12	SNS_StatusWords3	B_ENUM	D (20 Hz)	R	• 0x0001 = Not Used • 0x0002 = Power reset • 0x0004 = Transmitter initializing • 0x0008 = Not Used • 0x0010 = Not Used • 0x0020 = Not Used • 0x0040 = Not Used • 0x0080 = Not Used • 0x0100 = Calibration failed • 0x0200 = Calibration failed: Low • 0x0400 = Calibration failed: High • 0x0800 = Calibration failed: Noisy • 0x1000 = Transmitter failed • 0x2000 = Data loss • 0x4000 = Calibration in progress • 0x8000 = Slug flow
13	SNS_StatusWords4	B_ENUM	D (20 Hz)	R	• 0x0001 = API: Temperature out of range • 0x0002 = API: Density out of range • 0x0004 = Line RTD out of range • 0x0008 = Meter RTD out of range • 0x0010 = Reverse flow • 0x0020 = Factory data error • 0x0040 = ED: bad curve • 0x0080 = LMV override • 0x0100 = ED: Extrapolation error • 0x0200 = Need calibration factor • 0x0400 = Not Used • 0x0800 = Not Used • 0x1000= Transmitter not characterized • 0x2000 = Non-volatile memory error (CP) • 0x4000 = Non-volatile memory error (CP) • 0x8000 = Non-volatile memory error (CP)

Table D-4 Diagnostic block (Slot 3) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
14	SNS_StatusWords5	B_ENUM	D (20 Hz)	R	• 0x0001 = Boot sector (CP) • 0x0002 = Not Used • 0x0004 = Not Used • 0x0008 = Not Used • 0x0010 = Not Used • 0x0020 = Not Used • 0x0040 = D3 calibration in progress • 0x0080 = D4 calibration in progress • 0x0100 = Not used • 0x0200 = Not used • 0x0400 = Temperature slope calibration in progress • 0x0800 = Temperature offset calibration in progress • 0x1000 = FD calibration in progress • 0x2000 = D2 calibration in progress • 0x4000 = D1 calibration in progress • 0x8000 = Zero calibration in progress
15	SNS_StatusWords6	B_ENUM	D (20 Hz)	R	• 0x0001 = Not Used • 0x0002 = Not Used • 0x0004 = Not Used • 0x0008 = Not Used • 0x0010 = Not Used • 0x0020 = Not Used • 0x0040 = Not Used • 0x0080 = Not Used • 0x0100 = DE_0 active • 0x0200 = DE_1 active • 0x0400 = DE_2 active • 0x0800 = DE_3 active • 0x1000 = DE_4 active • 0x2000 = Not Used • 0x4000 = Not Used • 0x8000 = Incorrect board type (A030)
16	SNS_StatusWords7	B_ENUM	D (20 Hz)	R	• 0x0001 = K1/FCF combination unrecognized • 0x0002 = Warming up • 0x0004 = Low power (A031) • 0x0008 = Tube not full (A033) • 0x0010 = Meter verification / Outputs in fault (A032)(1) • 0x0020 = Meter verification / Outputs at last value (A131)(1) • 0x0040 = PIC UI EEPROM Error (A133) • 0x0080 = Not Used • 0x0100 = Not Used • 0x0200 = Not Used • 0x0400 = Not Used • 0x0800 = Not Used • 0x1000 = Not Used • 0x2000 = Not Used • 0x4000 = Meter verification failed (A034) • 0x8000 = Meter verification aborted (A035)

Table D-4 Diagnostic block (Slot 3) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
17	SNS_StatusWords8	B_ENUM	D (20 Hz)	R	• 0x0001 = Not Used • 0x0002 = Not Used • 0x0004 = Not Used • 0x0008 = Not Used • 0x0010 = Not Used • 0x0020 = Not Used • 0x0040 = Not Used • 0x0080 = Not Used • 0x0100 = Not Used • 0x0200 = Not Used • 0x0400 = Not Used • 0x0800 = Not Used • 0x1000 = Not Used • 0x2000 = Not Used • 0x4000 = Not Used • 0x8000 = Not Used
18	SYS_DigCommFault ActionCode	USINT16	S	R/W	• 0 = Upscale • 1 = Downscale • 2 = Zero • 3 = NAN • 4 = Flow goes to zero • 5 = None
19	DB_SYS_TimeoutValue LMV	USINT16	S	R/W	Fault timeout value Range: 0–60 seconds
20	UNI_Alarm_Index	USINT16	S	R/W	Alarm index used to configure or read alarm severity, or to acknowledge alarms See Table D-13 for alarm index codes
21	SYS_AlarmSeverity	USINT16	S	R/W	• 0 = Ignore • 1 = Info • 2 = Fault
22	SYS_AlarmStatus	B_ENUM	D (20 Hz)	R/W	The status of the alarm identified by the alarm index. • 0x00 = Acked /Cleared • 0x01 = Acked/Active • 0x10 = Not Acked/Cleared • 0x11 = Not Acked/Active Write 0 to acknowledge alarm
23	SYS_AlarmCount	USINT16	S	R	The number of inactive-to-active transitions of the alarm identified by the alarm index.
24	SYS_AlarmPosted	USINT32	S	R	The number of seconds since the last power-on time reset (Index 52) that the alarm identified by the alarm index was posted
25	SYS_AlarmCleared	USINT32	S	R	The number of seconds since the last power-on time reset (Index 52) that the alarm identified by the alarm index was cleared
26	UNI_AlarmHistoryIndex	USINT16	S	R/W	The entry in the alarm history log Range: 0–49
27	SYS_AlarmNumber	USINT16	S	R	The alarm number that corresponds to the alarm history entry identified by the alarm history index 1 = A001, 2 = A002, etc.
28	SYS_AlarmEvent	USINT16	S	R	The alarm status change that corresponds to the alarm history entry identified by the alarm history index • 1 = Posted • 2 = Cleared

Table D-4 Diagnostic block (Slot 3) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
29	SYS_AlarmTime	USINT32	S	R	The timestamp of the alarm status change that corresponds to the alarm history entry identified by the alarm history index Seconds since last power-on time reset (Index 52)
30	SYS_AckAllAlarms	USINT16	S	R/W	• 0x0000 = Not used • 0x0001 = Acknowledge
31	SYS_ClearAlarmHistory	USINT16	S	R/W	• 0x0000 = Not used • 0x0001 = Reset
32	SNS_DriveGain	FLOAT	D (20 Hz)	R	The drive gain %
33	SNS_RawTubeFreq	FLOAT	D (20 Hz)	R	The tube frequency Unit: Hz
34	SNS_LiveZeroFlow	FLOAT	D (20 Hz)	R	The unfiltered value of mass flow Unit: unit configured for mass flow
35	SNS_LPOamplitude	FLOAT	D (20 Hz)	R	The left pickoff voltage Unit: volts
36	SNS_RPOamplitude	FLOAT	D (20 Hz)	R	The right pickoff voltage Unit: volts
37	SNS_BoardTemp	FLOAT	D (20 Hz)	R	The temperature on the board Unit: °C
38	SNS_MaxBoardTemp	FLOAT	D (20 Hz)	R	The maximum temperature of the electronics Unit: °C
39	SNS_MinBoardTemp	FLOAT	D (20 Hz)	R	The minimum temperature of the electronics Unit: °C
40	SNS_AveBoardTemp	FLOAT	D (20 Hz)	R	The average temperature of the electronics Unit: °C
41	SNS_MaxSensorTemp	FLOAT	D (20 Hz)	R	The maximum temperature of the sensor Unit: °C
42	SNS_MinSensorTemp	FLOAT	D (20 Hz)	R	The minimum temperature of the sensor Unit: °C
43	SNS_AveSensorTemp	FLOAT	D (20 Hz)	R	The average temperature of the sensor Unit: °C
44	SNS_WireRTDRes	FLOAT	D (20 Hz)	R	The resistance of the 9-wire cable Unit: ohms
45	SNS_LineRTDRes	FLOAT	D (20 Hz)	R	The resistance of the process line RTD Unit: ohms
46	SYS_PowerCycleCount	USINT16	D	R	The number of transmitter power cycles
47	SYS_PowerOnTimeSec	USINT32	S	R	The cumulative amount of time the transmitter has been on since the last reset Unit: seconds since last reset
48	SNS_InputVoltage	FLOAT	S	R	Coriolis supply voltage (internal measurement), ~12 VDC Unit: volts
49	SNS_TargetAmplitude	FLOAT	S	R	The amplitude the transmitter is attempting to drive the sensor Unit: mV/HZ
50	SNS_CaseRTDRes	FLOAT	S	R	The resistance of the case (meter) RTD Unit: ohms

Table D-4 Diagnostic block (Slot 3) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
51	SYS_RestoreFactory Config	USINT16	S	R/W	• 0x0000 = No action • 0x0001 = Restore
52	SYS_ResetPowerOn Time	USINT16	S	R/W	• 0x0000 = No action • 0x0001 = Reset
53	FRF_EnableFCF Validation	USINT16	S	R/W	Type of meter verification to perform • 0x0000 = Disable • 0x0001 = Normal • 0x0002 = Factory verification of air • 0x0003 = Factory verification of water • 0x0004 = Debug • 0x0006 = Continue measurement(2)
54	FRF_FaultAlarm	USINT16	D	R/W	The state of the outputs when the meter verification routine is running • 0 = Last value • 1 = Fault
55	DB_FRF_StiffnessLimit	FLOAT	S	R/W	The setpoint of the stiffness limit. Represents percentage Unitless
56	FRF_AlgoState	USINT16	S	R	The current state of the meter verification routine 1–18
57	FRF_AbortCode	USINT16	S	R	The reason the meter verification routine aborted: • 0 = No error • 1 = Manual abort • 2 = Watchdog timeout • 3 = Frequency drift • 4 = High peak drive voltage • 5 = High drive current standard deviation • 6 = High drive current mean value • 7 = Drive loop reported error • 8 = High delta T standard deviation • 9 = High delta T value • 10 = State running
58	FRF_StateAtAbort	USINT16	S	R	The state of the meter verification routine when it aborted 1–18
59	DB_FRF_ StiffOutLimLpo	USINT16	D	R	Is the inlet stiffness out of limits? • 0 = No • 1 = Yes
60	DB_FRF_ StiffOutLimRpo	USINT16	D	R	Is the outlet stiffness out of limits? • 0 = No • 1 = Yes
61	FRF_Progress	USINT16	S	R	The progress of the meter verification routine %
62	DB_FRF_StiffnessLpo_ Mean	FLOAT	S	R	The current inlet stiffness calculated as a mean
63	DB_FRF_StiffnessRpo_ Mean	FLOAT	S	R	The current outlet stiffness calculated as a mean
64	DB_FRF_Damping_ Mean	FLOAT	S	R	The current damping calculated as a mean
65	DB_FRF_MassLpo_ Mean	FLOAT	S	R	The current inlet mass calculated as a mean

Table D-4 Diagnostic block (Slot 3) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
66	DB_FRF_MassRpo_ Mean	FLOAT	S	R	The current outlet mass calculated as a mean
67	DB_FRF_StiffnessLpo StdDev	FLOAT	S	R	The current inlet stiffness calculated as a standard deviation
68	DB_FRF_StiffnessRpo_ StdDev	FLOAT	S	R	The current outlet stiffness calculated as a standard deviation
69	DB_FRF_Damping_ StdDev	FLOAT	S	R	The current damping calculated as a standard deviation
70	DB_FRF_MassLpo_ StdDev	FLOAT	S	R	The current inlet mass calculated as a standard deviation
71	DB_FRF_MassRpo_ StdDev	FLOAT	S	R	The current outlet mass calculated as a standard deviation
72	DB_FRF_StiffnessLpo_ AirCal	FLOAT	S	R	The inlet stiffness calculated as a mean during factory calibration of air
73	DB_FRF_StiffnessRpo_ AirCal	FLOAT	S	R	The outlet stiffness calculated as a mean during factory calibration of air
74	DB_FRF_Damping_ AirCal	FLOAT	S	R	The damping calculated as a mean during factory calibration of air
75	DB_FRF_MassLpo_ AirCal	FLOAT	S	R	The inlet mass calculated as a mean during factory calibration of air
76	DB_FRF_MassRpo_ AirCal	FLOAT	S	R	The outlet mass calculated as a mean during factory calibration of air
77	DB_FRF_StiffnessLpo_ WaterCal	FLOAT	S	R	The inlet stiffness calculated as a mean during factory calibration of water
78	DB_FRF_StiffnessRpo_ WaterCal	FLOAT	S	R	The outlet stiffness calculated as a mean during factory calibration of water
79	DB_FRF_Damping_ WaterCal	FLOAT	S	R	The damping calculated as a mean during factory calibration of water
80	DB_FRF_MassLpo_ WaterCal	FLOAT	S	R	The inlet mass calculated as a mean during factory calibration of water
81	DB_FRF_MassRpo_ WaterCal	FLOAT	S	R	The outlet mass calculated as a mean during factory calibration of water
82	DB_UNI_DE_ ActionCode	USINT16	S	R /W	The action that will be performed by the event identified by the discrete event assignment index • 1 = Start Sensor Zero • 2 = Reset Mass Total • 3 = Reset Volume Total • 4 = Reset API Volume Total • 5 = Reset ED Volume Total • 6 = Reset ED Net Mass Tot • 7 = Reset ED Net Vol Tot • 8 = Reset All Totals • 9 = Start/Stop All Totals • 18 = Increment ED Curve • 21 = Reset GSV Total

Table D-4 Diagnostic block (Slot 3) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
83	DB_UNI_DE_ Assignment	USINT16	S	R /W	Discrete event assignment index • 57 = Discrete Event 1 • 58 = Discrete Event 2 • 59 = Discrete Event 3 • 60 = Discrete Event 4 • 61 = Discrete Event 5 • 251 = None
84	DB_SYS_MasterReset	USINT16	S	R/W	• 0x0000 = No action • 0x0001 = Perform master reset
85	SYS_AckAlarm	USINT16	S	R/W	Write alarm index to acknowledge alarm. See Table D-13 for alarm index codes
86	SYS_DriveCurrent	FLOAT	D (20 Hz)	R	Sensor drive current Units: mA
87(2)	DB_FRF_MV_Index	USINT16	D (20 Hz)	R/W	Index of meter verification test record on transmitter (0–19) • 0 = Newest • 19 = Oldest
88(2)	DB_FRF_MV_Counter	USINT16	D (20 Hz)	R	Counter assigned to meter verification test record
89(2)	DB_FRF_MV_Status	USINT16	D (20 Hz)	R	Meter verification test record: Test status • Bit 7 = Pass/Fail • Bits 6–4 = State • Bits 3–0 = Abort code
90(2)	DB_FRF_MV_Time	USINT32	D (20 Hz)	R	Meter verification test record: Test start time
91(2)	DB_FRF_MV_LPO_Nor m	FLOAT	D (20 Hz)	R	Meter verification test record: LPO stiffness
92(2)	DB_FRF_MV_RPO_Nor m	FLOAT	D (20 Hz)	R	Meter verification test record: RPO stiffness
93(2)	DB_FRF_MV_FirstRun_ Time	FLOAT	D (20 Hz)	R/W	Meter verification scheduler: Hours until first test • Range: 1–1000 • 0 = No test scheduled
94(2)	DB_FRF_MV_Elapse_Ti me	FLOAT	D (20 Hz)	R/W	Meter verification scheduler: Hours between tests • Range: 1–1000 • 0 = No recurring execution
95(2)	DB_FRF_MV_Time_Left	FLOAT	D (20 Hz)	R	Meter verification scheduler: Hours until next test

(1) Applies only to systems with the original version of the meter verification application.
(2) Applies only to systems with Smart Meter Verification.

D.6 Device Information block (Slot 4)

Table D-5 Device Information block (Slot 4)

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
4	SYS_FeatureKey	B_ENUM	S	R	Transmitter options enabled • 0x0000 = Standard • 0x0800 = Meter verification • 0x0008 = Enhanced density • 0x0010 = Petroleum measurement
5	SYS_CEQ_Number	USINT16	S	R	ETO (Engineering To Order) on transmitter
6	SNS_SensorSerialNum	USINT32	S	R/W	
7	SNS_SensorType	STRING	S	R/W	
8	SNS_SensorTypeCode	USINT16	S	R/W	• 0 = Curved tube • 1 = Straight tube
9	SNS_SensorMaterial	USINT16	S	R/W	• 0 = None • 3 = Hastelloy C-22 • 4 = Monel • 5 = Tantalum • 6 = Titanium • 19 = 316L stainless steel • 23 = Inconel • 252 = Unknown • 253 = Special
10	SNS_LinerMaterial	USINT16	S	R/W	• 0 = None • 10 = PTFE (Teflon) • 11 = Halar • 16 = Tefzel • 251 = None • 252 = Unknown • 253 = Special
11	SNS_FlangeType	USINT16	S	R/W	• 0 = ANSI 150 • 1 = ANSI 300 • 2 = ANSI 600 • 5 = PN 40 • 7 = JIS 10K • 8 = JIS 20K • 9 = ANSI 900 • 10 = Sanitary clamp fitting • 11 = Union • 12 = PN 100 • 252 = Unknown • 253 = Special
12	SNS_MassFlowHiLim	FLOAT	S	R	High mass flow limit of sensor
13	SNS_TempFlowHiLim	FLOAT	S	R	High temperature limit of sensor
14	SNS_DensityHiLim	FLOAT	S	R	High density limit of sensor
15	SNS_VolumeFlowHiLim	FLOAT	S	R	High volume flow limit of sensor
16	SNS_MassFlowLoLim	FLOAT	S	R	Low mass flow limit of sensor
17	SNS_TempFlowLoLim	FLOAT	S	R	Low temperature limit of sensor
18	SNS_DensityLoLim	FLOAT	S	R	Low density limit of sensor
19	SNS_VolumeFlowLoLim	FLOAT	S	R	Low volume flow limit of sensor
20	SNS_MassFlowLoSpan	FLOAT	S	R	Mass flow minimum range of sensor
21	SNS_TempFlowLoSpan	FLOAT	S	R	Temperature minimum range of sensor
22	SNS_DensityLoSpan	FLOAT	S	R	Density minimum range of sensor

Table D-5 **Device Information block (Slot 4)** *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
23	SNS_VolumeFlow LoSpan	FLOAT	S	R	Volume flow minimum range of sensor
24	HART_HartDeviceID	USINT32	S	R/W	Transmitter serial number
25	SYS_SoftwareRev	USINT16	S	R	Transmitter software revision (xxx.xx format, e.g., 141 = rev1.41)
26	SYS_BoardRevision	USINT16	S	R	Board revision

D.7 Local Display block (Slot 5)

Table D-6 **Local Display block (Slot 5)**

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
4	UI_EnableLdoTotalizer Reset	USINT16	S	R/W	Reset totalizers from display • 0x0000 = Disabled • 0x0001 = Enabled
5	UI_EnableLdoTotalizer StartStop	USINT16	S	R/W	Start/stop totalizers from display • 0x0000 = Disabled • 0x0001 = Enabled
6	UI_EnableLdoAutoScroll	USINT16	S	R/W	Display auto scroll • 0x0000 = Disabled • 0x0001 = Enabled
7	UI_EnableLdoOffline Menu	USINT16	S	R/W	Enable/disable access to display offline menu • 0x0000 = Disabled • 0x0001 = Enabled
8	UI_EnableSecurity	USINT16	S	R/W	Password required to access display offline menu • 0x0000 = Password not required • 0x0001 = Password required
9	UI_EnableLdoAlarm Menu	USINT16	S	R/W	Enable/disable access to display alarm menu • 0x0000 = Disabled • 0x0001 = Enabled
10	UI_EnableLdoAckAll Alarms	USINT16	S	R/W	Ack All function from display • 0x0000 = Disabled • 0x0001 = Enabled
11	UI_OfflinePassword	USINT16	S	R/W	Display password 0 to 9999
12	UI_AutoScrollRate	USINT16	S	R/W	The number of seconds for which each display variable will be displayed 1 to 30
13	UI_BacklightOn	USINT16	S	R/W	• 0x0000 = Off • 0x0001 = On
14	UNI_UI_ProcVarIndex	USINT16	S	R/W	Process variable index See Table D-13 for codes
15	UI_NumDecimals	USINT16	S	R/W	The number of digits displayed to the right of the decimal point for the process variable identified by the process variable index Range: 0–5
16	UI_ProcessVariables (LDO_VAR_1_CODE)	USINT16	S	R/W	See Table D-13 for codes. All codes are valid except for 251 (None).

Table D-6 Local Display block (Slot 5) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
17	UI_ProcessVariables (LDO_VAR_2_CODE)	USINT16	S	R/W	See Table D-13 for codes. All codes are valid.
18	UI_ProcessVariables (LDO_VAR_3_CODE)	USINT16	S	R/W	
19	UI_ProcessVariables (LDO_VAR_4_CODE)	USINT16	S	R/W	
20	UI_ProcessVariables (LDO_VAR_5_CODE)	USINT16	S	R/W	
21	UI_ProcessVariables (LDO_VAR_6_CODE)	USINT16	S	R/W	
22	UI_ProcessVariables (LDO_VAR_7_CODE)	USINT16	S	R/W	
23	UI_ProcessVariables (LDO_VAR_8_CODE)	USINT16	S	R/W	
24	UI_ProcessVariables (LDO_VAR_9_CODE)	USINT16	S	R/W	
25	UI_ProcessVariables (LDO_VAR_10_CODE)	USINT16	S	R/W	
26	UI_ProcessVariables (LDO_VAR_11_CODE)	USINT16	S	R/W	
27	UI_ProcessVariables (LDO_VAR_12_CODE)	USINT16	S	R/W	
28	UI_ProcessVariables (LDO_VAR_13_CODE)	USINT16	S	R/W	
29	UI_ProcessVariables (LDO_VAR_14_CODE)	USINT16	S	R/W	
30	UI_ProcessVariables (LDO_VAR_15_CODE)	USINT16	S	R/W	
31	UI_UpdatePeriodmsec	USINT16	S	R/W	Refresh rate of the display Range: 100–10,000 milliseconds
32	UI_BacklightOnIntensity	USINT16	S	R/W	The brightness of the backlight Range: 0 (off) to 63 (full on)
33	UI_Language	USINT16	S	R/W	• 0 = English • 1 = German • 2 = French • 3 = Not used • 4 = Spanish
34	SYS_Enable_IRDA_ Comm	USINT16	S	R/W	IrDA port availability: • 0x0000 = Disabled • 0x0001 = Enabled
35	SYS_Enable_IRDA_ WriteProtect	USINT16	S	R/W	IrDA port usage: • 0x0000 = Read/write • 0x0001 = Read-only

D.8 API block (Slot 6)

Table D-7 API block (Slot 6)

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
4	SNS_API_CorrDensity	FLOAT	D (20 Hz)	R	Current value of API Temperature Corrected Density process variable
5	SNS_API_CorrVolFlow	FLOAT	D (20 Hz)	R	Current value of API Temperature Corrected Volume Flow process variable
6	SNS_API_AveCorr Density	FLOAT	D (20 Hz)	R	Batch weighted average density
7	SNS_API_AveCorrTemp	FLOAT	D (20 Hz)	R	Batch weighted average temperature
8	SNS_API_CTL	FLOAT	D (20 Hz)	R	Current CTL value
9	SNS_API_CorrVolTotal	FLOAT	D (20 Hz)	R	Current value of API Temperature Corrected Volume Total
10	SNS_API_CorrVolInv	FLOAT	D (20 Hz)	R	Current value of API Temperature Corrected Volume Inventory
11	SNS_ResetApiRefVol Total	USINT16	---	R/W	Reset API Temperature Corrected Volume Total • 0x0000 = No action • 0x0001 = Reset
12	SNS_ResetAPIGSVInv	USINT16	S	R/W	Reset API Temperature Corrected Volume Inventory • 0x0000 = No action • 0x0001 = Reset
13	SNS_APIRefTemp	FLOAT	S	R/W	The reference temperature to use in the API calculations
14	SNS_APITEC	FLOAT	S	R/W	The thermal expansion coefficient to use in the API calculations
15	SNS_API2540TableType	USINT16	S	R/W	The table type to use in the API calculations • 17 = Table 5A • 18 = Table 5B • 19 = Table 5D • 36 = Table 6C • 49 = Table 23A • 50 = Table 23B • 51 = Table 23D • 68 = Table 24C • 81 = Table 53A • 82 = Table 53B • 83 = Table 53D • 100 = Table 54C

D.9 Enhanced Density block (Slot 7)

Table D-8 Enhanced Density block (Slot 7)

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
4	SNS_ED_RefDens	FLOAT	D (20 Hz)	R	Current value of ED density at reference
5	SNS_ED_SpecGrav	FLOAT	D (20 Hz)	R	Current value of ED density (fixed SG units)
6	SNS_ED_StdVolFlow	FLOAT	D (20 Hz)	R	Current value of ED standard volume flow rate
7	SNS_ED_NetMassFlow	FLOAT	D (20 Hz)	R	Current value of ED net mass flow rate

Table D-8 Enhanced Density block (Slot 7) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
8	SNS_ED_NetVolFlow	FLOAT	D (20 Hz)	R	Current value of ED net volume flow rate
9	SNS_ED_Conc	FLOAT	D (20 Hz)	R	Current value of ED concentration
11	SNS_ED_StdVolTotal	FLOAT	D (20 Hz)	R	Current value of ED standard volume total
12	SNS_ED_StdVolInv	FLOAT	D (20 Hz)	R	Current value of ED standard volume inventory
13	SNS_ED_NetMassTotal	FLOAT	D (20 Hz)	R	Current value of ED net mass total
14	SNS_ED_NetMassInv	FLOAT	D (20 Hz)	R	Current value of ED net mass inventory
15	SNS_ED_NetVolTotal	FLOAT	D (20 Hz)	R	Current value of ED net volume total
16	SNS_ED_NetVolInv	FLOAT	D (20 Hz)	R	Current value of ED net volume inventory
17	SNS_ResetEDRefVol Total	USINT16	---	R/W	Reset ED standard volume total: • 0x0000 = No action • 0x0001 = Reset
18	SNS_ResetEDNetMass Total	USINT16	---	R/W	Reset ED net mass total: • 0x0000 = No action • 0x0001 = Reset
19	SNS_ResetEDNetVol Total	USINT16	---	R/W	Reset ED net volume total: • 0x0000 = No action • 0x0001 = Reset
20	SNS_ResetEDVolInv	USINT16	S	R/W	Reset ED standard volume inventory: • 0x0000 = No action • 0x0001 = Reset
21	SNS_ResetEDNetMass Inv	USINT16	S	R/W	Reset ED net mass inventory: • 0x0000 = No action • 0x0001 = Reset
22	SNS_ResetEDNetVolInv	USINT16	S	R/W	Reset ED net volume inventory: • 0x0000 = No action • 0x0001 = Reset
23	SNS_ED_CurveLock	USINT16	S	R/W	Write-protect (lock) all ED curves: • 0x0000 = Not locked • 0x0001 = Locked
24	SNS_ED_Mode	USINT16	S	R/W	Derived variable: • 0 = None • 1 = Density at reference temperature • 2 = Specific gravity • 3 = Mass concentration (density) • 4 = Mass concentration (specific gravity) • 5 = Volume concentration (density) • 6 = Volume concentration (specific gravity) • 7 = Concentration (density) • 8 = Concentration (specific gravity)
25	SNS_ED_ActiveCurve	USINT16	S	R/W	Active curve index (a) Range: 0–5
26	UNI_ED_CurveIndex	USINT16	S	R/W	Curve configuration index (n) Range: 0–5
27	UNI_ED_TempIndex	USINT16	S	R/W	Curve_n temperature isotherm index (x) Range: 0–5
28	UNI_ED_ConcIndex	USINT16	S	R/W	Curve_n concentration index (y) Range: 0–5
29	SNS_ED_TempISO	FLOAT	S	R/W	Temperature value: Curve_n Isotherm_x

Table D-8 Enhanced Density block (Slot 7) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
30	SNS_ED_DensAtTemp ISO	FLOAT	S	R/W	Density value: $Curve_n$ $Isotherm_x$ $Concentration_y$
31	SNS_ED_DensAtTemp Coeff	FLOAT	S	R/W	Coefficient: $Curve_n$ $Isotherm_x$ $Concentration_y$
32	SNS_ED_ConcLabel55	FLOAT	S	R/W	$Curve_n$ concentration units label code: • 100 = Degrees Twaddell • 101 = Degrees Brix • 102 = Degrees Baume (heavy) • 103 = Degrees Baume (light) • 105 Percent solids per weight • 106 = Percent solids per volume • 107 = Degrees Balling • 108 = Proof per volume • 109 = Proof per mass • 160 = Degrees Plato • 253 = Special
33	SNS_ED_DensAtConc	FLOAT	S	R/W	$Curve_n$ (1x6) density at $Concentration_y$ at reference temperature
34	SNS_ED_DensAtConc Coeff	FLOAT	S	R/W	$Curve_n$ (1x6) coefficient at $Concentration_y$ at reference temperature
35	SNS_ED_ConcLabel51	FLOAT	S	R/W	$Curve_n$ (1x6) $Concentration_y$ value (y-axis)
36	SNS_ED_RefTemp	FLOAT	S	R/W	$Curve_n$ reference temperature
37	SNS_ED_SGWaterRef Temp	FLOAT	S	R/W	$Curve_n$ specific gravity water reference temperature
38	SNS_ED_SGWaterRef Dens	FLOAT	S	R/W	$Curve_n$ specific gravity water reference density
39	SNS_ED_SlopeTrim	FLOAT	S	R/W	$Curve_n$ trim: slope
40	SNS_ED_OffsetTrim	FLOAT	S	R/W	$Curve_n$ trim: offset
41	SNS_ED_ExtrapAlarm Limit	FLOAT	S	R/W	$Curve_n$ extrapolation alarm limit (%)
42	SNS_ED_CurveName	STRING	S	R/W	$Curve_n$ name
43	SNS_ED_MaxFitOrder	USINT16	S	R/W	$Curve_n$ maximum fit order Range: 2–5
44	SNS_ED_FitResults	USINT16	S	R	$Curve_n$ curve fit results: • 0 = Good • 1 = Poor • 2 = Failed • 3 = Empty
45	SNS_ED_ConcUnit Code	USINT16	S	R/W	$Curve_n$ concentration units code: • 1110 = Degrees Twaddell • 1426 = Degrees Brix • 1111 = Deg Baume (heavy) • 1112 = Deg Baume (light) • 1343 = % sol/wt • 1344 = % sol/vol • 1427 = Degrees Balling • 1428 = Proof (volume) • 1429 = Proof (mass) • 1346 = Percent Plato • 1342 = Percent (Special Units)
46	SNS_ED_ExpectedAcc	FLOAT	S	R	$Curve_n$ expected accuracy of curve fit

Table D-8 Enhanced Density block (Slot 7) *continued*

Index	Name	Data type	Memory class	Access	Definition/Code/Comments
47	SNS_ED_ResetFlag	USINT16	S	W	Reset all density curve data: • 0x0000 = No action • 0x0001 = Reset
48	SNS_ED_EnableDens LowExtrap	USINT16	S	R/W	Low-density extrapolation alarm: • 0x0000 = Disable • 0x0001 = Enable
49	SNS_ED_EnableDens HighExtrap	USINT16	S	R/W	High-density extrapolation alarm: • 0x0000 = Disable • 0x0001 = Enable
50	SNS_ED_EnableTemp LowExtrap	USINT16	S	R/W	Low-temperature extrapolation alarm: • 0x0000 = Disable • 0x0001 = Enable
51	SNS_ED_EnableTemp HighExtrap	USINT16	S	R/W	High-temperature extrapolation alarm: • 0x0000 = Disable • 0x0001 = Enable
52	SNS_ED_LongCurve Name	OCTET STRING	S	R/W	Extended name of curve

D.10 I&M functions (Slot 0)

Table D-9 I&M functions

Index	Sub-index	Name	Description	Data type	Size	Memory class	Access
255	65000	HEADER	Manufacturer- specific	STRING	10	S	R
		MANUFACTURER_ID	ID for manufacturer that is assigned by PTO	USINT16	2	S	R
		ORDER_ID	Order number of device	STRING	20	S	R
		SERIAL_NO	Production serial number of device	STRING	16	S	R
		HARDWARE_REVISION	Revision number of the hardware	USINT16	2	S	R
		SOFTWARE_REVISION	Software or firmware revision of device or module	1×CHAR 3×USINT8	4	S	R
		REV_COUNTER	Marks the change of hardware revision or any of its parameters	USINT16	2	S	R
		PROFILE_ID	Profile type of supporting profile	USINT16	2	S	R
		PROFILE_SPECIFIC_TYPE	Specific profile type	USINT16	2	S	R
		IM_VERSION	Implemented version of I&M functions	2×USINT8	2	S	R
		IM_SUPPORTED	Indicated availability of I&M functions	USINT16(1)	2	S	R
	65001	HEADER	Manufacturer-specific	STRING	10	S	R
		TAG_FUNCTION	Device identification tag	STRING	32	S	R/W
		TAG_LOCATION	Device location identification tag	STRING	22	S	R/W

(1) Implemented as bit array.

D.11 Totalizer and inventory measurement unit codes

Table D-10 Mass totalizer and mass inventory measurement unit codes

Code	Label	Description
1089	g	Gram
1088	Kg	Kilogram
1092	metric tons	Metric ton
1094	lbs	Pound
1095	short tons	Short ton (2000 pounds)
1096	long tons	Long ton (2240 pounds)

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Table D-11 Liquid volume totalizer and liquid volume inventory measurement unit codes

Code	Label	Description
1048	gal	Gallon
1038	l	Liter
1049	ImpGal	Imperial gallon
1034	m3	Cubic meter
1036	cm3	Cubic centimeter
1051	bbl	Barrel(1)
1641	Beer bbl	Beer barrel(2)
1043	ft3	Cubic foot

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

Table D-12 Gas standard volume totalizer and gas standard volume inventory measurement unit codes

Code	Label	Description
1053	SCF	Standard cubic feet
1521	Nm3	Normal cubic meters
1526	Sm3	Standard cubic meters
1531	NL	Normal liter
1536	SL	Standard liter

D.12 Process variable codes

Table D-13 Process variable codes

Code	Description
0	Mass flow rate
1	Temperature
2	Mass total
3	Density
4	Mass inventory
5	Volume flow rate
6	Volume total
7	Volume inventory
15	API: Temperature-corrected density
16	API: Temperature-corrected (standard) volume flow
17	API: Temperature-corrected (standard) volume total
18	API: Temperature-corrected (standard) volume inventory
19	API: Batch weighted average density
20	API: Batch weighted average temperature
21	Enhanced density: Density at reference temperature
22	Enhanced density: Density (fixed SG units)

Table D-13 Process variable codes *continued*

Code	Description
23	Enhanced density: Standard volume flow rate
24	Enhanced density: Standard volume total
25	Enhanced density: Standard volume inventory
26	Enhanced density: Net mass flow rate
27	Enhanced density: Net mass total
28	Enhanced density: Net mass inventory
29	Enhanced density: Net volume flow rate
30	Enhanced density: Net volume total
31	Enhanced density: Net volume inventory
32	Enhanced density: Concentration
33	API: CTL
46	Tube frequency
47	Drive gain
48	Case temperature
49	Left pickoff amplitude
50	Right pickoff amplitude
51	Board temperature
53	External pressure
55	External temperature
63	Gas standard volume flow rate
64	Gas standard volume total
65	Gas standard volume inventory
69	Live zero
251	None

D.13 Alarm index codes

Table D-14 Alarm index codes

Code	Description
1	Nonvolatile memory failure
2	RAM/ROM error
3	Sensor failure
4	Temperature overrange
5	Input overrange
6	Transmitter not characterized
7	Reserved
8	Density overrange
9	Transmitter initializing/warming up
10	Calibration failure
11	Zero too low

Table D-14 **Alarm index codes** *continued*

Code	Description
12	Zero too high
13	Zero too noisy
14	Transmitter failed
16	Line RTD Temperature out-of-range
17	Meter RTD temperature out-of-range
18	Reserved
19	Reserved
20	Incorrect sensor type (K1)
21	Invalid sensor type
22	NV error (core processor)
23	NV error (core processor)
24	NV error (core processor)
25	Boot fail (core processor)
26	Reserved
27	Security breach
28	Reserved
29	Internal communication failure
30	Hardware/software incompatible
31	Low power
32	Meter verification fault alarm
33	Tubes not full
42	Drive overrange
43	Data loss possible
44	Calibration in progress
45	Slug flow
47	Power reset
56	API: Temperature out of limits
57	API: Density out of limits
60	Enhanced density: unable to fit curve data
61	Enhanced density: extrapolation alarm
71	Meter verification info alarm
72	Simulation mode active
73–139	Undefined

Appendix E
Display Codes and Abbreviations

E.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.

E.2 Codes and abbreviations

Table E-1 lists and defines the codes and abbreviations that are used for display variables (see Section 8.9.3 for information on configuring display variables).

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

Note: These tables do not list terms that are spelled out completely, or codes that are used to identify measurement units. For the codes that are used to identify measurement units, see Section 6.3.

Table E-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	
DGAIN	Drive gain	
EXT P	External pressure	
EXT T	External temperature	
GSV F	Gas standard volume flow	
GSV I	Gas standard volume flow inventory	
LPO_A	Left pickoff amplitude	
LVOLI	Volume inventory	
LZERO	Live zero flow	
MASSI	Mass inventory	
MTR T	Case temperature	
NET M	Net mass flow rate	Enhanced density application only
NET V	Net volume flow rate	Enhanced density application only
NETMI	Net mass inventory	Enhanced density application only
NETVI	Net volume inventory	Enhanced density application only
PWRIN	Input voltage	Refers to power input to the core processor

Table E-1 Display codes used for display variables

Code or abbreviation	Definition	Comment or reference
RDENS	Density at reference temperature	Enhanced density application only
RPO A	Right pickoff amplitude	
SGU	Specific gravity units	
STD V	Standard volume flow rate	Enhanced density application only
STDVI	Standard volume inventory	Enhanced density application only
TCDEN	Temperature-corrected density	Petroleum measurement application only
TCORI	Temperature-corrected inventory	Petroleum measurement application only
TCORR	Temperature-corrected total	Petroleum measurement application only
TCVOL	Temperature-corrected volume	Petroleum measurement application only
TUBEF	Raw tube frequency	
WTAVE	Weighted average	

Table E-2 Display codes used in off-line menu

Code or abbreviation	Definition	Comment or reference
ACK	Display Ack All menu	
ACK ALARM	Acknowledge alarm	
ACK ALL	Acknowledge all	
ACT	Action	Action assigned to a discrete event
ADDR	Address	
BKLT, B LIGHT	Display backlight	
CAL	Calibrate	
CHANGE PASSW	Change password	Change the password required for access to display functions
CONFG	Configuration	
CORE	Core processor	
CUR Z	Current zero	
CUSTODY XFER	Custody transfer	
DENS	Density	
DRIVE%, DGAIN	Drive gain	
DISBL	Disable	**Select** to disable
DSPLY	Display	
E*x*	Event *x*	Refers to Event 1 or Event 2 when setting the setpoint.
ENABL	Enable	**Select** to enable
EXTRN	External	
EVNT*x*	Event *x*	
FAC Z	Factory zero	
FCF	Flow calibration factor	

Table E-2 Display codes used in off-line menu

Code or abbreviation	Definition	Comment or reference
FLDIR	Flow direction	
FLSWT, FL SW	Flow switch	
GSV	Gas standard volume	
GSV T	Gas standard volume total	
IRDA	Infrared	
LANG	Display language	
M_ASC	Modbus ASCII	
M_RTU	Modbus RTU	
MASS	Mass flow	
MBUS	Modbus	
MFLOW	Mass flow	
MSMT	Measurement	
MTR F	Meter factor	
OFF-LINE MAINT	Off-line maintenance menu	
OFFLN	Display off-line menu	
PRESS	Pressure	
r.	Revision	
SENSR	Sensor	
SPECL	Special	
SrC	Source	Variable assignment for outputs
TEMPR	Temperature	
VER	Version	
VERFY	Verify	
VFLOW	Volume flow	
VOL	Volume or volume flow	
WRPRO	Write protect	
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 Asia
Emerson Process Management
1 Pandan Crescent
Singapore 128461
Republic of Singapore
T +65 6777-8211
F +65 6770-8003

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 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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