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Configuration and Use Manual
P/N 20000327, Rev. FB
June 2011

Micro Motion®
Model 2700 Transmitter with PROFIBUS-PA

Configuration and Use Manual

Micro Motion®

EMERSON™
Process Management

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Chapter 1
Before You Begin

1.1 Overview

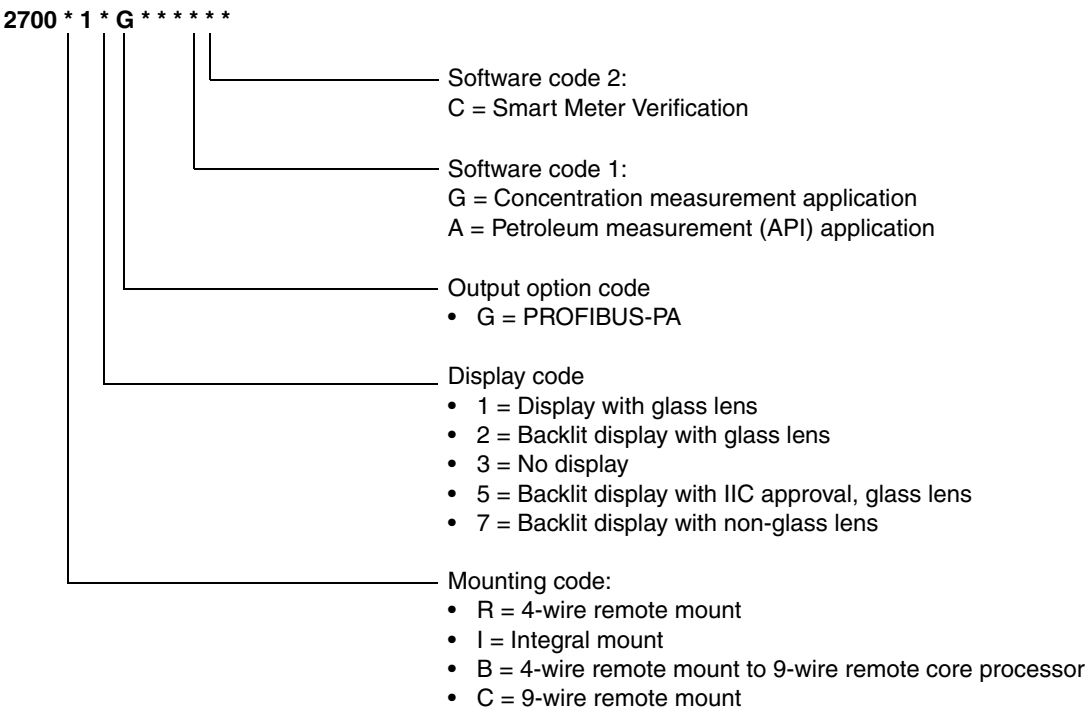
This chapter provides an orientation to the use of this manual, and includes a configuration overview flowchart and a pre-configuration worksheet. This manual describes the procedures required to start, configure, use, maintain, and troubleshoot Micro Motion® Model 2700 transmitters with PROFIBUS-PA.

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 options are indicated by the model number located on the transmitter tag. The model number is a string of the following form:



1.4 PROFIBUS-PA functionality

The transmitter supports the following methods of configuration and operation:

- Configuration methods:
  - Device description (EDD) for use with a PROFIBUS configuration tool such as Siemens® Simatic® Process Device Manager (PDM). In this manual, the term "EDD" is used to refer to this type of configuration.
  - Direct read and write of PROFIBUS-PA bus parameters.
- Operation methods:
  - GSD file with a PROFIBUS host. The transmitter supports two GSD options—Profile-specific, which is created by PNO, and Manufacturer-specific, which is created by by Micro Motion in order to implement a larger set of function blocks. See Section 2.5 for more information about the two GSD options.

    In this manual, the term "host" or "PROFIBUS host" is used to refer to this type of operation.
  - Device description (EDD) with PROFIBUS configuration tool (e.g., Simatic PDM). The EDD provides a superset of the operational functionality of the GSD, plus configuration capability.
- Identification and maintenance (I&M) functions:
  - I&M 0
  - I&M 1
  - I&M 2
  - PA I&M 0

The transmitter supports both classic and condensed status byte formats.

- Classic mode conforms to the PROFIBUS-PA Profile v3.01, Section 3.7.3.6.
- Condensed mode conforms to the PROFIBUS-PA Specification June 2005 Amendment 2 to the PROFIBUS Profile v3.01, Condensed Status and Diagnostic Messages v1.0.

1.5 Determining version information

Table 1-1 lists the version information you may need to know and describes how to obtain the information. This manual assumes transmitter firmware v3.2 or a later version and ProLink v2.92 with the Build 9827 patch or a later version.

Note: The hardware for transmitters with v2.0 and lower firmware is incompatible with the hardware needed to support v3.0 and later firmware. To upgrade from an earlier firmware version to v3.0 or higher firmware requires hardware replacement.

Table 1-1 Obtaining version information

Component	Tool	Method
Transmitter software	With ProLink II	**View > Installed Options > Software Revision**
	With EDD	**MMI Coriolis Flow > Transducer Block > Device Information > Software Rev**
	With display	**OFF-LINE MAINT > VER**

Table 1-1 Obtaining version information (continued)

Component	Tool	Method
Core processor software	With ProLink II	Not available
	With EDD	Not available
	With display	**OFF-LINE MAINT > VER**
ProLink II	With ProLink II	**Help > About ProLink II**
GSD version(1)	Text editor	Open file **V3x_057A.gsd** or **PA139742.GSD** and check parameter **GSD_Revision**
EDD version	Text editor	Open file **MMIcorflow.DDL** and check parameter **DD_REVISION**

(1) There are two GSD options available: Manufacturer-specific and Profile-specific. See Section 2.5 for more information.

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 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 2700 transmitter with PROFIBUS-PA

	Functionality		
Tool	**View/operation**	**Setup/maintenance**	**Requirements**
Transmitter display	Partial	Partial	Transmitter with display
ProLink II	Full	Full	ProLink II v2.92 or later
Host(1)	Partial	None	GSD file V3x_057A.gsd *or* PA139742.GSD
EDD	Full	Full	PDM file set
Bus parameters	Full	Full	None

(1) There are two GSD options available: Manufacturer-specific and Profile-specific. See Section 2.5 for more information.

The PDM and GSD files can be downloaded from the following address:

http://www.emersonprocess.com/micromotion/softwaredownloads

Also available at this address is a document titled *Commissioning MVD Profibus PA Documentation Supplement*. This supplement will assist you with connecting to the transmitter with Siemens® Simatic® Process Device Manager (PDM). If you are using Simatic PDM, download the PDM file set and follow the EDD instructions in this manual.

Basic information on using the display is provided in Appendix B.

Basic information on ProLink II is provided in Appendix C. For more information, refer to the ProLink II manual, which is available on the Micro Motion web site (www.micromotion.com). Although some functions of the Model 2700 transmitter with PROFIBUS-PA may be available through earlier versions of ProLink II, version 2.92 with the Build 9827 patch or a later version is required for full configuration, maintenance, and operation.

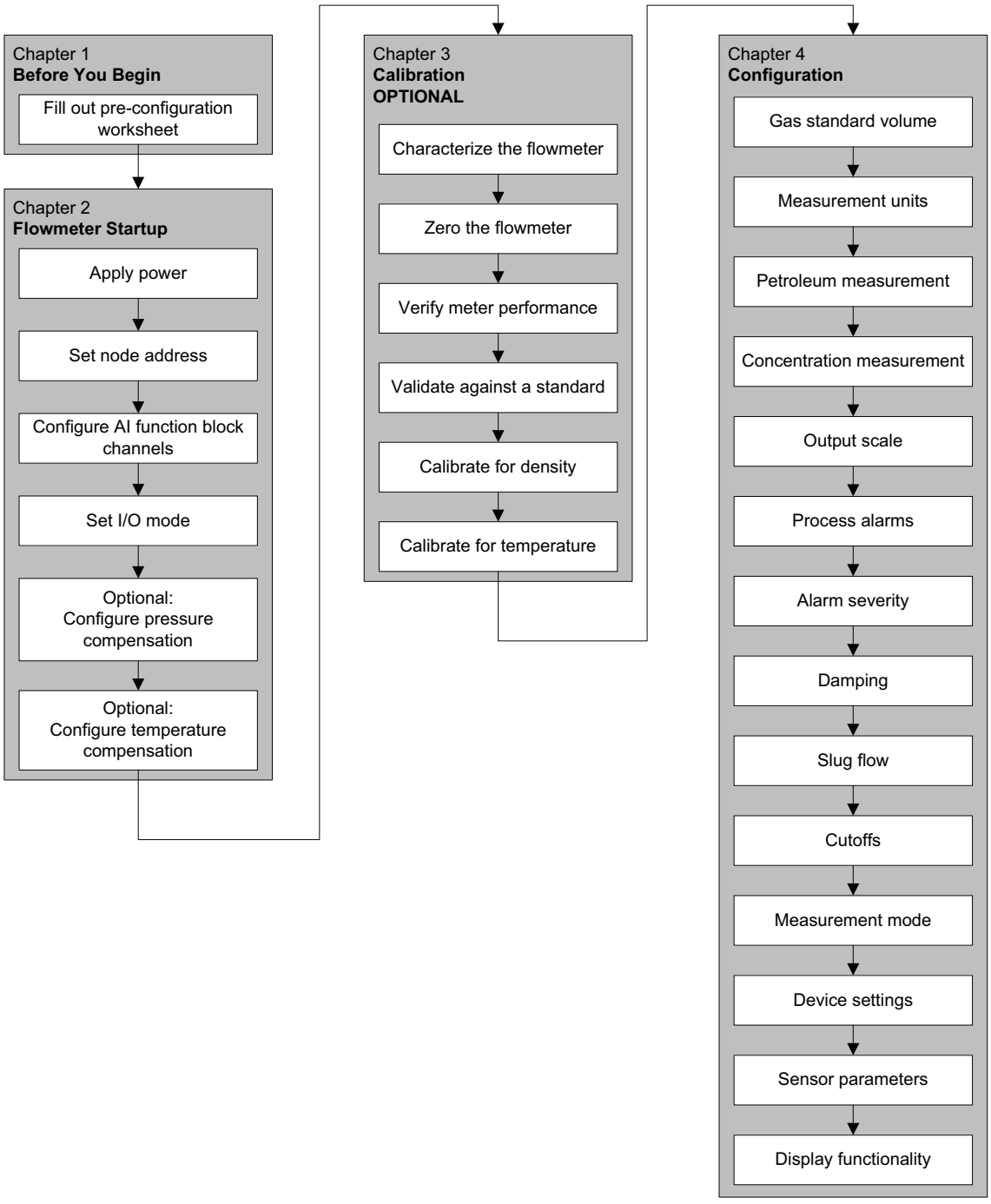
1.7 Planning the configuration

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 FOR TRANSMITTER:

TRANSMITTER	SENSOR
MODEL NUMBER	MODEL NUMBER
SERIAL NUMBER	SERIAL NUMBER
SOFTWARE VERSION	
NODE ADDRESS	

MEASUREMENT UNITS	
MASS FLOW	VOLUME FLOW
DENSITY	PRESSURE
TEMPERATURE	

INSTALLED APPLICATIONS	
METER VERIFICATION SOFTWARE	☐
PETROLEUM MEASUREMENT APPLICATION	☐
CONCENTRATION MEASUREMENT 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 1700 and Model 2700 Transmitters: Installation Manual*
Connecting the transmitter to Simatic PDM	*Commissioning MVD Profibus PA Documentation Supplement*
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 (U.S.A.)
- In Asia:
  - In Japan, phone 3 5769-6803
  - In other locations, phone +65 6777-8211 (Singapore)
- In Europe:
  - In the U.K., phone 0870 240 1978 (toll-free)
  - In other locations, phone +31 (0) 318 495 555 (The Netherlands)

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

Chapter 2
Startup

2.1 Overview

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

The procedures in this section will enable you to:

- Apply power to the flowmeter (Section 2.2)
- Set the node address (Section 2.3)
- Configure the AI block channels (Section 2.4)
- Set the I/O mode of the transmitter (Section 2.5)
- Configure the totalizer block mode (Section 2.6)
- Optional: Configure pressure compensation (Section 2.7)
- Optional: Configure temperature compensation (Section 2.8)

Note: All procedures provided in this chapter assume that you have established communication with the transmitter and that you are complying with all applicable safety requirements. See Appendix C or the documentation for your PROFIBUS host or configuration tool.

2.2 Applying power

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

Operating the flowmeter without covers in place creates electrical hazards that can cause death, injury, or property damage. Make sure all covers are in place before applying power to the transmitter.

Turn on the electrical power at the power supply. The flowmeter will automatically perform diagnostic routines. If the transmitter has a display, the status LED will turn green and begin to flash when the transmitter has finished its startup diagnostics.

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.

2.3 Setting the node address

The factory default setting for the node address is 126. To set the node address:

- With the display, choose **OFF-LINE MAINT > CONFG > ADDRESS PBUS**.
- With ProLink II, choose **ProLink > Configuration > Device (Profibus) > Profibus Address**.
- With a PROFIBUS host, use the change address function of the host.

2.4 Configuring the analog input function block channels

You can set each of the transmitter's AI function blocks to measure one transducer block channel. The AI blocks are set at the factory to a default setting that is adequate for most applications, but you can change the assignment of the AI blocks to meet special needs.

The default channel configuration for each block is shown in Table 2-1.

Table 2-1 Default channel configuration

Block	Default channel	Default units
AI 1	Mass flow	kg/s
AI 2	Temperature	K
AI 3	Density	kg/l
AI 4	Volume flow	m^3/h

The available transducer block channels are shown in Table 2-2.

Table 2-2 Process variables by transducer block channel

Channel value			
Slot	**Index**	**Value**	**Process variable**
11 (0x0B)	17 (0x11)	0x0B11	Volume flow
11 (0x0B)	21 (0x15)	0x0B15	Mass flow
11 (0x0B)	25 (0x19)	0x0B19	Density
11 (0x0B)	29 (0x1D)	0x0B1D	Temperature
11 (0x0B)	64 (0x40)	0x0B40	Gas standard volume flow
11 (0x0B)	114 (0x72)	0x0B72	Pressure
11 (0x0B)	160 (0xA0)	0x0BA0	Drive gain
12 (0x0C)	29 (0x1D)	0x0C1D	Petroluem measurement – corrected density
12 (0x0C)	30 (0x1E)	0x0C1E	Petroluem measurement – corrected volume flow
12 (0x0C)	31 (0x1F)	0x0C1F	Petroluem measurement – average corrected density
12 (0x0C)	32 (0x20)	0x0C20	Petroluem measurement – average corrected temp
12 (0x0C)	33 (0x21)	0x0C21	Petroluem measurement – CTL
12 (0x0C)	47 (0x2F)	0x0C2F	Concentration measurement – reference density
12 (0x0C)	48 (0x30)	0x0C30	Concentration measurement – specific gravity
12 (0x0C)	49 (0x31)	0x0C31	Concentration measurement – standard volume flow
12 (0x0C)	50 (0x32)	0x0C32	Concentration measurement – net mass flow

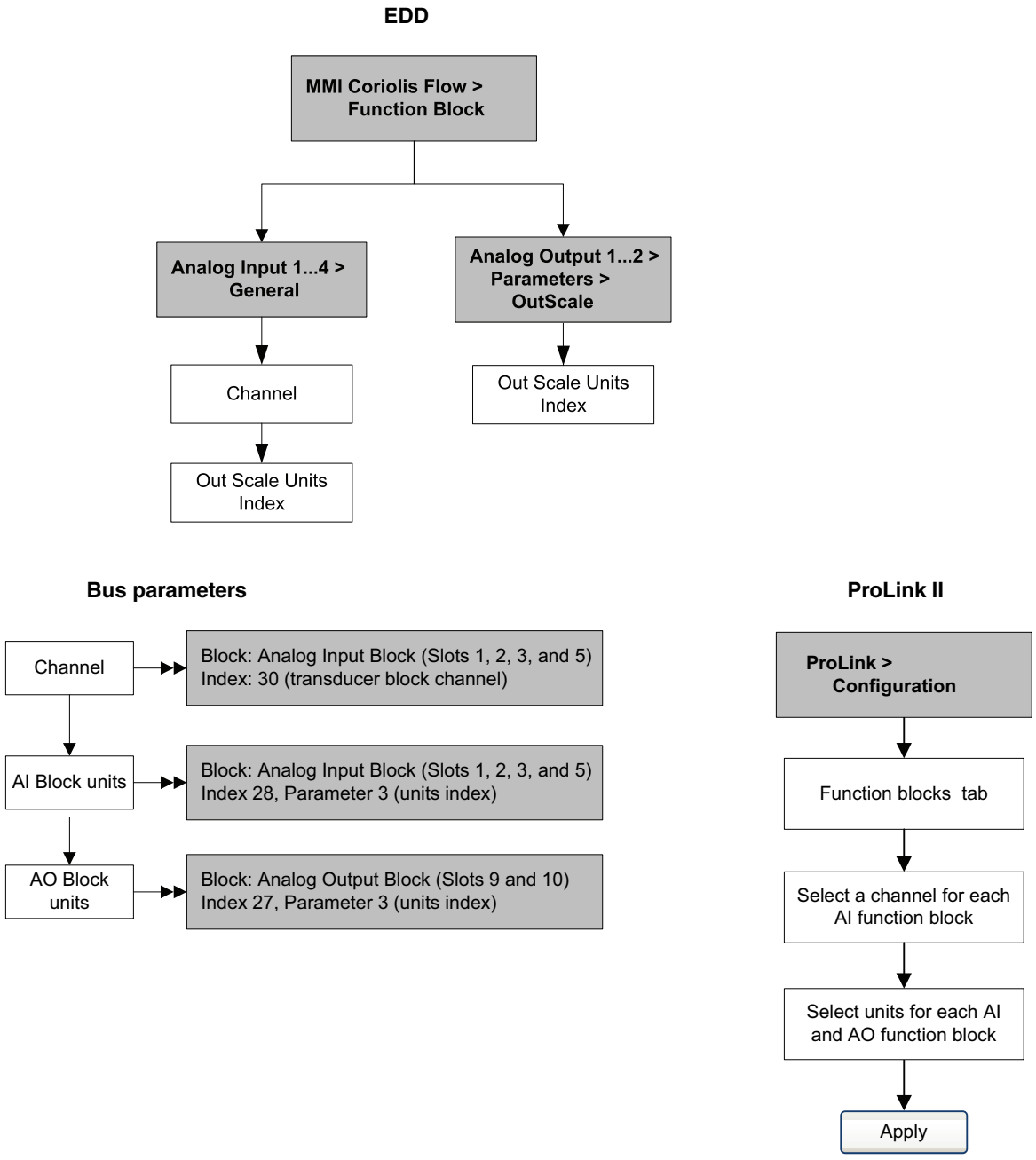
Table 2-2 Process variables by transducer block channel (continued)

12 (0x0C)	51 (0x33)	0x0C33	Concentration measurement – net volume flow
12 (0x0C)	52 (0x34)	0x0C34	Concentration measurement – concentration
12 (0x0C)	53 (0x35)	0x0C35	Concentration measurement – Baume

To configure the AI function block channels:

- With the EDD, bus parameters, or ProLink II, see the menu flowcharts in Figure 2-1.
- With the display, see the menu flowchart in Figure B-14.

Figure 2-1 Configuring channels and units – EDD, bus parameters, and ProLink II



2.5 Setting the I/O mode

The transmitter can function in two different I/O modes: Profile-specific and Manufacturer-specific. The factory default is Manufacturer-specific. The two modes control which function blocks are available for use, and whether the format of the status byte is “classic” or “condensed.” (See Appendix D for more information on the format of the status byte.)

- In Profile-specific mode, the transmitter has the use of three AI blocks and one totalizer block. The status byte output format defaults to classic mode.
- In Manufacturer-specific mode, the transmitter has the use of four AI blocks, four totalizer blocks, and two AO blocks. The status byte output format defaults to condensed mode.

Refer to Table 2-3 for the slot identifications and blocks permitted by each mode. You must select modules exactly as described in Table 2-3, or select an empty module for slots that you do not intend to use. If any modules are left unconfigured, the transmitter will not send data.

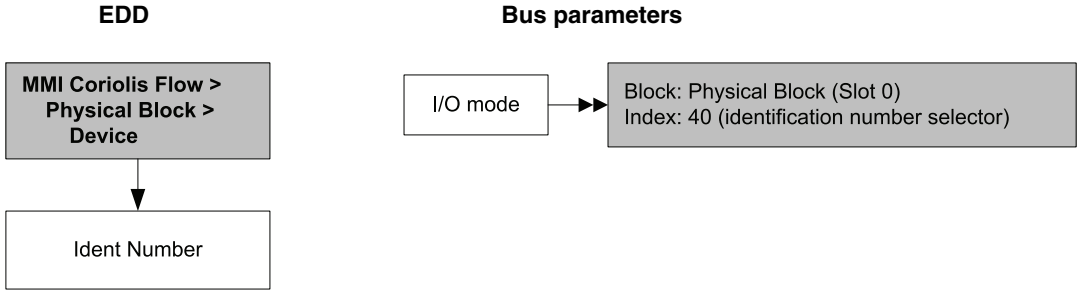
Table 2-3 I/O mode slot configurations

Slot	Profile-specific mode	Manufacturer-specific mode
1	AI 1	AI 1
2	AI 2	AI 2
3	AI 3	AI 3
4	Totalizer 1	Totalizer 1
5		AI 4
6		Totalizer 2
7		Totalizer 3
8		Totalizer 4
9		AO 1
10		AO 2

To set the I/O mode of the transmitter:

- With the EDD or bus parameters, see the menu flowcharts in Figure 2-2.
- With the display, choose **OFFLINE_MAINT > CONFG > IDENT SEL**.

Figure 2-2 Setting the I/O mode



There are two GSD files that correspond to the two I/O modes. If you are using a PROFIBUS host with GSD files to operate the transmitter, you must use the GSD that corresponds to the I/O mode you have chosen. Table 2-4 lists the GSD file names. Load the correct GSD file into your PROFIBUS host or configuration tool.

Note: Set the I/O mode in the Physical Block before loading the GSD file.

Table 2-4 PROFIBUS GSD file names

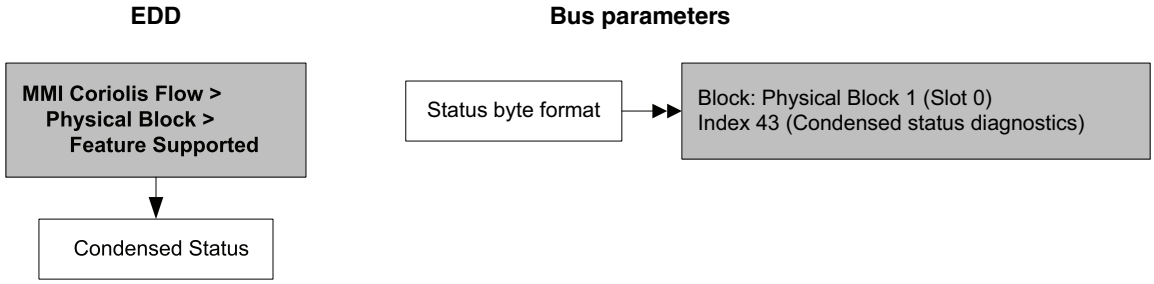
Identification number	GSD file name
Profile specific	PA139742.GSD
Manufacturer specific	V3x_057A.gsd

2.5.1 Overriding the status byte format

Each I/O mode has a default status byte format – classic or condensed. To override this default:

- With the GSD, set the Condensed Status parameterization bit to either 1 (for condensed status) or 0 (for classic status).
- With the EDD or bus parameters, use the menu flowcharts in Figure 2-3.

Figure 2-3 Status byte format



2.6 Configuring the totalizer block mode

The behavior of the four totalizer function blocks can be configured in two ways:

- Standard, which provides standard PROFIBUS totalizer function block behavior.

  In this mode, the totalizer block will integrate whatever data it receives. The Out value of a totalizer in this mode has no relationship to the totalizer data reported by the transducer block, ProLink II, or the display.
- Any of the values in Table 2-5, which cause the totalizer function block to pass through the specified totalizer value from the transducer block.

  Micro Motion recommends using one of these modes, because the totalizer block output will be more accurate and will match readings taken with ProLink II and the display.

To configure the totalizer block mode:

- With the EDD or bus parameters, refer to the menu flowcharts in Figure 2-4.
- With the display, refer to the menu flowcharts in Figure B-16.

Figure 2-4 **Configuring totalizer function block mode**

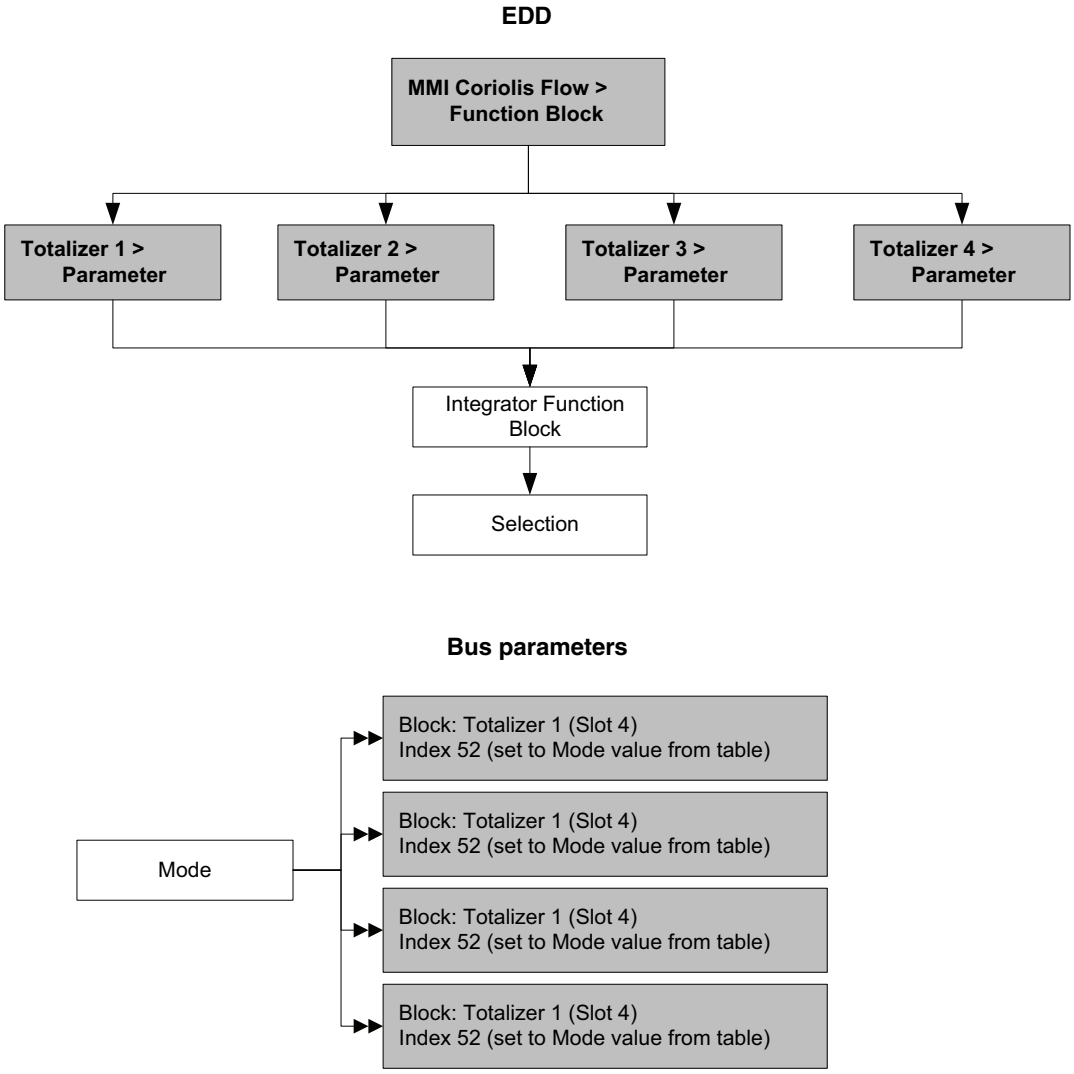


Table 2-5 **Process variables by transducer block channel**

	Channel value		
Slot	**Index**	**Value**	**Process variable**
11(0x0B)	17(0x11)	0x0B11	Volume flow
11(0x0B)	21(0x15)	0x0B15	Mass flow
11(0x0B)	64(0x40)	0x0B40	Gas standard volume flow
12(0x0C)	30(0x1E)	0x0C1E	Petroleum measurement – corrected volume flow
12(0x0C)	49(0x31)	0x0C31	Concentration measurement – standard volume flow
12(0x0C)	50(0x32)	0x0C32	Concentration measurement – net mass flow
12(0x0C)	51(0x33)	0x0C33	Concentration measurement – net volume flow

2.7 Configuring pressure compensation

Due to process pressure change away from calibration pressure, there can be a change in sensor flow and density sensitivity. This change is called pressure effect. Pressure compensation corrects for these changes.

Not all sensors and applications require pressure compensation. Contact Micro Motion Customer Service before you configure pressure compensation.

Configuring pressure compensation requires three steps:

1. Determining pressure compensation values (Section 2.7.1)
2. Enabling pressure compensation (Section 2.7.2)
3. Selecting a pressure source (Section 2.7.3)

2.7.1 Pressure compensation values

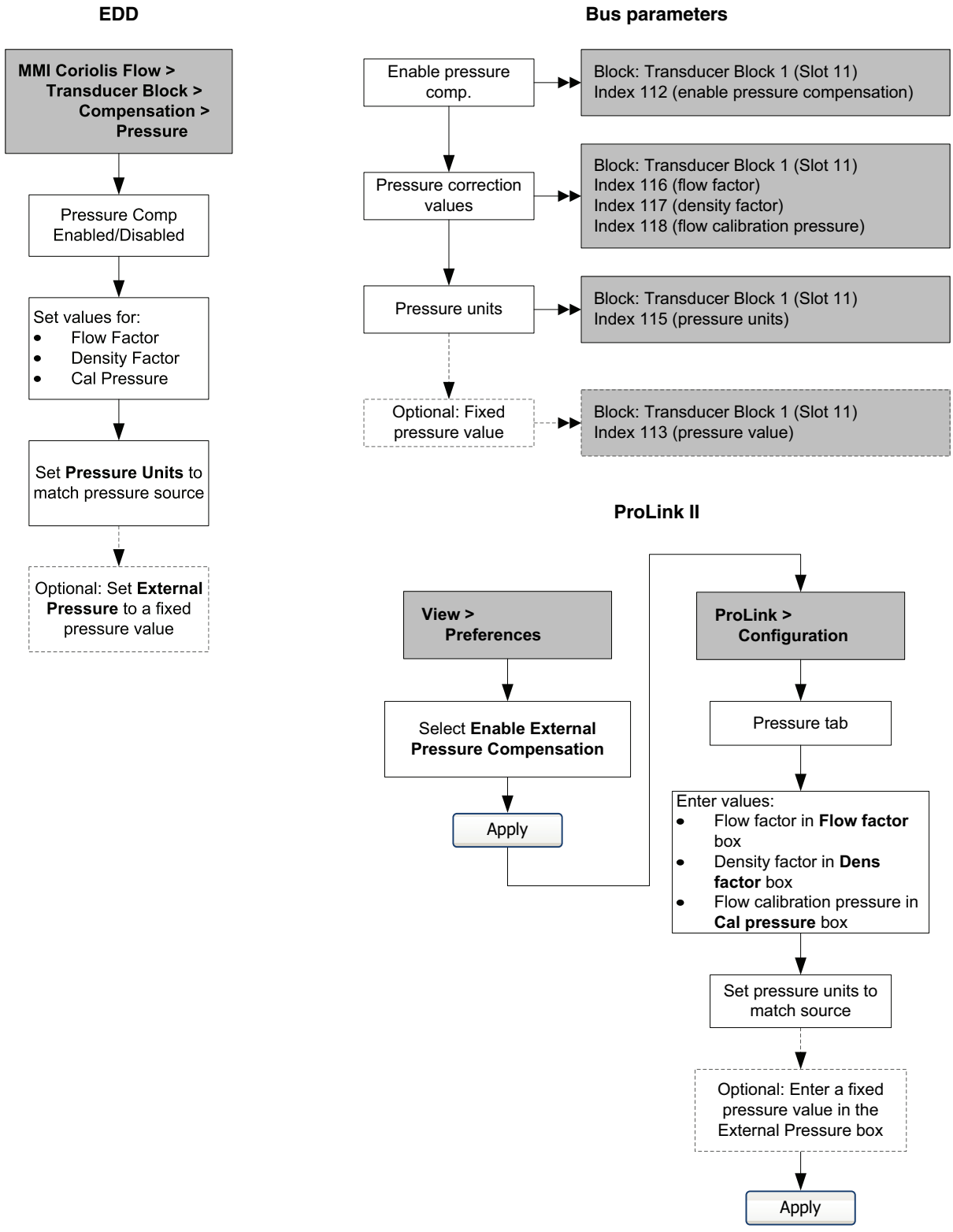
There are three values involved in pressure compensation:

- *Flow factor* – The flow factor is the percent change in flow rate per psi. Consult the product data sheet for your sensor for this value. You will need to reverse the sign of the flow factor. For example, if the flow factor in the product data sheet is –0.001% per psi, the pressure compensation flow factor would be +0.001% per psi.
- *Density factor* – The density factor is the change in fluid density, in g/cm^3 per psi. Consult the product data sheet for your sensor for this value. You will need to reverse the sign of the density factor. For example, if the density factor in the product data sheet is –0.00004 g/cm^3 per psi, the pressure compensation flow factor would be +0.00004 g/cm^3 per psi.
- *Flow calibration pressure* – The pressure at which the flowmeter was calibrated. Refer to the calibration document shipped with your sensor. If the data is unavailable, use 20 psi (1,4 bar).

2.7.2 Enabling pressure compensation

To enable pressure compensation, see the menu flowcharts in Figure 2-5. You will need the three pressure compensation values from Section 2.7.1.

Figure 2-5 Enabling pressure compensation



2.7.3 Configuring a pressure source

You will need to choose one of two sources for pressure data:

- Analog Output function block – This option allows you to poll for pressure data from an external pressure source.
- Fixed pressure data – This option uses a known, constant pressure value.

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

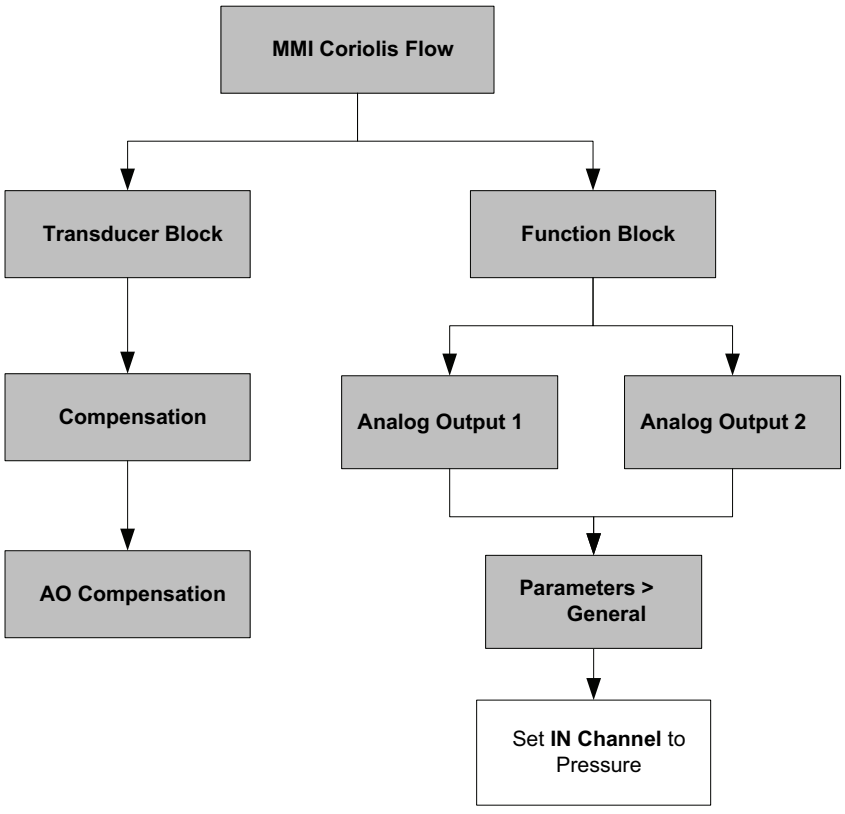
If you configure pressure compensation to use an AO block for pressure compensation, the other AO block remains available for temperature compensation. However, only one of the AO blocks can be set up for external pressure.

To configure fixed pressure data, refer to the menu flowcharts in Figure 2-5.

To configure an AO function block for pressure compensation:

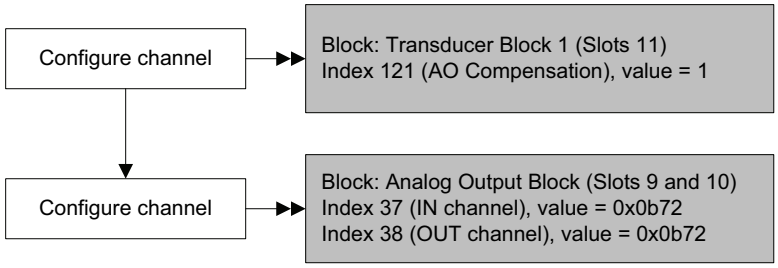
- With the EDD, refer to the flowchart in Figure 2-6.
- With bus parameters, refer to the flowchart in Figure 2-7.
- With the display, refer to the menu flowcharts in Figure B-15.

Figure 2-6 Configuring an AO function block for pressure compensation – EDD



Note: When setting the IN channel to Pressure via the EDD, the OUT channel will be automatically set to Pressure as well. Setting the IN channel via bus parameters does not automatically change the OUT channel. You must manually set the OUT channel to Pressure or the block will go into Out of Service mode.

Figure 2-7 **Configuring an AO function block for pressure compensation – Bus parameters**



2.8 Configuring 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 fixed temperature value), rather than the temperature value from the Coriolis sensor, is used in petroleum measurement or enhanced density calculations only. The temperature value from the Coriolis sensor is used for all other calculations.
- If external temperature compensation is disabled, the temperature value from the Coriolis sensor is used in all calculations.

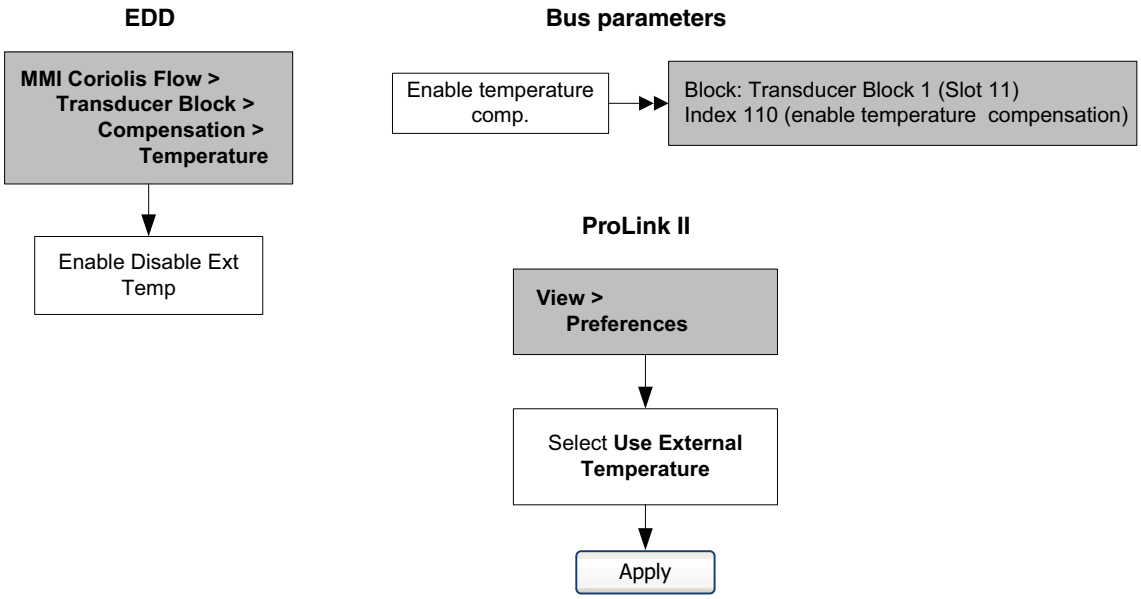
Configuring temperature compensation requires two steps:

1. Enabling external temperature compensation (Section 2.8.1)
2. Configuring a temperature source (Section 2.8.2)

2.8.1 Enabling external temperature compensation

To enable temperature compensation, refer to the flowcharts in Figure 2-8.

Figure 2-8 **Enabling external temperature compensation**



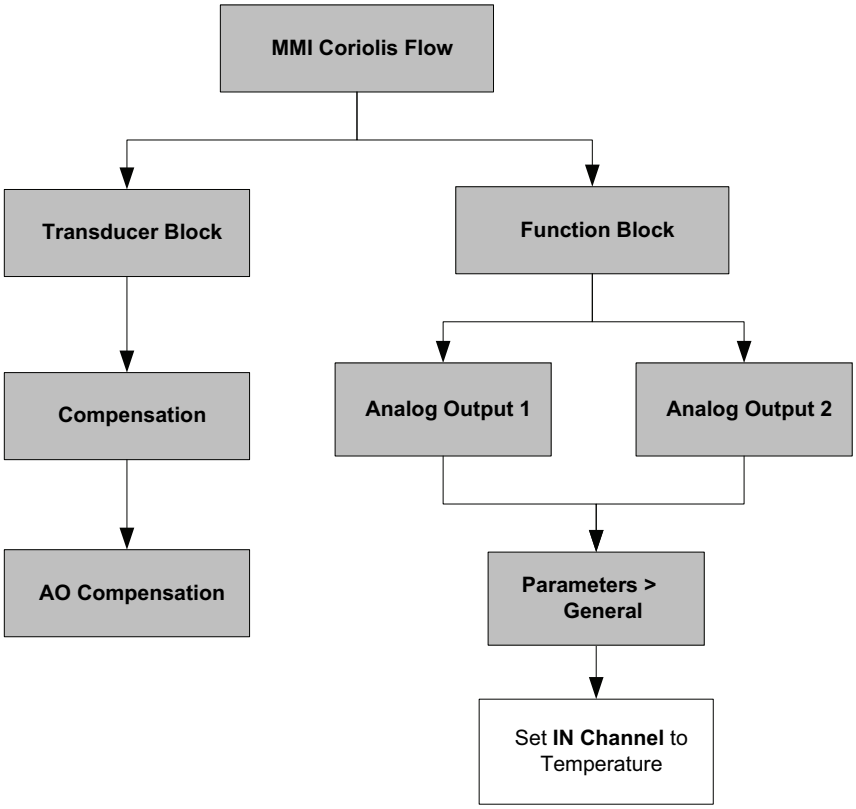
2.8.2 Configuring a temperature source

External temperature data is reported through an analog output (AO) function block. The transmitter has two AO blocks, each of which can be assigned to a compensation variable channel.

To configure an AO function block for temperature compensation:

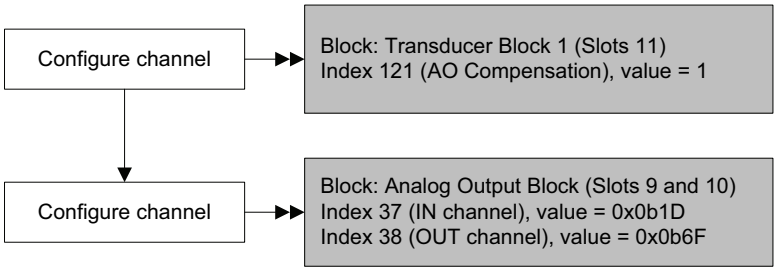
- With the EDD, refer to the flowchart in Figure 2-9.
- With bus parameters, refer to the flowchart in Figure 2-10.
- With the display, refer to the flowcharts in Figure B-15.

Figure 2-9 Configuring an AO function block for temperature compensation – EDD



Note: When setting the IN channel to Temperature via the EDD, the OUT channel will be automatically set to Temperature as well. Setting the IN channel via bus parameters does not automatically change the OUT channel. You must manually set the OUT channel to Temperature or the block will go into Out of Service mode.

Figure 2-10 Configuring an AO function block for temperature compensation – Bus parameters



Chapter 3
Calibration

3.1 Overview

This chapter describes the following procedures:

- Characterization (Section 3.3)
- Smart Meter Verification (Section 3.4)
- Meter validation and adjusting meter factors (Section 3.5)
- Zero calibration (Section 3.6)
- Density calibration (Section 3.7)
- Temperature calibration (Section 3.8)

Note: All procedures provided in this chapter assume that you have established communication with the transmitter and that you are complying with all applicable safety requirements. See Appendix C or the documentation for your PROFIBUS host or configuration tool.

3.2 Characterization, Smart Meter Verification, meter validation, and calibration

There are four procedures:

- *Characterization* – adjusts the transmitter to compensate for the unique traits of the sensor with which it is paired
- *Smart Meter Verification* – establishing confidence in the sensor's performance by analyzing secondary variables that are highly correlated with flow and density calibration factors
- *Meter validation* – confirming performance by comparing the sensor's measurements to a primary standard
- *Calibration* – establishing the relationship between a process variable (flow, density, or temperature) and the signal produced by the sensor, or establishing the transmitter's response to a zero-flow condition.

Meter validation, characterization, and calibration are available on all Model 2700 transmitters. Smart Meter Verification is available only if the Smart Meter Verification option was ordered with the transmitter.

These four procedures are discussed and compared in Sections 3.2.1 through 3.2.4. Before performing any of these procedures, review these sections to ensure that you will be performing the appropriate procedure for your purposes.

3.2.1 Characterization

Characterizing the flowmeter adjusts the transmitter to compensate for the unique traits of the sensor it is paired with. Characterization parameters (sometimes called “calibration factors”) describe the sensor’s sensitivity to flow, density, and temperature.

If the transmitter and the sensor were ordered together as a Coriolis flowmeter, then the flowmeter has already been characterized. Under some circumstances (typically when pairing a sensor and transmitter together for the first time), you may need to re-enter characterization data. If you are unsure about whether you should characterize your flowmeter, contact Micro Motion Customer Service.

3.2.2 Smart Meter Verification

Smart 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.

Smart Meter Verification does not affect measurement in any way. Micro Motion recommends performing Smart Meter Verification at regular intervals.

3.2.3 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.

3.2.4 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
- Density calibration
- Temperature calibration

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

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

Zero calibration requires only that flow through the sensor is stopped.

Flowmeters 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.

3.2.5 Comparison and recommendations

When choosing among Smart 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.
  - 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 low-temperature and high-temperature fluids. Zero calibration requires stopping flow through the sensor.
- External measurement requirements
  - Smart Meter Verification does not require external measurements.
  - Zero calibration does not require external measurements.
  - Density calibration, temperature calibration, and meter validation require external measurements. For good results, the external measurement must be highly accurate.
- Measurement adjustment
  - Smart 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 obtaining the Smart Meter Verification transmitter option and performing Smart Meter Verification on a regular basis.

3.3 Performing a characterization

Characterizing a flowmeter involves entering parameters that are printed on the sensor tag.

3.3.1 Characterization parameters

The characterization parameters that must be entered depend on the sensor type: "T-Series" or "Other," as listed in Table 3-1. The "Other" category includes all Micro Motion sensors except T-Series.

The characterization parameters are provided on the sensor tag. The format of the sensor tag varies depending on your sensor's date of purchase. See Figures 3-1 and 3-2 for illustrations of newer and older sensor tags.

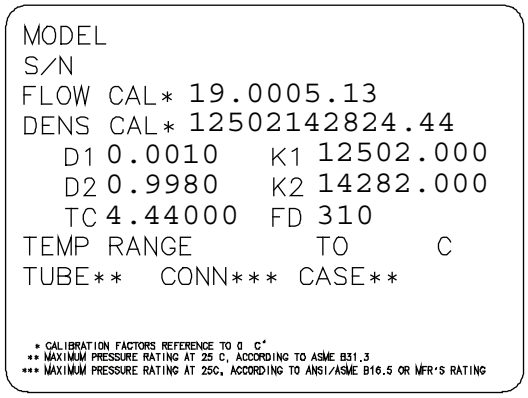
Table 3-1 Sensor characterization parameters

Characterization data	EDD label	Bus parameter index	Sensor type	
			T-Series	Other
K1[1]	K1	92	✓	✓
K2[1]	K2	93	✓	✓
FD[1]	FD	94	✓	✓
D1[1]	D1	97	✓	✓
D2[1]	D2	98	✓	✓
DT or TC[1]	Density Temp Coeff (DT)	102	✓	✓
Flow cal[2]	FD Value	99		✓
FCF[2]	FD Value	99	✓	
FT[2]	FD Value	99	✓	
FTG	FTG	103	✓	
FFQ	FFQ	104	✓	
DTG	DTG	105	✓	
DFQ1	DFQ1	106	✓	
DFQ2	DFQ2	107	✓	

(1) See the section entitled "Density calibration factors."
(2) See the section entitled "Flow calibration values."

Figure 3-1 Sample calibration tags – All sensors except T-Series

Newer tag



Older tag

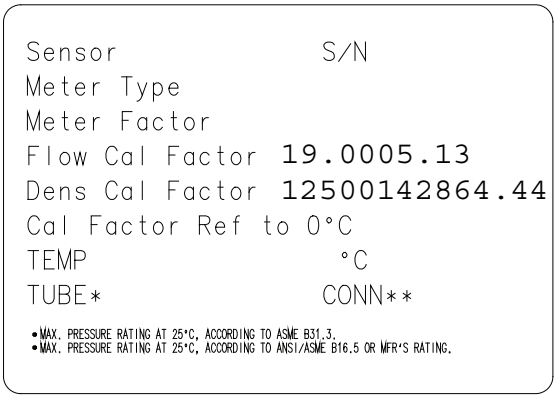
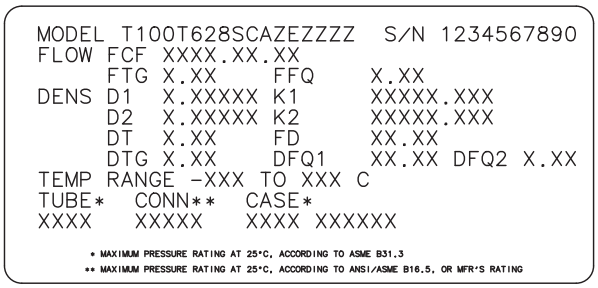
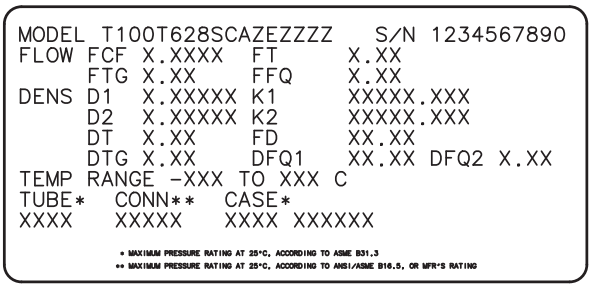


Figure 3-2 Sample calibration tags – T-Series sensors

Newer tag



Older tag



Density calibration factors

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

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

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

- For K1, enter the first 5 digits of the density calibration factor. In the sample tag in Figure 3-1, this value is shown as 12500.
- For K2, enter the second 5 digits of the density calibration factor. In the sample tag in Figure 3-1, this value is shown as 14286.

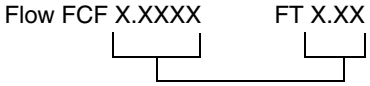
If your sensor does not show an FD value, contact Micro Motion customer service. If your sensor tag does not show a DT or TC value, enter the last 3 digits of the density calibration factor. In the sample tag in Figure 3-1, this value is shown as 4.44.

Flow calibration values

Two separate values are used to describe flow calibration: a 6-character FCF value (including one decimal point) and a 4-character FT value (including one decimal point). During characterization, these are entered as a single 10-character string that includes two decimal points. In ProLink II, this value is called the Flowcal parameter.

To obtain the required value:

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

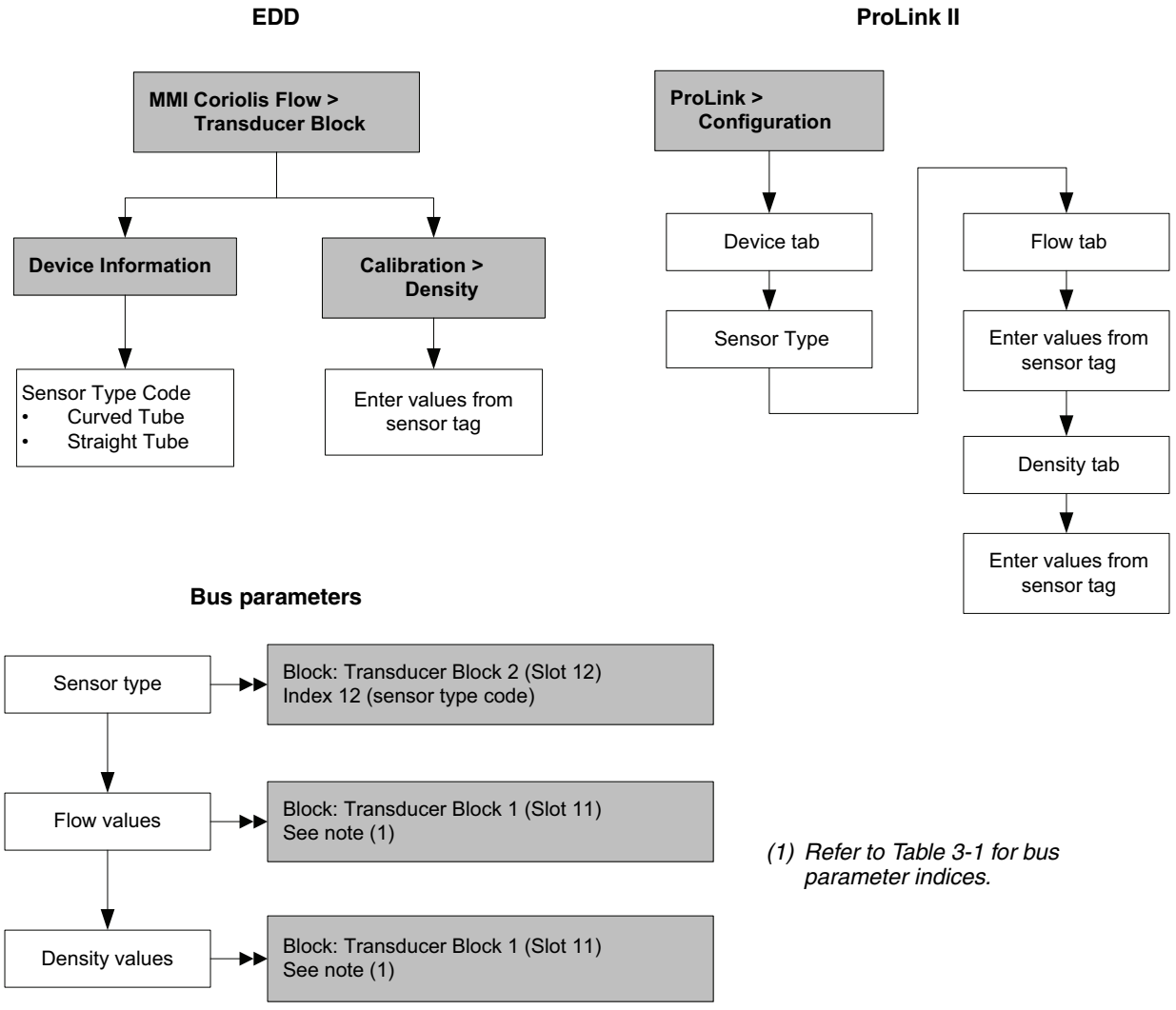


- For newer T-Series sensors, the 10-character string is represented on the sensor tag as the FCF value. The value should be entered exactly as shown, including the decimal points. No concatenation is required.
- For all other sensors, the 10-character string is represented on the sensor tag as the Flow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

3.3.2 How to characterize

To characterize the flowmeter, refer to Table 3-1 and the menu flowcharts in Figure 3-3.

Figure 3-3 Characterizing the flowmeter



(1) Refer to Table 3-1 for bus parameter indices.

3.4 Performing Smart Meter Verification

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

3.4.1 Preparing for the Smart Meter Verification test

The Smart Meter Verification procedure 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, stop flow.

If stability varies outside test limits, the Smart Meter Verification procedure will be aborted. Verify the stability of the process and retry the test.

Transmitter configuration

Smart 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. Disable all control loops for the duration of the test, and ensure that any data reported during this period is handled appropriately.

3.4.2 Running the Smart Meter Verification test

To run a Smart Meter Verification test:

- With the EDD, refer to Figure 3-4.
- With bus parameters, refer to Figure 3-5 and to Table 3-2.
- With ProLink II, refer to Figure 3-6.
- With the display, refer to Figure B-6.

Figure 3-4 **Smart Meter Verification – EDD**

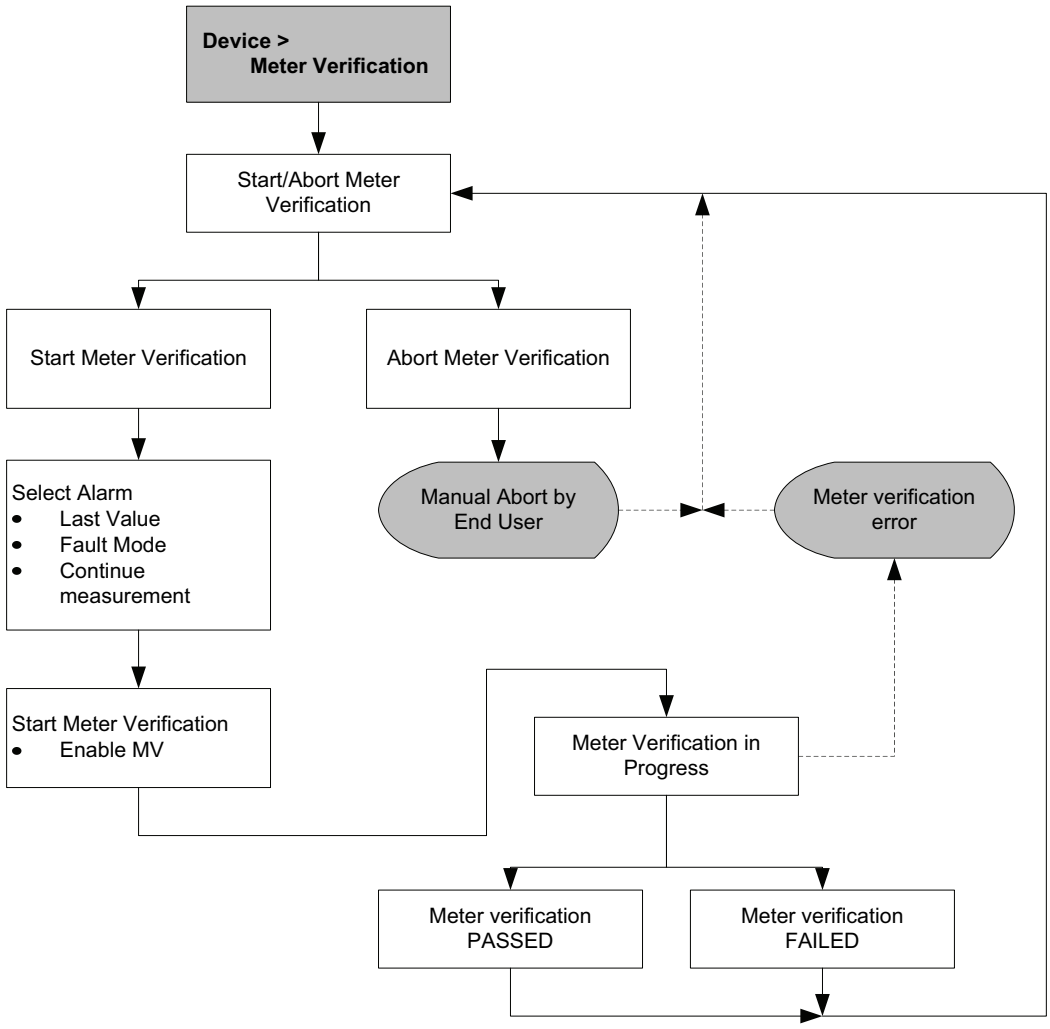


Figure 3-5 **Smart Meter Verification – bus parameters**

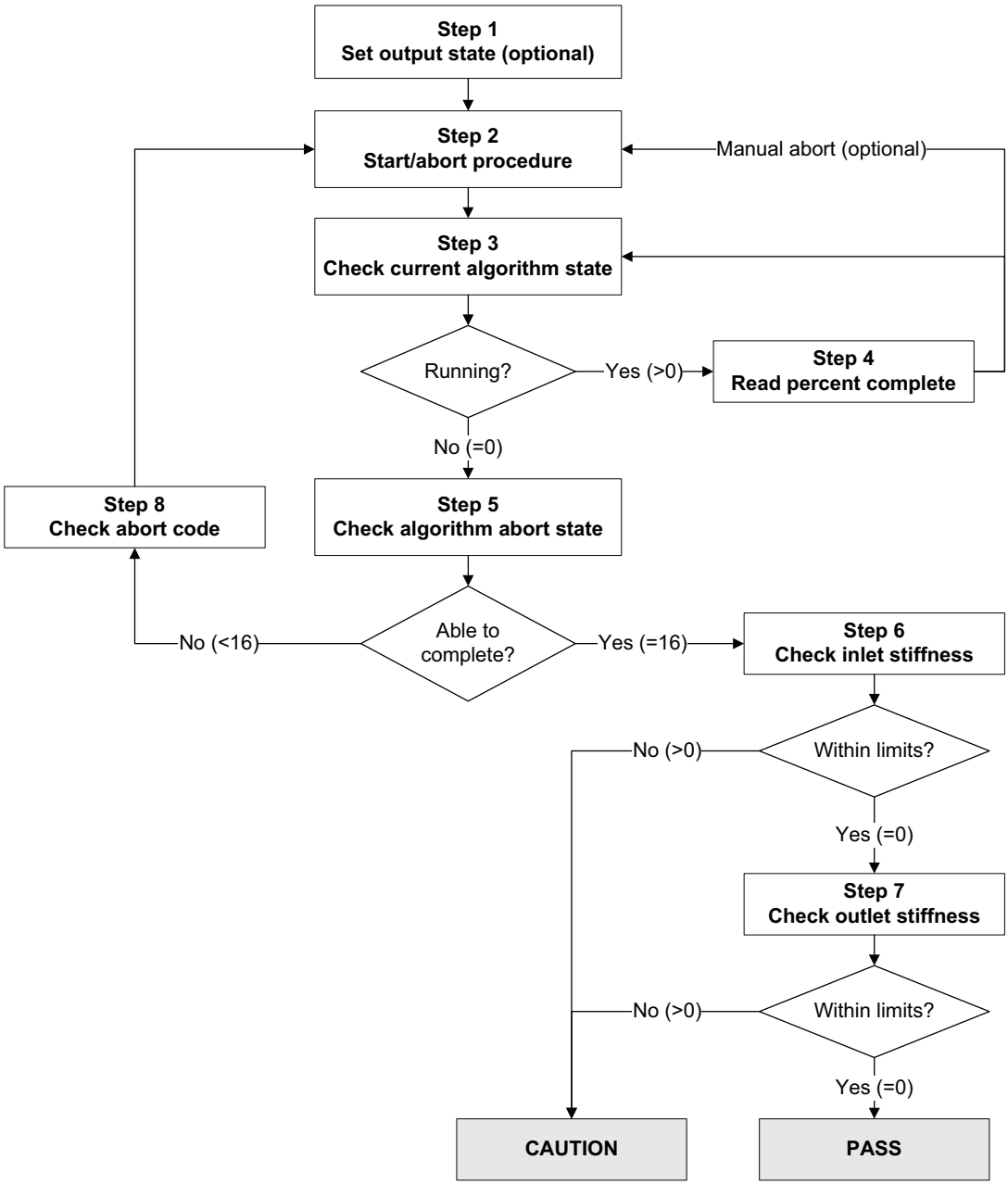
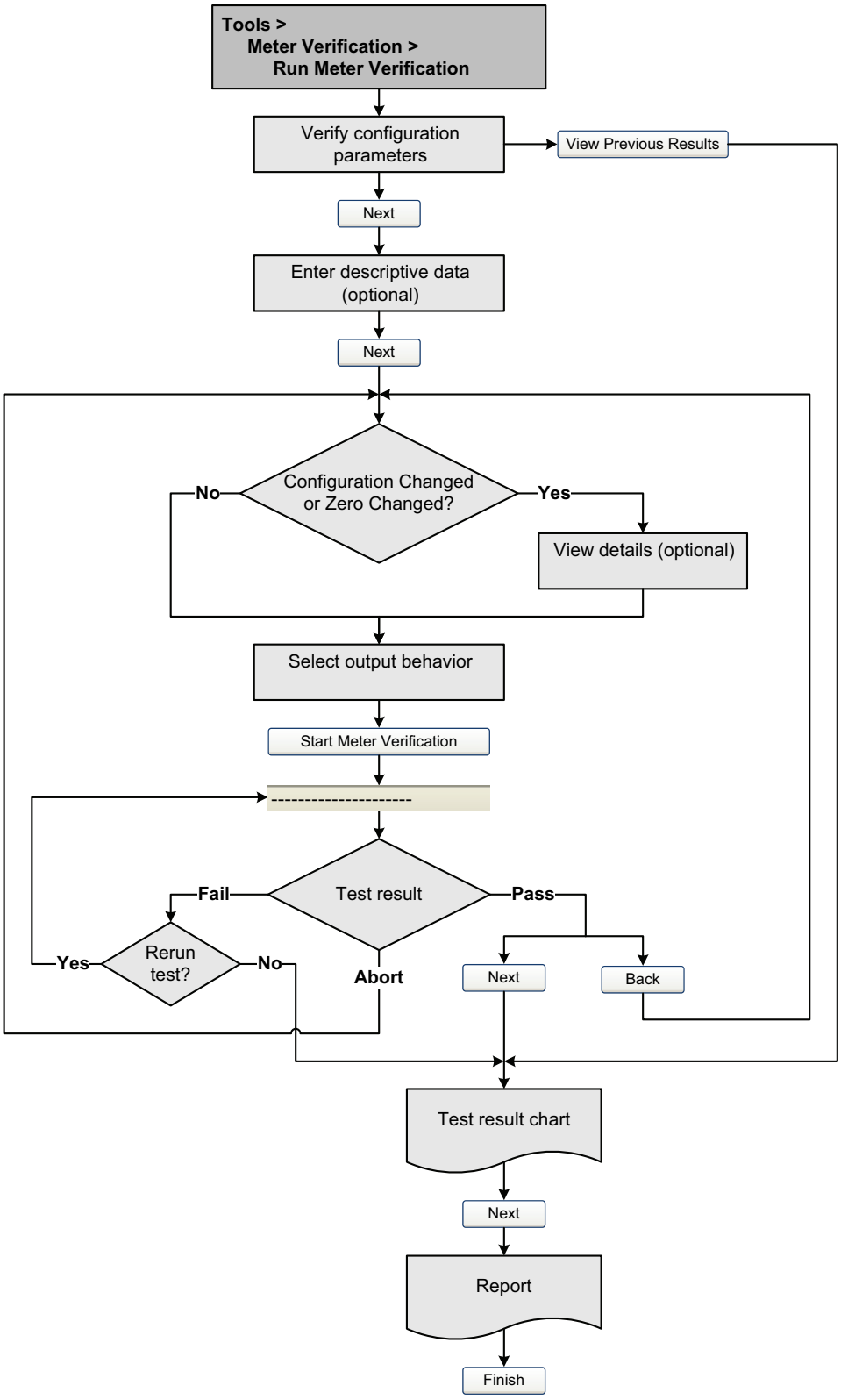


Table 3-2 PROFIBUS parameters for Smart Meter Verification

Step number	Step description	Parameters
1	Set output state	Block: Transducer block 1 Index: 182 Value: • 0: Last measured value (default) • 1: Fault
2	Start/abort procedure	Block: Transducer block 1 Index: 72 (Start/Stop Meter Verification) • 0x00: No effect • 0x01: Start On-Line Meter Verification
3	Check current algorithm state	Block: Transducer block 1 Index: 75 Value: • Bits 4–6: State
4	Read percent complete	Block: Transducer block 1 Index: 189 (Progress)
5	Check algorithm abort state	Block: Transducer block 1 Index: 75 Value: • Bits 0–3: Abort code
6	Check inlet stiffness	Block: Transducer block 1 Index: 77 • 0: Within uncertainty limit • 1: Outside uncertainty limit
7	Check outlet stiffness	Block: Transducer block 1 Index: 78 • 0: Within uncertainty limit • 1: Outside uncertainty limit
8	Read abort code	Block: Transducer block 1 Index: 185 Codes: See Table 3-3

Figure 3-6 **Smart Meter Verification – ProLink II**



3.4.3 Reading and interpreting Smart Meter Verification test results

Pass/Fail/Abort

When the Smart Meter Verification test is completed, the result will be reported as Pass, Fail/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 uncertainty limit. If transmitter zero and configuration match factory values, the sensor will meet factory specifications for flow and density measurement. It is expected that meters will pass Smart 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 Smart Meter Verification test. If you previously set outputs 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 Smart Meter Verification test (e.g., process instability). Abort codes are listed in Table 3-3, and suggested actions are provided for each code.

Table 3-3 Smart 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 3.4.1 and rerun the test.
13	No factory reference data for Smart Meter Verification test performed on air	Contact Micro Motion customer service and provide the abort code.
14	No factory reference data for Smart Meter Verification test performed on water	Contact Micro Motion customer service and provide the abort code.
15	No configuration data for Smart 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 seconds 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

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 run a Smart 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

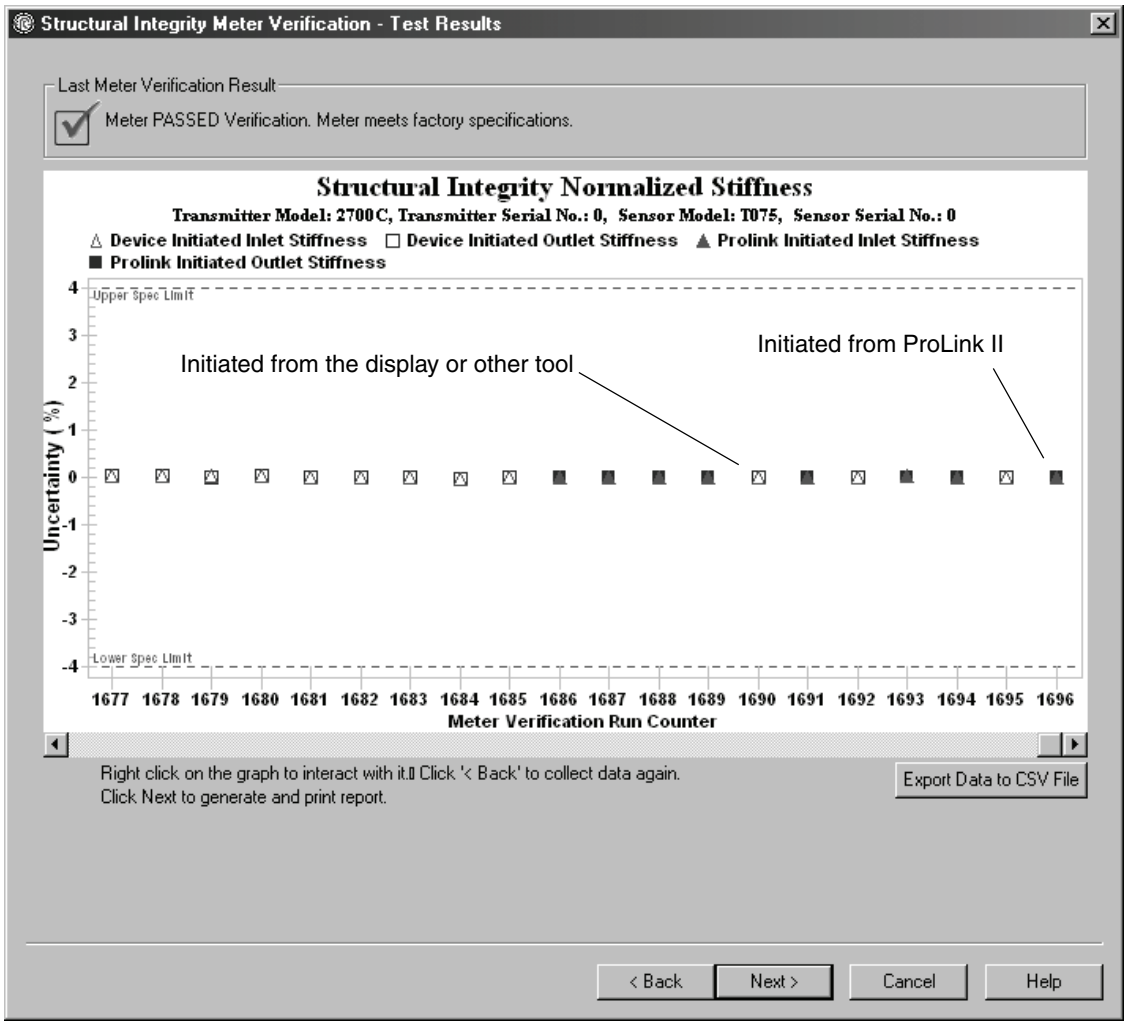
Note: If you request an action while synchronization is in process, ProLink II displays a message asking whether or not you want to complete synchronization. If you choose No, the ProLink II database may not include the latest test results from the transmitter.

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

- A test result chart (see Figure 3-7*).*
- A test report that includes the descriptive information for the current test, the test result chart, and background information about Smart 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 Smart Meter Verification panel. See Figure 3-7. Test reports are available only for tests initiated from ProLink II.

Figure 3-7 **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

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

- Powered-on seconds 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, refer to the menu flowchart in Figure B-7.

3.4.4 Setting up automatic or remote execution of the Smart Meter Verification test

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

- Set up a one-time automatic execution
- Set up a recurring execution

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, choose **Tools > Meter Verification > Schedule Meter Verification**.
- With the EDD, choose **Device > Meter Verification**.
- With the display, see Figure B-8.

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.

3.5 Performing meter validation

To perform meter validation:

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

   Note that all three meter factors are independent:

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

   Therefore, to adjust volume flow, you must set the meter factor for volume flow. Setting a meter factor for mass flow and a meter factor for density will not produce the desired result. The volume flow calculations are based on original mass flow and density values, before the corresponding meter factors have been applied.

2. Calculate the meter factor as follows:

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

   b. Measure the sample using an external standard.

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

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

   If you are calculating the volume flow meter factor, note that proving volume in the field may be expensive, and the procedure may be hazardous for some process fluids. Therefore, because volume is inversely proportional to density, an alternative to direct sampling and measurement is to calculate the volume flow meter factor from the density meter factor. This method provides partial correction by adjusting for any portion of the total offset that is caused by density measurement offset. Use this method only when a volume flow reference is not available, but a density reference is available. To use this method:

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

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

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

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

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

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

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:

$$\text{MeterFactor}_{\text{MassFlow}} = 1 \times \frac{250}{250.27} = 0.9989$$

The first mass flow meter factor is 0.9989.

One year later, the flowmeter is proved again. The flowmeter mass measurement is 250.07 lb; the reference device measurement is 250.25 lb. A new mass flow meter factor is determined as follows:

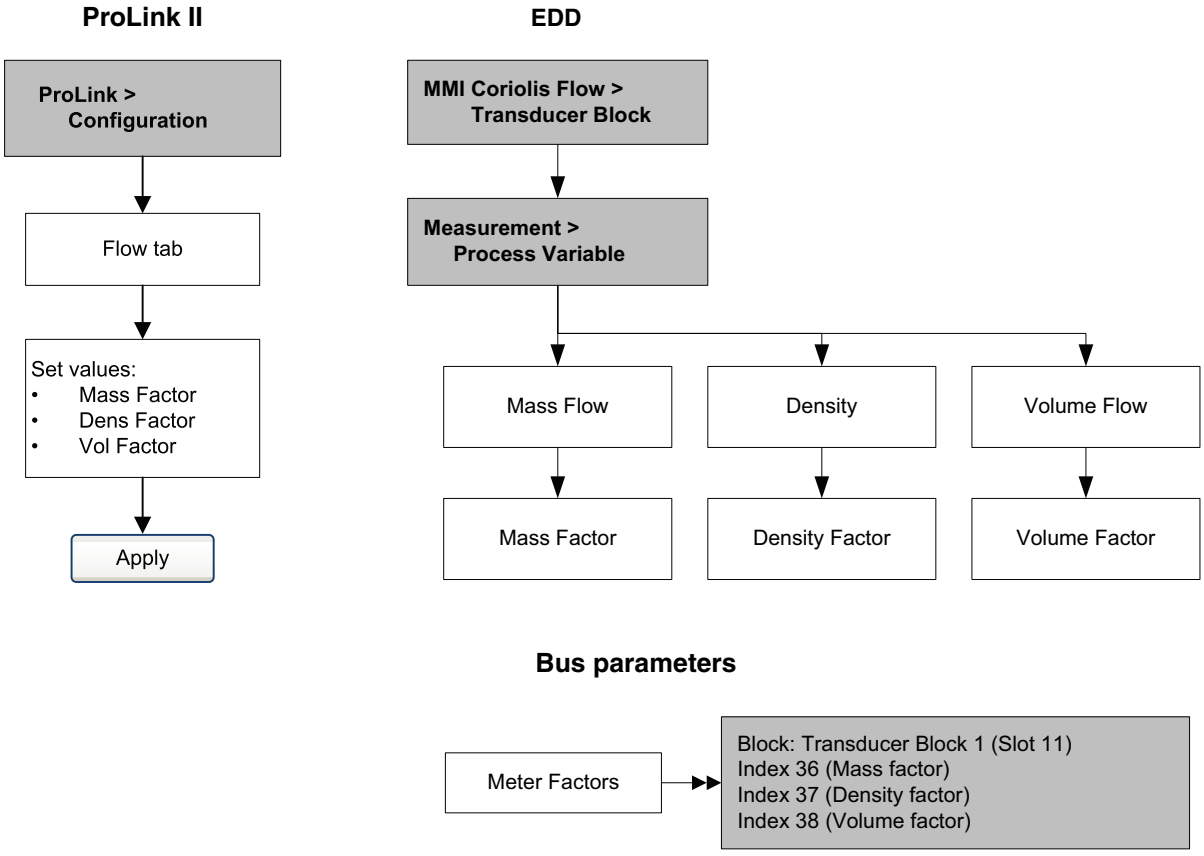
$$\text{MeterFactor}_{\text{MassFlow}} = 0.9989 \times \frac{250.25}{250.07} = 0.9996$$

The new mass flow meter factor is 0.9996.

To adjust meter factors:

- With the EDD, bus parameters, or ProLink II, refer to the menu flowcharts in Figure 3-8.
- With the display, refer to the menu flowchart in Figure B-12.

Figure 3-8 Adjusting meter factors



3.6 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 length 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 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.

If the transmitter is connected to an enhanced core processor, there are two recovery functions that may be used if the zero procedure fails:

- 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 – Always available via all configuration tools.

Note: If the flowmeter fails the zeroing procedure twice, refer to Section 6.6.

3.6.1 Preparing for the zeroing procedure

To prepare for the zeroing 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 and the flow through the sensor has completely stopped.



If fluid is flowing through the sensor, the sensor zero calibration may be inaccurate, resulting in inaccurate process measurement. To improve the sensor zero calibration and measurement accuracy, ensure that process flow through the sensor has completely stopped.

3.6.2 Zeroing procedure

To zero the flowmeter:

- With the EDD, refer to the menu flowchart in Figure 3-9.
- With bus parameters, refer to the menu flowchart in Figure 3-10.
- With ProLink II, refer to the menu flowchart in Figure 3-11.
- With the display, refer to the menu flowchart in Figure B-17.

Figure 3-9 **Zeroing procedure – EDD**

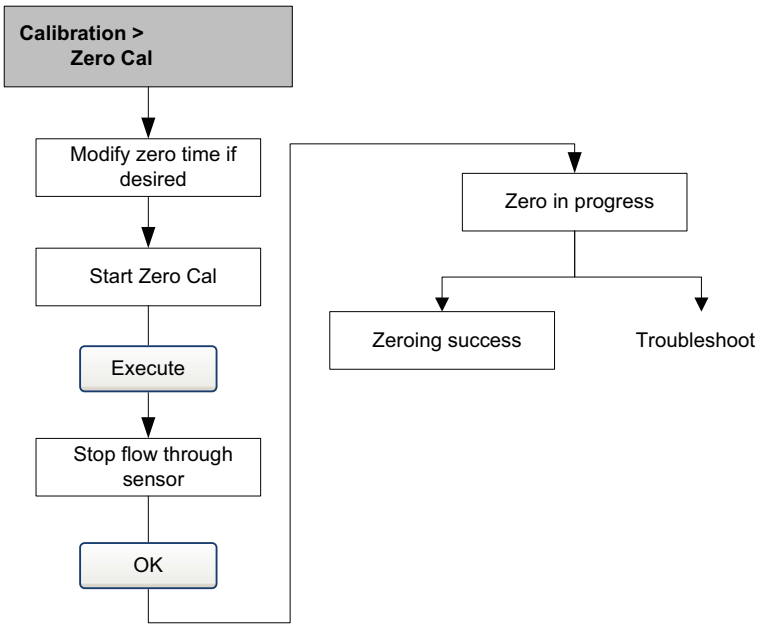


Figure 3-10 **Zeroing procedure – Bus parameters**

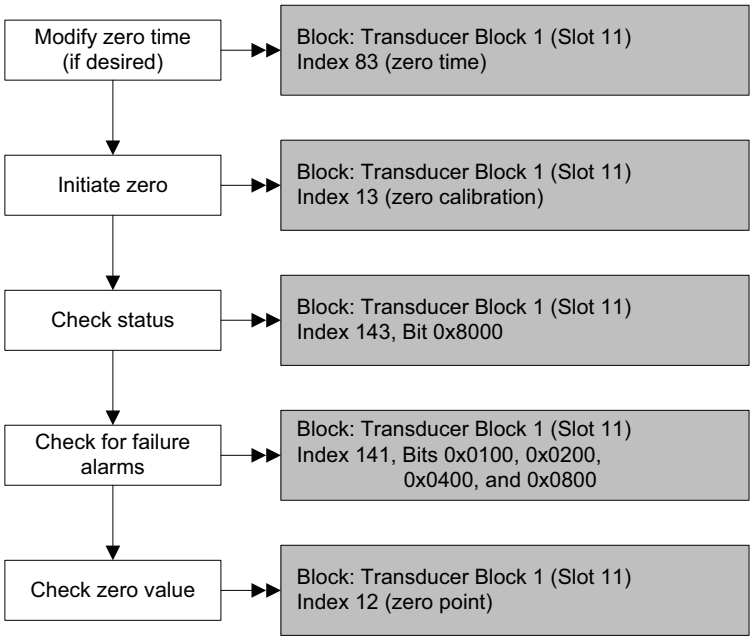
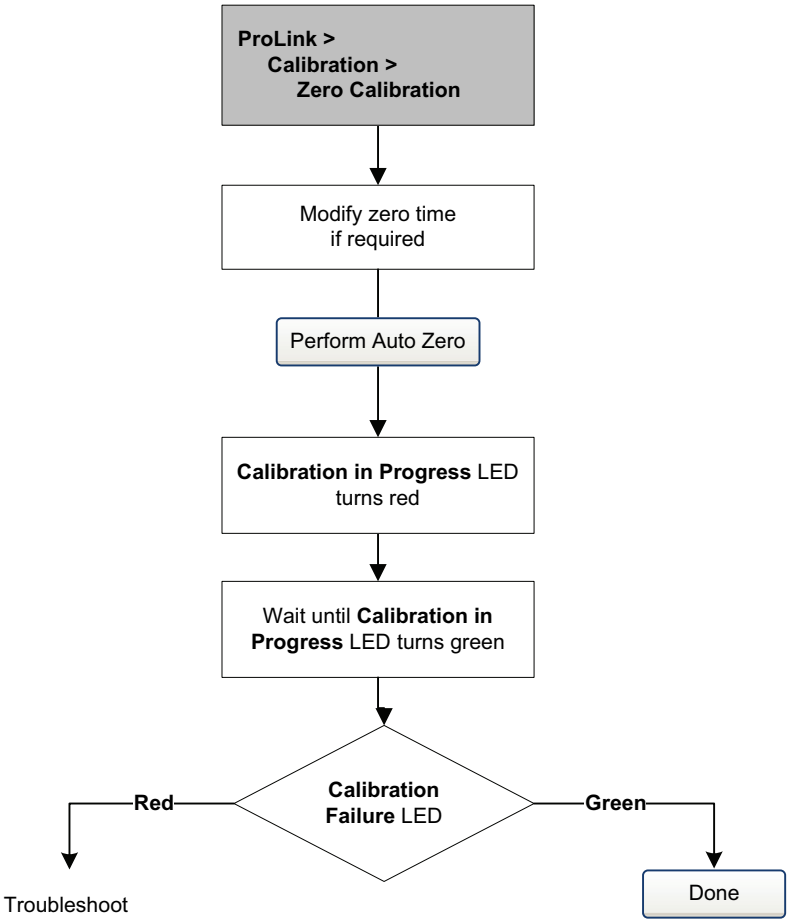


Figure 3-11 **Zeroing procedure – ProLink II**



3.7 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 calibrations:

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

The calibrations 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.

3.7.1 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.



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

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

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

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

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

3.7.2 Density calibration procedure

To perform a D1 and D2 density calibration, refer to the menu flowcharts Figures 3-12, 3-13, and 3-14.

To perform a D3 or a D3-and-D4 density calibration, refer to the menu flowcharts in Figures 3-15, 3-16, and 3-17.

Figure 3-12 **D1 and D2 density calibration – EDD**

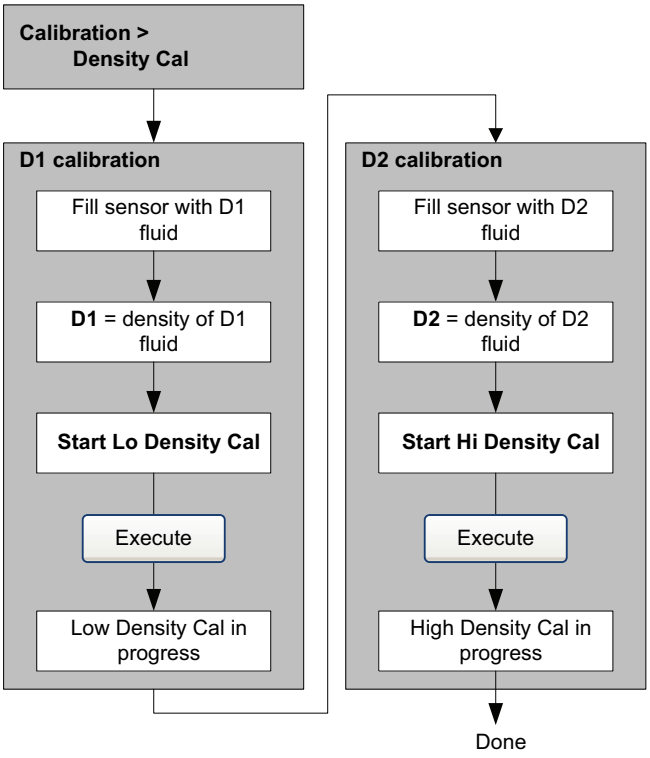


Figure 3-13 **D1 and D2 density calibration – Bus parameters**

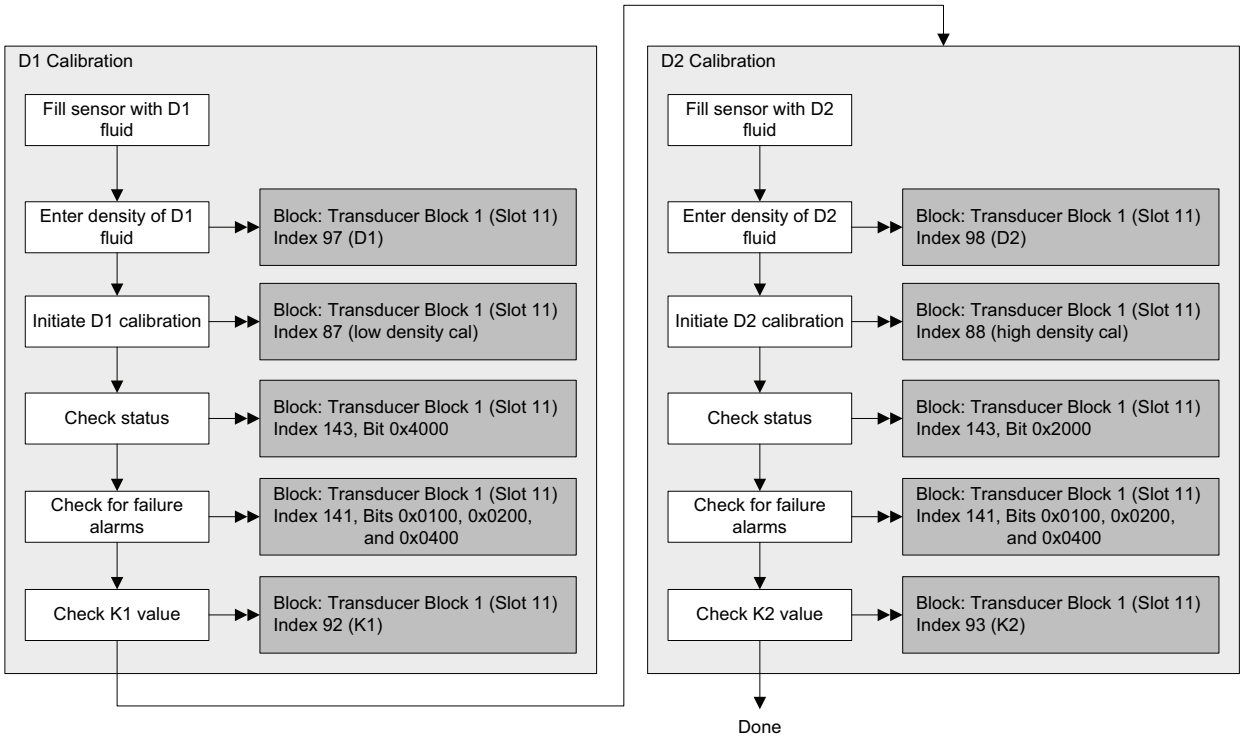


Figure 3-14 D1 and D2 density calibration – ProLink II

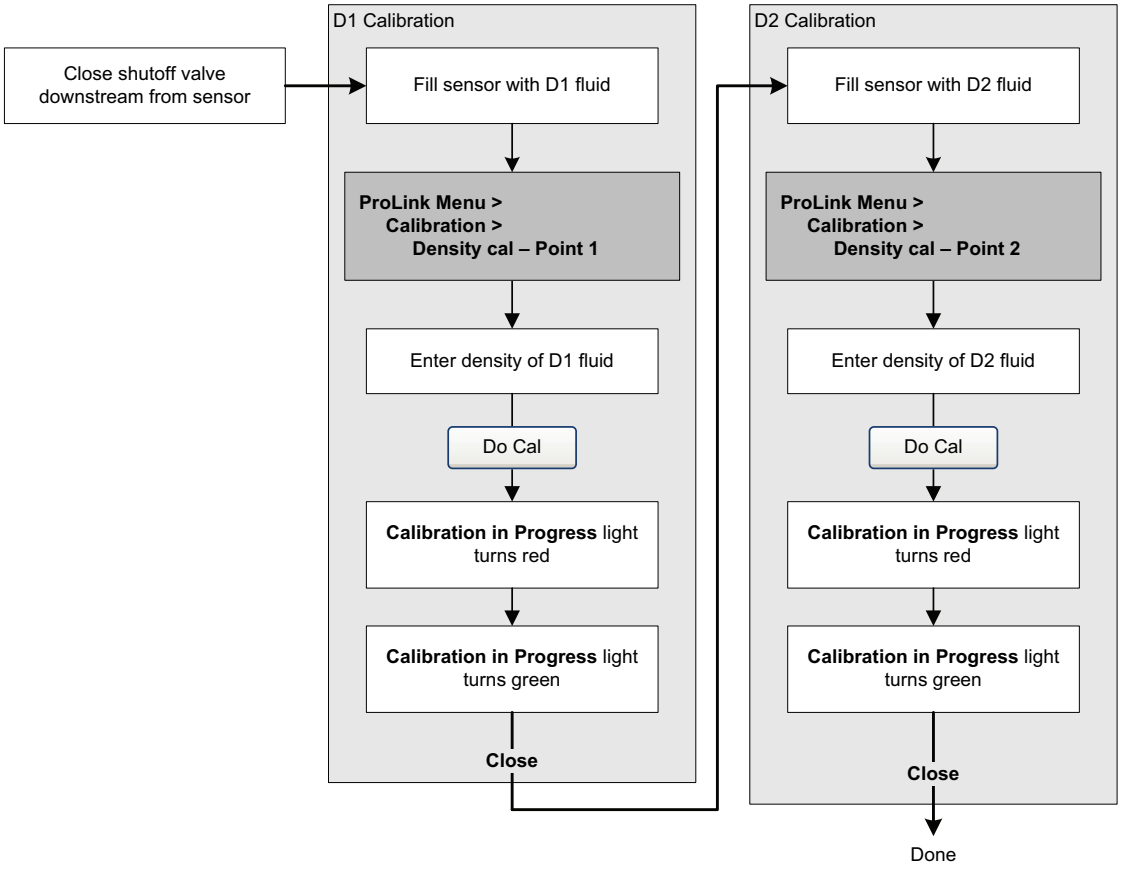


Figure 3-15 **D3 or D3-and-D4 density calibration – EDD**

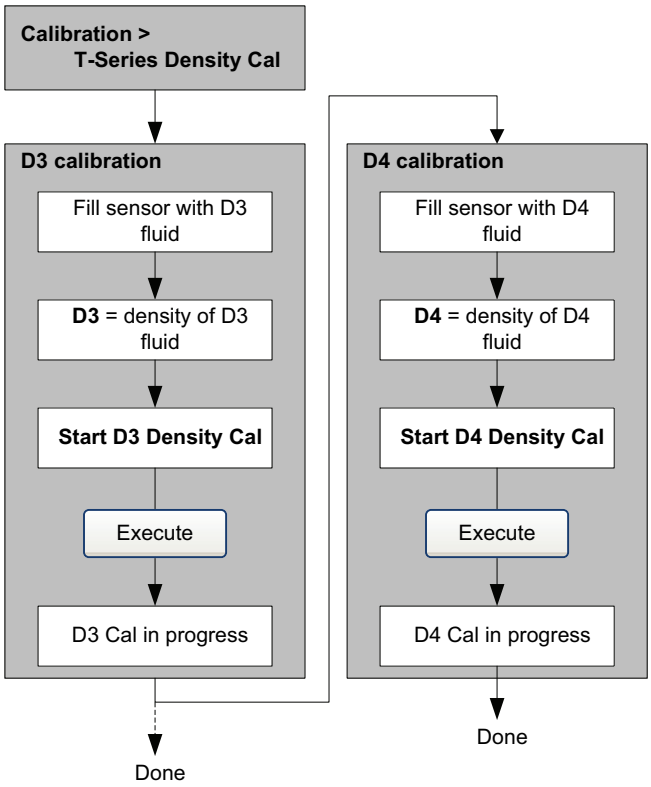


Figure 3-16 **D3 or D3-and-D4 density calibration – Bus parameters**

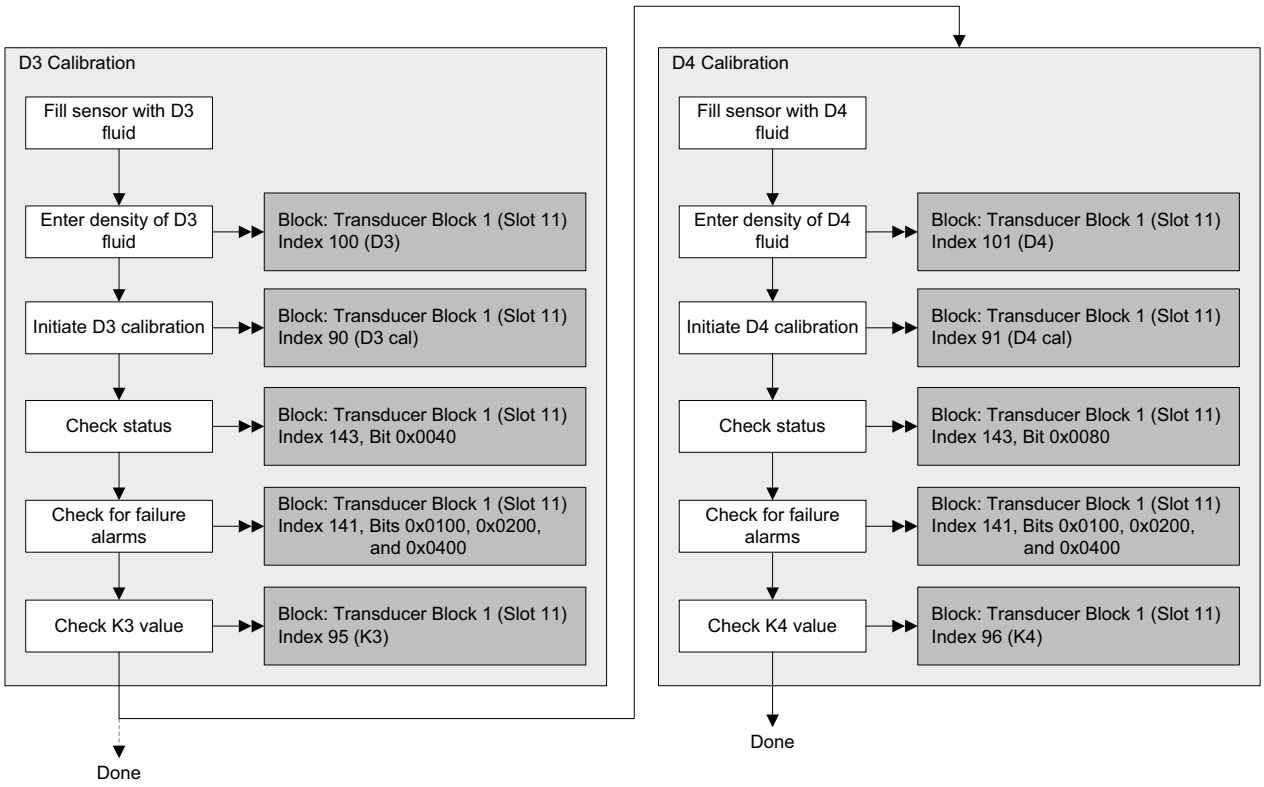
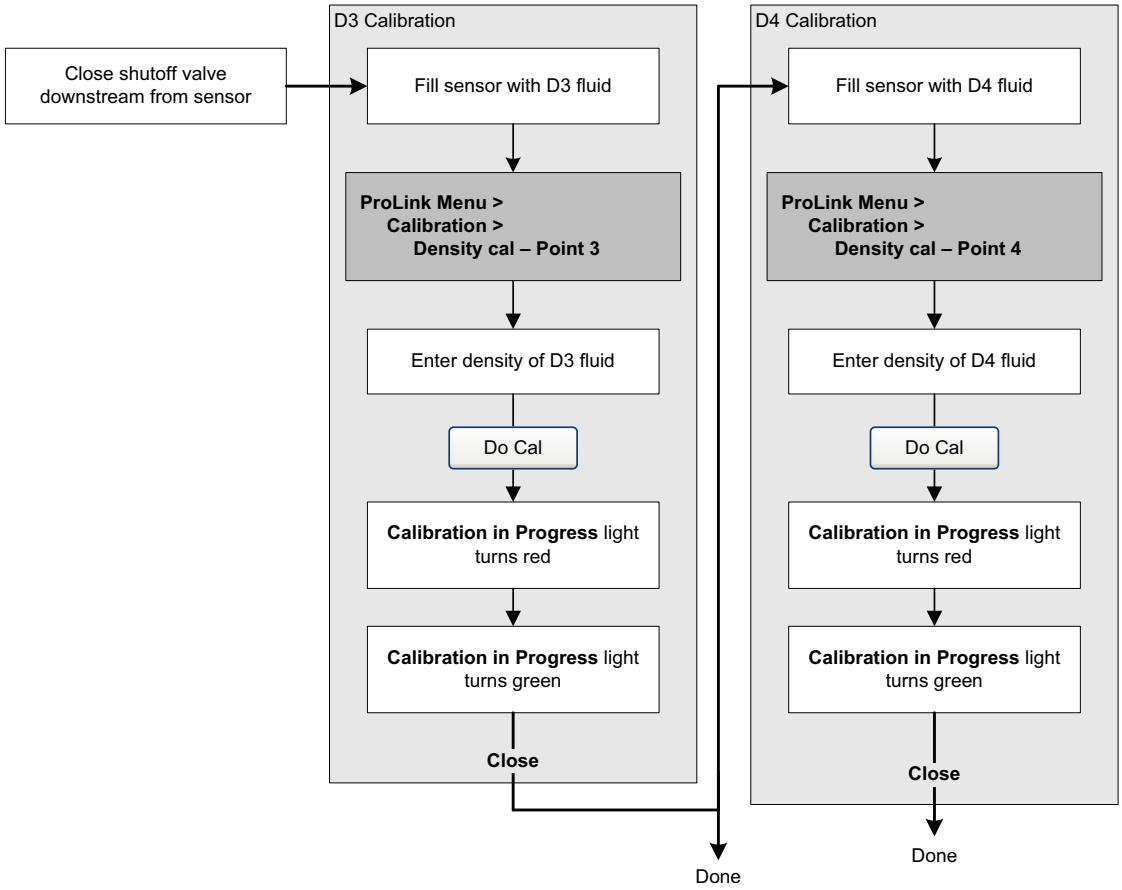


Figure 3-17 **D3 or D3-and-D4 density calibration – ProLink II**

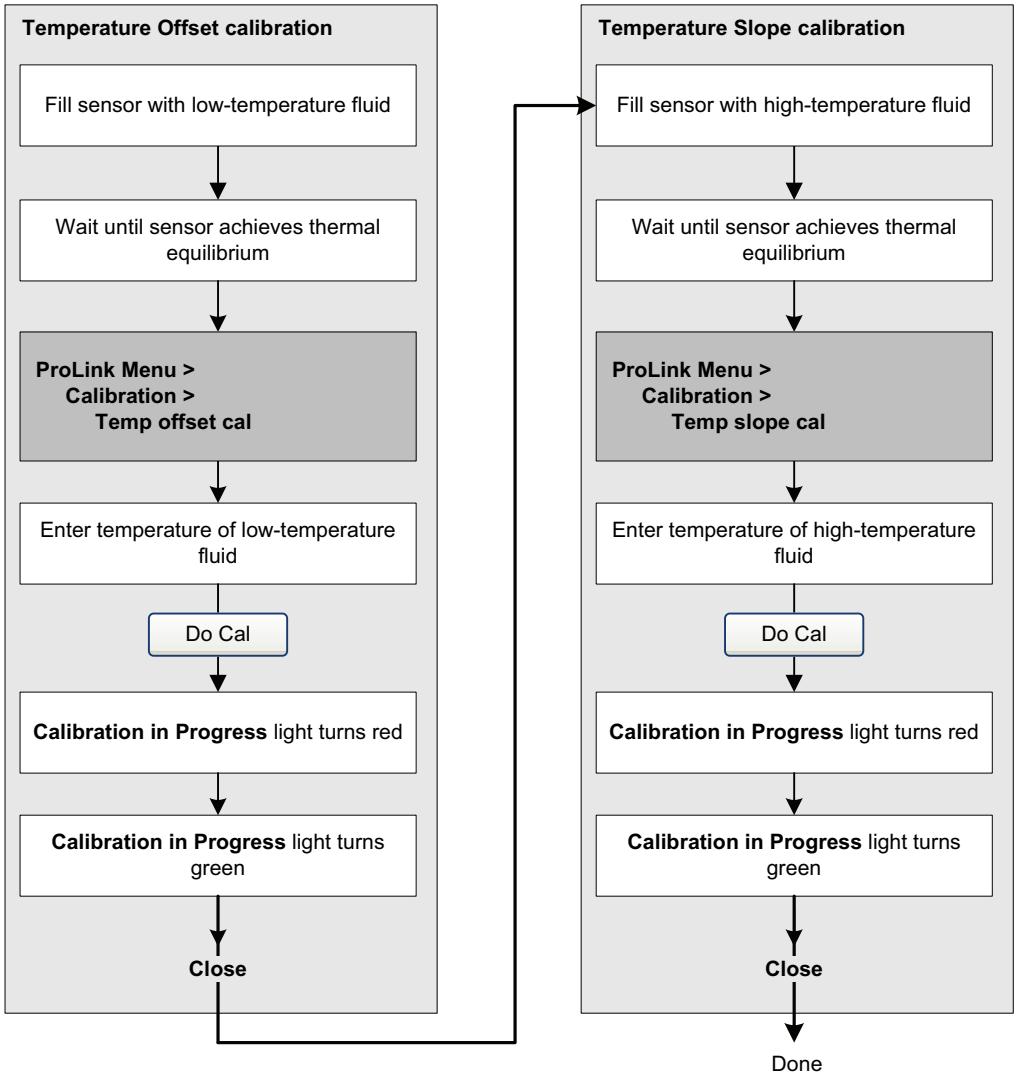


3.8 Performing temperature calibration

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

To perform a temperature calibration, you must use ProLink II. Refer to the menu flowchart in Figure 3-18.

Figure 3-18 **Temperature calibration – ProLink II**



Chapter 4
Configuration

4.1 Overview

This section describes how to change the operating settings of the transmitter.

Note: All procedures provided in this chapter assume that you have established communication with the transmitter and that you are complying with all applicable safety requirements. See Appendix C or the documentation for your PROFIBUS host or configuration tool.

4.2 Default target mode

The default target mode for all blocks is Auto. It is not necessary to set blocks to OOS mode before changing the parameters described in this chapter.

4.3 Configuration map

Use the map in Table 4-1 to guide you through a complete or partial configuration of the transmitter.

Table 4-1 Configuration map

	Method			
Topic	**EDD**	**ProLink II**	**Display**	**Section**
Gas standard volume	✔	✔		4.4
Measurement units	✔	✔	✔	4.5
Petroleum measurement application	✔	✔		4.6
Concentration measurement application	✔	✔		4.7
Output scale	✔			4.8
Process alarms	✔			4.9
Alarm severity	✔	✔		4.10
Damping	✔	✔		4.11
Slug flow	✔	✔		4.12
Cutoffs	✔	✔		4.13
Measurement mode	✔	✔		4.14
Sensor parameters	✔	✔		4.15
Display functionality	✔	✔	✔	4.16

4.4 Configuring standard 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. 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 concentration measurement application, liquid volume flow measurement is required.

To configure gas standard volume flow you must:

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

Note: The display will allow you to select a volume measurement unit from the set available for the configured volume flow type, but it will not allow you to configure gas standard volume flow.

Figure 4-1 Enabling and configuring gas standard volume – EDD

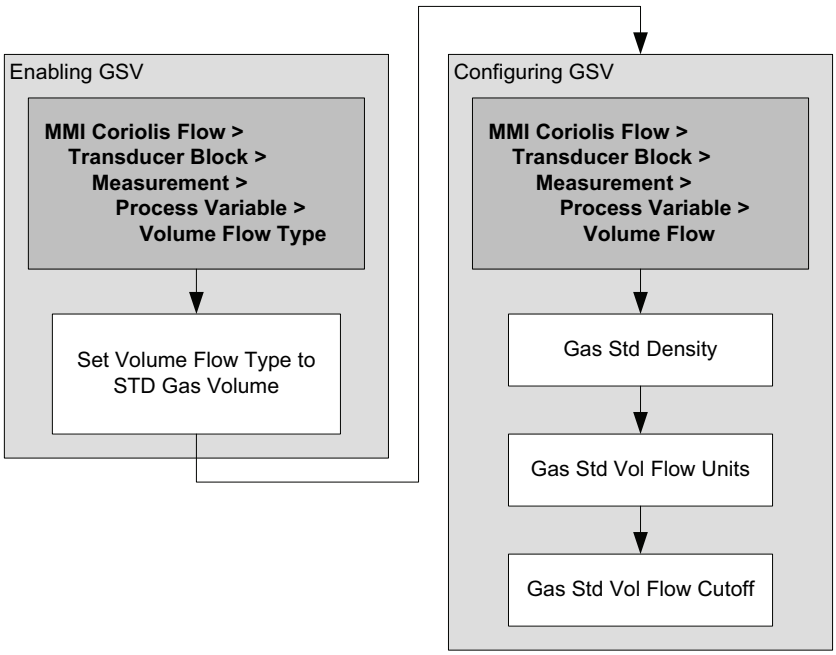


Figure 4-2 Enabling and configuring gas standard volume – Bus parameters

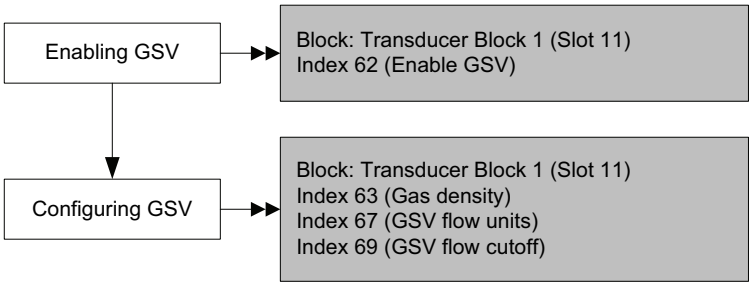
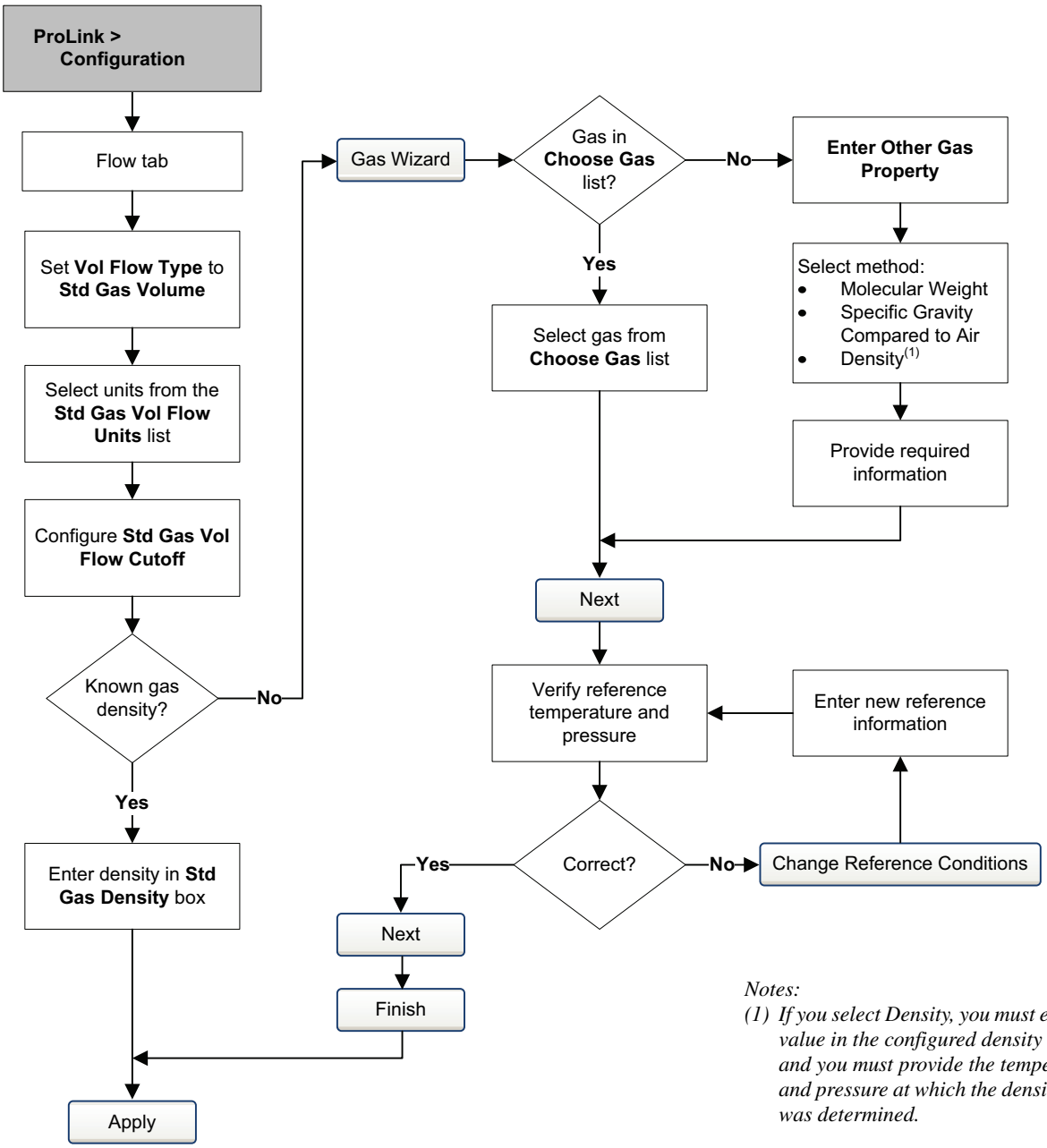


Figure 4-3 Enabling and configuring gas standard volume – ProLink II



Notes:

(1) If you select 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.

4.5 Changing the measurement units

The transmitter is able to store measurement units in two different places: in the transducer block and in the AI blocks. These two units locations are independent and can be set to different values. This affects configuration in the following ways:

- If you are using a PROFIBUS configuration tool or the display, units will be set to match in both the relevant AI block and the transducer block.
- If you are using ProLink II, use the **Function Block** tab to configure units. Although units can be configured on some of the other tabs, doing so may produce unintended results.

Note: Changing the measurement units for a process variable automatically changes the associated totalizer units as well. For example, setting the mass flow units to g/s will automatically set the mass totalizer unit to grams.

Note: Configure the AI block channel before configuring the AI block units. The AI blocks will produce an error if the measurement units are set to a value that is impossible for the configured channel.

To configure measurement units, refer to Tables 4-2 through 4-7 and the flowcharts in Figures 2-1 and 2-3.

Table 4-2 Mass flow measurement units

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

Table 4-3 Volume flow measurement units – Liquid

Volume flow unit			
EDD	**ProLink II**	**Display**	**Unit description**
CFS	ft3/sec	CUFT/S	Cubic feet per second
CFM	ft3/min	CUF/MN	Cubic feet per minute
CFH	ft3/hr	CUFT/H	Cubic feet per hour
ft^3/d	ft3/day	CUFT/D	Cubic feet per day
m^3/s	m3/sec	M3/S	Cubic meters per second
m^3/min	m3/min	M3/MIN	Cubic meters per minute
m^3/h	m3/hr	M3/H	Cubic meters per hour
m^3/d	m3/day	M3/D	Cubic meters per day
gal/s	US gal/sec	USGPS	U.S. gallons per second
GPM	US gal/min	USGPM	U.S. gallons per minute
gal/h	US gal/hr	USGPH	U.S. gallons per hour
gal/d	US gal/d	USGPD	U.S. gallons per day
Mgal/d	mil US gal/day	MILG/D	Million U.S. gallons per day
L/s	l/sec	L/S	Liters per second
L/min	l/min	L/MIN	Liters per minute
L/h	l/hr	L/H	Liters per hour
ML/d	mil l/day	MILL/D	Million liters per day
ImpGal/s	Imp gal/sec	UKGPS	Imperial gallons per second
ImpGal/min	Imp gal/min	UKGPM	Imperial gallons per minute
ImpGal/h	Imp gal/hr	UKGPH	Imperial gallons per hour
ImpGal/d	Imp gal/day	UKGPD	Imperial gallons per day
bbl/s	barrels/sec	BBL/S	Barrels per second(1)
bbl/min	barrels/min	BBL/MN	Barrels per minute(1)
bbl/h	barrels/hr	BBL/H	Barrels per hour(1)
bbl/d	barrels/day	BBL/D	Barrels per day(1)
—	Beer barrels/sec	BBBL/S	Beer barrels per second(2)
—	Beer barrels/min	BBBL/MN	Beer barrels per minute(2)
—	Beer barrels/hr	BBBL/H	Beer barrels per hour(2)
—	Beer barrels/day	BBBL/D	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 4-4 Volume flow measurement units – Gas

Volume flow unit			
EDD	**ProLink II**	**Display**	**Unit description**
Nm^3/s	Nm3/sec	NM3/S	Normal cubic meters per second
Nm^3/m	Nm3/min	NM3/MN	Normal cubic meters per minute
Nm^3/h	Nm3/hr	NM3/H	Normal cubic meters per hour

Table 4-4 Volume flow measurement units – Gas (continued)

Volume flow unit			
EDD	**ProLink II**	**Display**	**Unit description**
Nm^3/d	Nm3/day	NM3/D	Normal cubic meters per day
NL/s	NLPS	NLPS	Normal liter per second
NL/m	NLPM	NLPM	Normal liter per minute
NL/h	NLPH	NLPH	Normal liter per hour
NL/d	NLPD	NLPD	Normal liter per day
SCFS	SCFS	SCFS	Standard cubic feet per second
SCFM	SCFM	SCFM	Standard cubic feet per minute
SCFH	SCFH	SCFH	Standard cubic feet per hour
SCFD	SCFD	SCFD	Standard cubic feet per day
Sm^3/s	Sm3/S	SM3/S	Standard cubic meters per second
Sm^3/m	Sm3/min	SM3/MN	Standard cubic meters per minute
Sm^3/h	Sm3/hr	SM3/H	Standard cubic meters per hour
Sm^3/d	Sm3/day	SM3/D	Standard cubic meters per day
SL/s	SLPS	SLPS	Standard liter per second
SL/m	SLPM	SLPM	Standard liter per minute
SL/h	SLPH	SLPH	Standard liter per hour
SL/d	SLPD	SLPD	Standard liter per day

Table 4-5 Density measurement units

Density unit			
EDD	**ProLink II**	**Display**	**Unit description**
g/cm^3	g/cm3	G/CM3	Grams per cubic centimeter
g/L	g/l	G/L	Grams per liter
g/ml	g/ml	G/ML	Grams per milliliter
kg/L	kg/l	KG/L	Kilograms per liter
kg/m^3	kg/m3	KG/M3	Kilograms per cubic meter
lb/gal	lbs/Usgal	LB/GAL	Pounds per U.S. gallon
lb/ft^3	lbs/ft3	LB/CUF	Pounds per cubic foot
lb/in^3	lbs/in3	LB/CUI	Pounds per cubic inch
$STon/yd^3$	sT/yd3	ST/CUY	Short ton per cubic yard
degAPI	degAPI	D API	Degrees API
SGU	SGU	SGU	Specific gravity unit (not temperature corrected)

Table 4-6 Temperature measurement units

Temperature unit			
PROFIBUS-PA	**ProLink II**	**Display**	**Unit description**
°C	°C	°C	Degrees Celsius
°F	°F	°F	Degrees Fahrenheit
°R	°R	°R	Degrees Rankine
K	°K	°K	Kelvin

Although pressure units are listed in Table 4-7, the transmitter does not measure pressure. These units are for configuring external pressure compensation. Refer to Section 2.7.

Table 4-7 Pressure measurement units

Pressure unit			
EDD	**ProLink II**	**Display**	**Unit description**
ft H20 @68 DegF	Ft Water @ 68°F	FTH2O	Feet water @ 68 °F
inch H2O @4 DegC	In Water @ 4°C	INW4C	Inches water @ 4 °C
inch H20 @68 DegF	In Water @ 68°F	INH2O	Inches water @ 68 °F
mm H2O @4 DegC	mm Water @ 4°C	mmW4C	Millimeters water @ 4 °C
mm H20 @68 DegF	mm Water @ 68°F	mmH2O	Millimeters water @ 68 °F
inch Hg @0 DegC	In Mercury @ 0°C	INHG	Inches mercury @ 0 °C
mm Hg @0 DegC	mm Mercury @ 0°C	mmHG	Millimeters mercury @ 0 °C
psi	PSI	PSI	Pounds per square inch
bar	bar	BAR	Bar
millibar	millibar	mBAR	Millibar
g_per_cm2	g/cm2	G/SCM	Grams per square centimeter
kg_per_cm2	kg/cm2	KG/SCM	Kilograms per square centimeter
Pa	pascals	PA	Pascals
MegaPa	megapascals	MPA	Megapascals
KiloPa	Kilopascals	KPA	Kilopascals
torr @0 DegC	Torr @ 0C	TORR	Torr @ 0 °C
atm	atms	ATM	Atmospheres

4.6 Configuring the petroleum measurement application

The *petroleum measurement parameters* determine the values that will be used in petroleum measurement-related calculations. The petroleum measurement 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 petroleum measurement process variables, ensure that liquid volume flow measurement is specified. See Section 4.4.

4.6.1 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.

Petroleum measurement 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 *5x*, *6x*, *23x*, or *24x* table, the default reference temperature is 60 °F, and cannot be changed.
  - If you specify a *53x* or *54x* 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 4-8 summarizes these options.

Table 4-8 Petroleum measurement 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

4.6.2 Configuration procedure

The petroleum measurement configuration parameters are listed and defined in Table 4-9.

Table 4-9 Petroleum measurement 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 *Petroleum measurement 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.

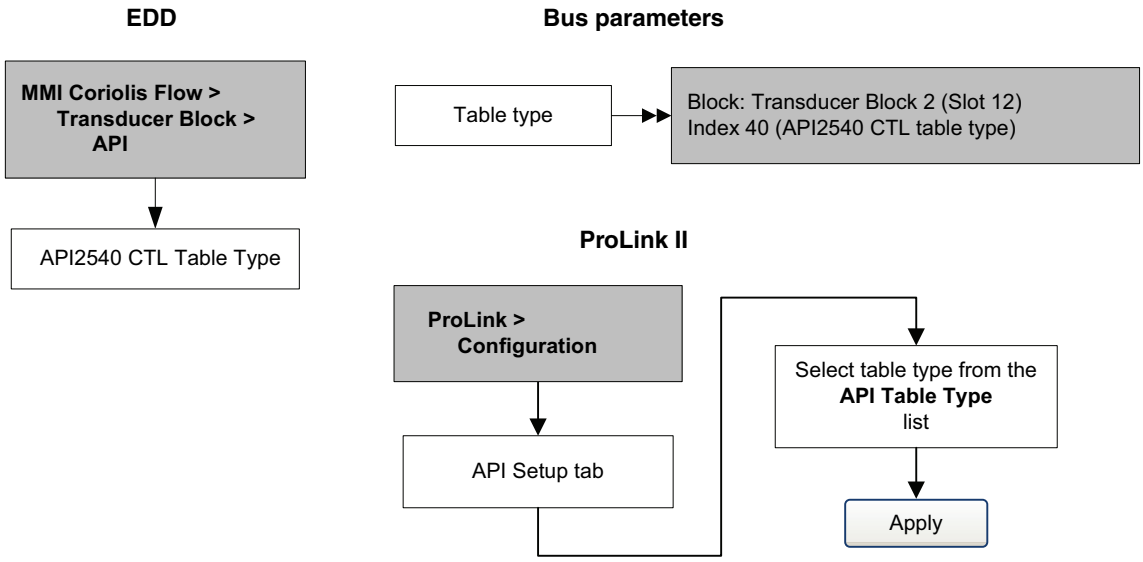
(1) Configurable if Table Type is set to 6C, 24C, or 54C.

(2) In most cases, the temperature unit used by the petroleum measurement reference table should also be the temperature unit configured for the transmitter to use in general processing. To configure the temperature unit, see Section 4.5.

Setting the table type

To set the petroleum measurement table type, refer to the flowcharts in Figure 4-4.

Figure 4-4 **Setting the petroleum measurement table type**



Setting the reference temperature

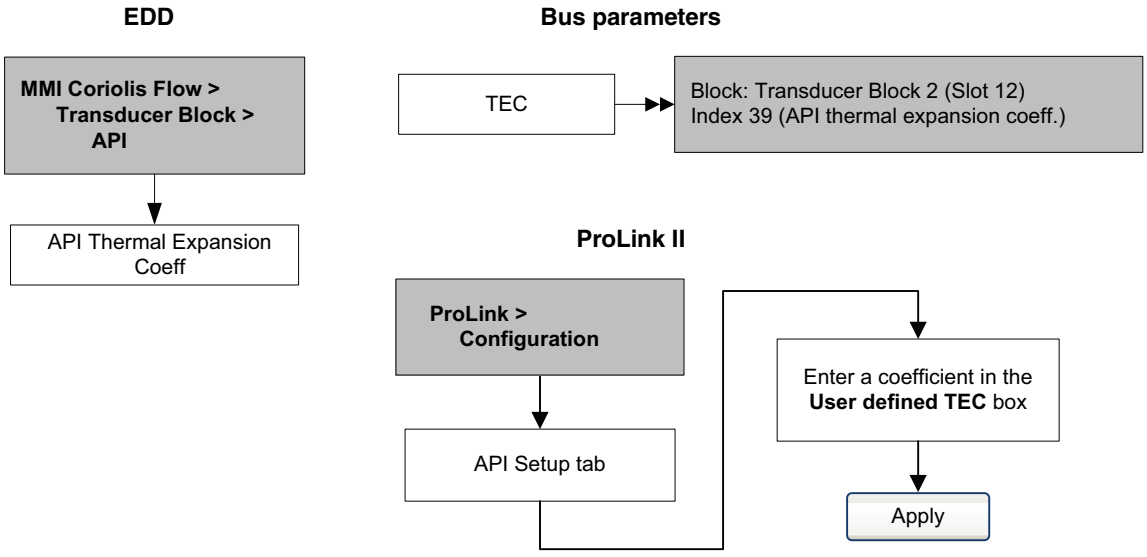
For the temperature value to be used in CTL calculation, you can use the temperature data from the sensor, or you can configure external temperature compensation to use temperature data from an external temperature device.

- To use temperature data from the sensor, no action is required.
- To configure external temperature compensation, see Section 2.8.

Setting the thermal expansion coefficient

If the CTL derivation method for the petroleum measurement table type is method 2, you need to set the thermal expansion coefficient (TEC). To set a user-defined TEC, refer to the flowcharts in Figure 4-5.

Figure 4-5 **Setting a user-defined TEC**



4.7 Configuring the concentration measurement application

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

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

Note: The concentration measurement application requires liquid volume measurement units. If you plan to use concentration measurement process variables, ensure that liquid volume flow measurement is specified. See Section 4.4.

4.7.1 About the concentration measurement application

The concentration measurement calculation requires a concentration measurement curve, which specifies the relationship between temperature, concentration, and density for the process fluid being measured. Micro Motion supplies a set of six standard concentration measurement curves (see Table 4-10). 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 concentration measurement process variables (see Table 4-11). The available concentration measurement 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 a concentration measurement 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 4-11.

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 4-10 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 4-10 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 4-11 Derived variables and available process variables

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
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 4-11 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	✓	✓	✓	✓		

4.7.2 Configuration procedure

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

Note: The concentration measurement manual uses ProLink II as the standard configuration tool for the concentration measurement application. Because the PROFIBUS parameters are very similar to the ProLink II labels, you can follow the instructions for ProLink II and adapt them to your host. All of the parameters related to the concentration measurement application can be found in Transducer Block 2 (Slot 12).

The typical configuration procedure simply sets up the concentration measurement 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 4-10).
2. Set the transmitter's temperature measurement unit to match the unit used by the curve (as listed in Table 4-10).
3. Set the derived variable to Mass Conc (Dens).
4. Specify the active curve.

4.8 Changing the output scale

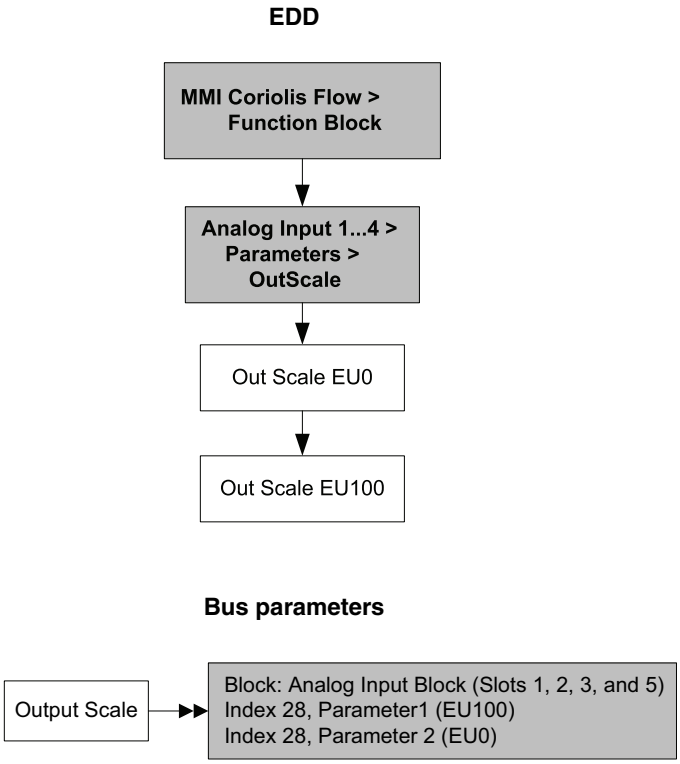
The AI function blocks can be configured to scale their output. The output scale is established by defining a process variable value at 0% of scale and at 100% of scale. The output of the AI block will be translated to a value between these two limits.

If you choose to use output scaling, note that it has no effect on the process values found in the transducer block. This results in the following behaviors:

- ProLink II and the display use the process values in the transducer block. Therefore, the output of a scaled AI block may differ from the value reported by other communication tools.
- Slug flow and flow cutoffs are configured in the transducer block. Therefore, output scaling has no effect on the behavior of the transmitter with regard to slug flow or flow cutoffs.

To change the output scale, refer to the flowcharts in Figure 4-6.

Figure 4-6 Changing the output scale



4.9 Changing process alarms

The transmitter uses *process alarms* to indicate that a process value has exceeded its user-defined limits. The transmitter maintains four alarm values for each process variable. In addition, the transmitter has an alarm hysteresis function to prevent erratic alarm reports.

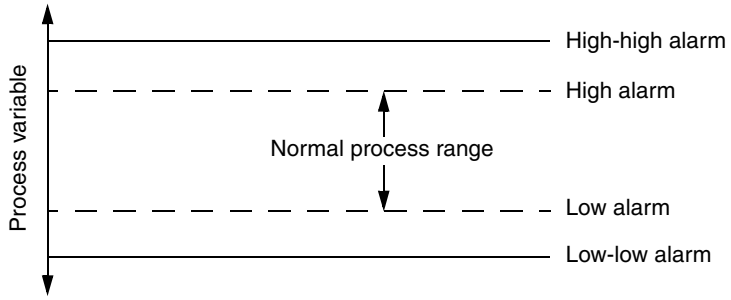
Note: Process alarms are only posted through the AI function blocks and totalizer blocks and are not shown on the display or in ProLink II.

4.9.1 Alarm values

The *process alarm values* are the limits for process variables. Whenever a process variable exceeds a process alarm value, the alarm will be reflected in the "Alarm Summary" parameters in each block.

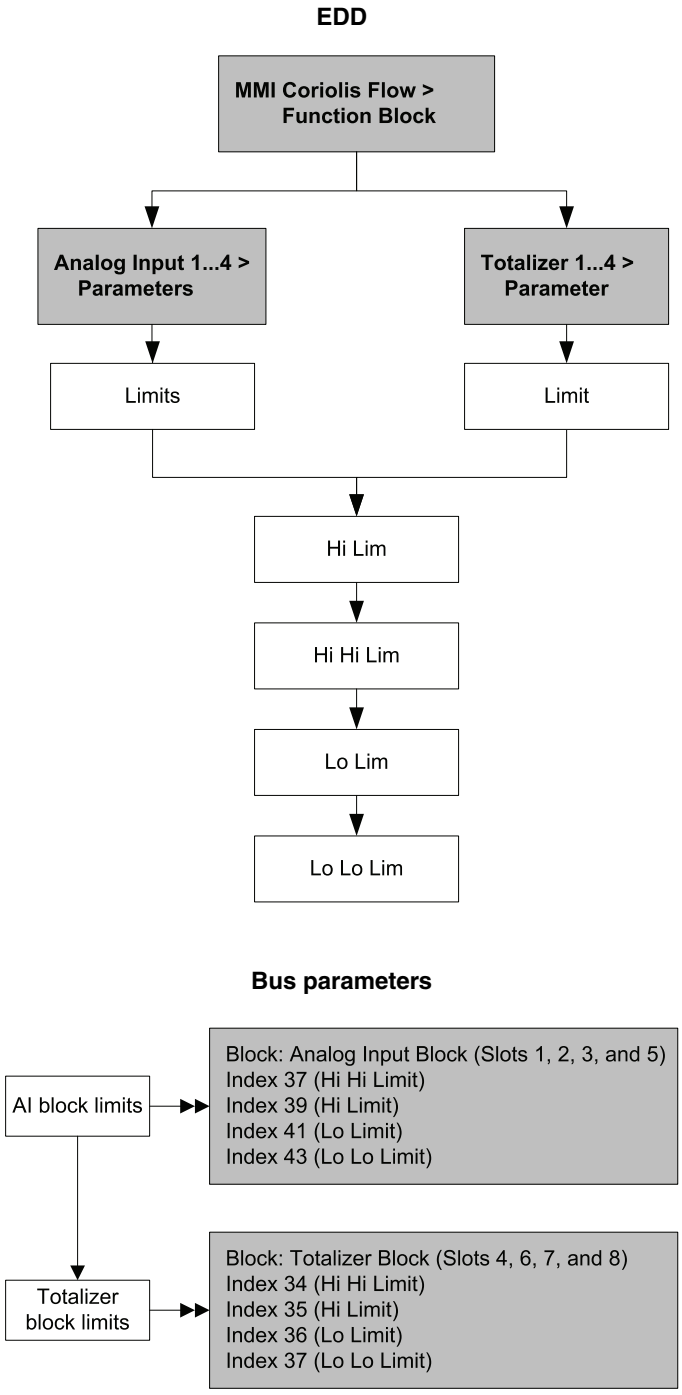
Each AI function block and totalizer block has four process alarm limits: high alarm, high-high alarm, low alarm, and low-low alarm. See Figure 4-7. The high and low process alarm values represent normal process limits. The high-high and low-low process alarm values are used for more complex alarm signals (e.g., to indicate a more severe problem than a regular process alarm indicates).

Figure 4-7 Alarm values



To change the alarm values, refer to the flowcharts in Figure 4-8.

Figure 4-8 Changing alarm values



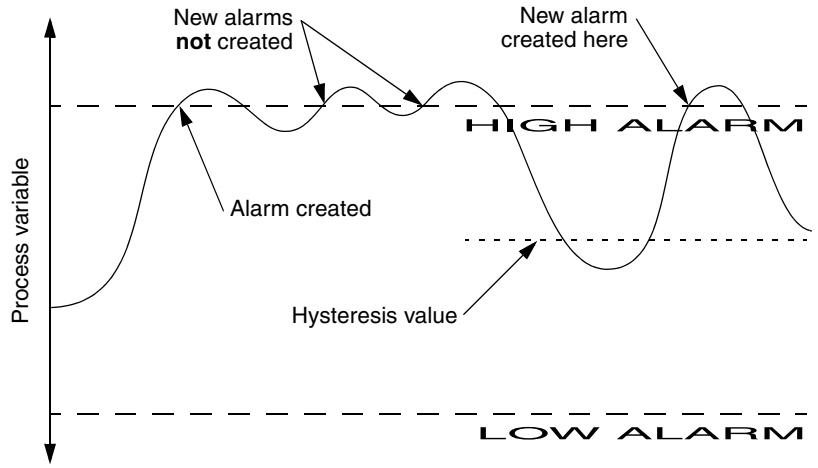
4.9.2 Alarm hysteresis

The *alarm hysteresis* value is a percentage of the output scale. After a process alarm is created, the transmitter will not create new alarms unless the process first returns to a value within the range of the alarm hysteresis percentage. Figure 4-9 shows the transmitter's alarm behavior with an alarm hysteresis value of 50%.

Note the following about hysteresis:

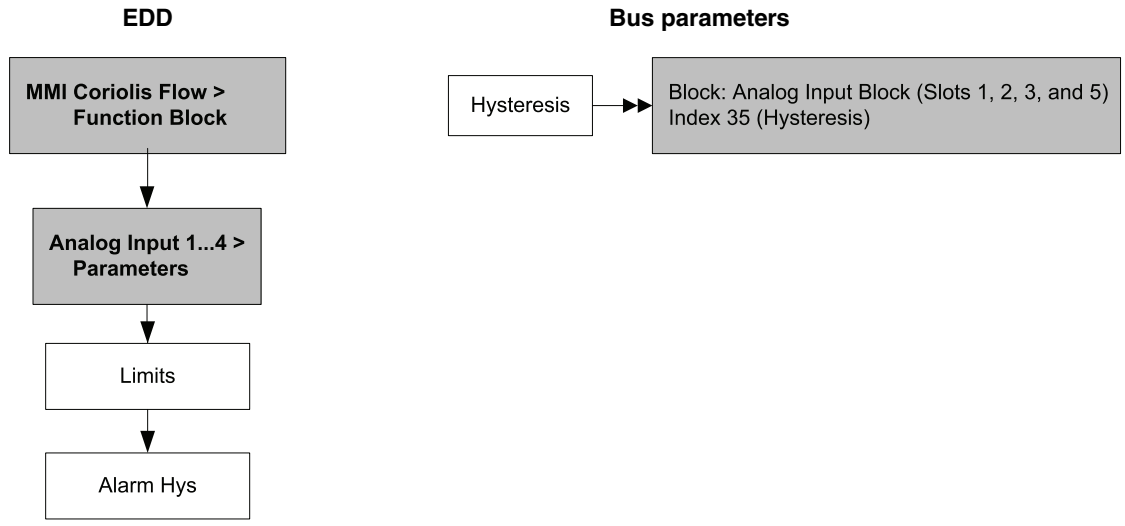
- A low hysteresis value allows the transmitter to broadcast a new alarm every time or nearly every time the process variable crosses over the alarm limit.
- A high hysteresis value prevents the transmitter from broadcasting new alarms unless the process variable first returns to a value sufficiently below the high alarm limit or above the low alarm limit.

Figure 4-9 High versus low alarm hysteresis values



To change the alarm hysteresis value, refer to the flowcharts in Figure 4-10.

Figure 4-10 Changing the alarm hysteresis



4.10 Configuring status alarm severity

The severity level of some status 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.

A list of all status alarms and default severity levels is shown in Table 4-12. (For more information on status alarms, including possible causes and troubleshooting suggestions, see Section 6.8.)

Table 4-12 Status alarms and severity levels

Alarm code	Index	Description	Default severity	Configurable
A001	1	EEPROM checksum	Fault	No
A002	2	RAM error	Fault	No
A003	3	Sensor failure	Fault	Yes
A004	4	Temperature sensor failure	Fault	No
A005	5	Input overrange	Fault	Yes
A006	6	Transmitter not configured	Fault	Yes
A008	8	Density overrange	Fault	Yes
A009	9	Transmitter initializing/warming up	Ignore	Yes
A010	10	Calibration failure	Fault	No
A011	11	Calibration too low	Fault	Yes
A012	12	Calibration too high	Fault	Yes
A013	13	Zero too noisy	Fault	Yes
A014	14	Transmitter failed	Fault	No
A016	16	Line temperature out-of-range	Fault	Yes
A017	17	Meter RTD temperature out-of-range	Fault	Yes
A020	20	Calibration factors unentered	Fault	Yes
A021	21	Incorrect sensor type	Fault	No
A022	22	Configuration corrupt	Fault	Yes
A023	23	Totals corrupt	Fault	Yes
A024	24	CP program corrupt	Fault	Yes
A025	25	Boot sector fault	Fault	Yes
A026	26	Sensor/transmitter communication failure	Fault	No
A028	28	Sensor/transmitter write failure	Fault	No
A029	29	Internal communication failure	Fault	Yes
A030	30	Hardware/software incompatible	Fault	Yes
A031	31	Low power	Fault	No
A032	32	Smart Meter Verification in progress and outputs fixed	Informational	Yes
A033	33	Tube Not Full	Fault	Yes
A034	34	Smart Meter Verification failed	Informational	Yes
A035	35	Smart Meter Verification aborted	Informational	Yes
A102	42	Drive overrange	Informational	Yes

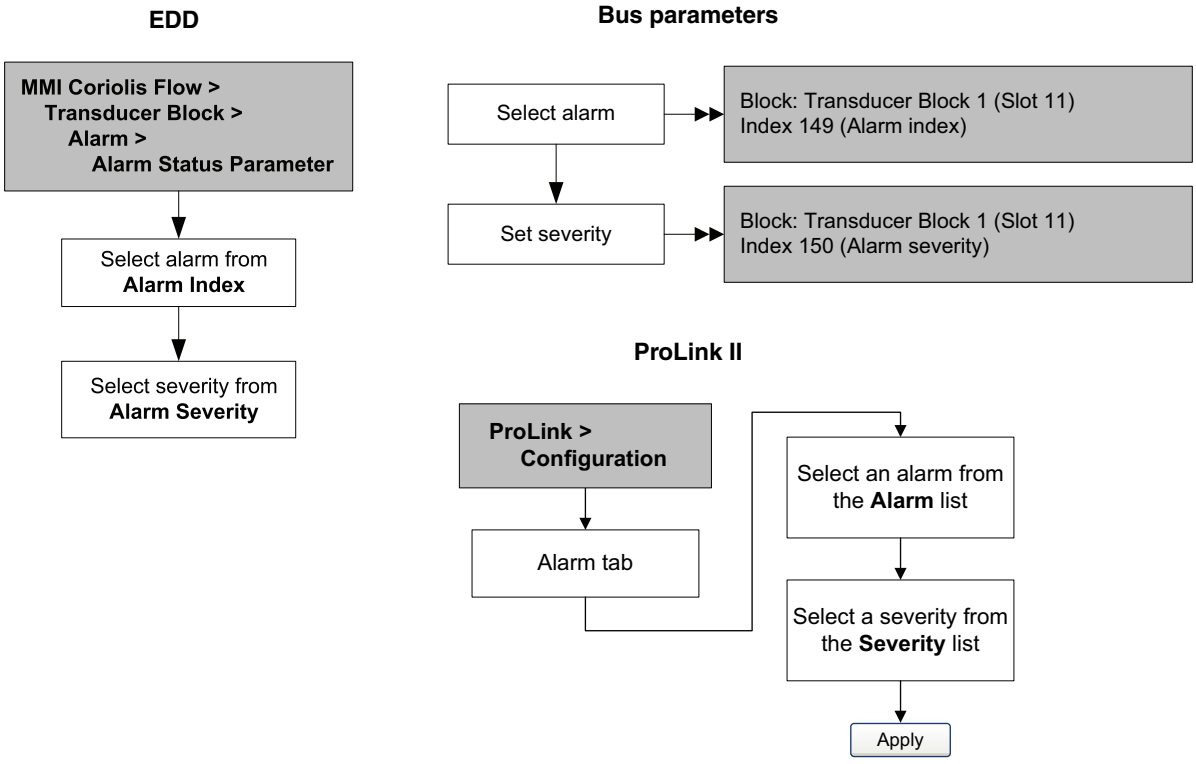
Table 4-12 Status alarms and severity levels (continued)

Alarm code	Index	Description	Default severity	Configurable
A103	43	Data loss possible	Informational	Yes
A104	44	Calibration in progress	Informational(1)	Yes
A105	45	Slug flow	Informational	Yes
A107	47	Power reset occurred	Informational	Yes
A116	56	API temperature outside standard range	Informational	Yes
A117	57	API density out of limits	Informational	Yes
A120	60	Concentration measurement: unable to fit curve data	Informational	No
A121	61	Concentration measurement: extrapolation alarm	Informational	Yes
A131	71	Smart Meter Verification in progress	Informational	Yes
A132	72	Simulation mode active	Informational(1)	Yes

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

To configure status alarm severity, refer to the flowcharts in Figure 4-11. Some configurable alarms can be set to either Informational or Ignore, but not to Fault.

Figure 4-11 Configuring status alarm severity



4.11 Changing the damping values

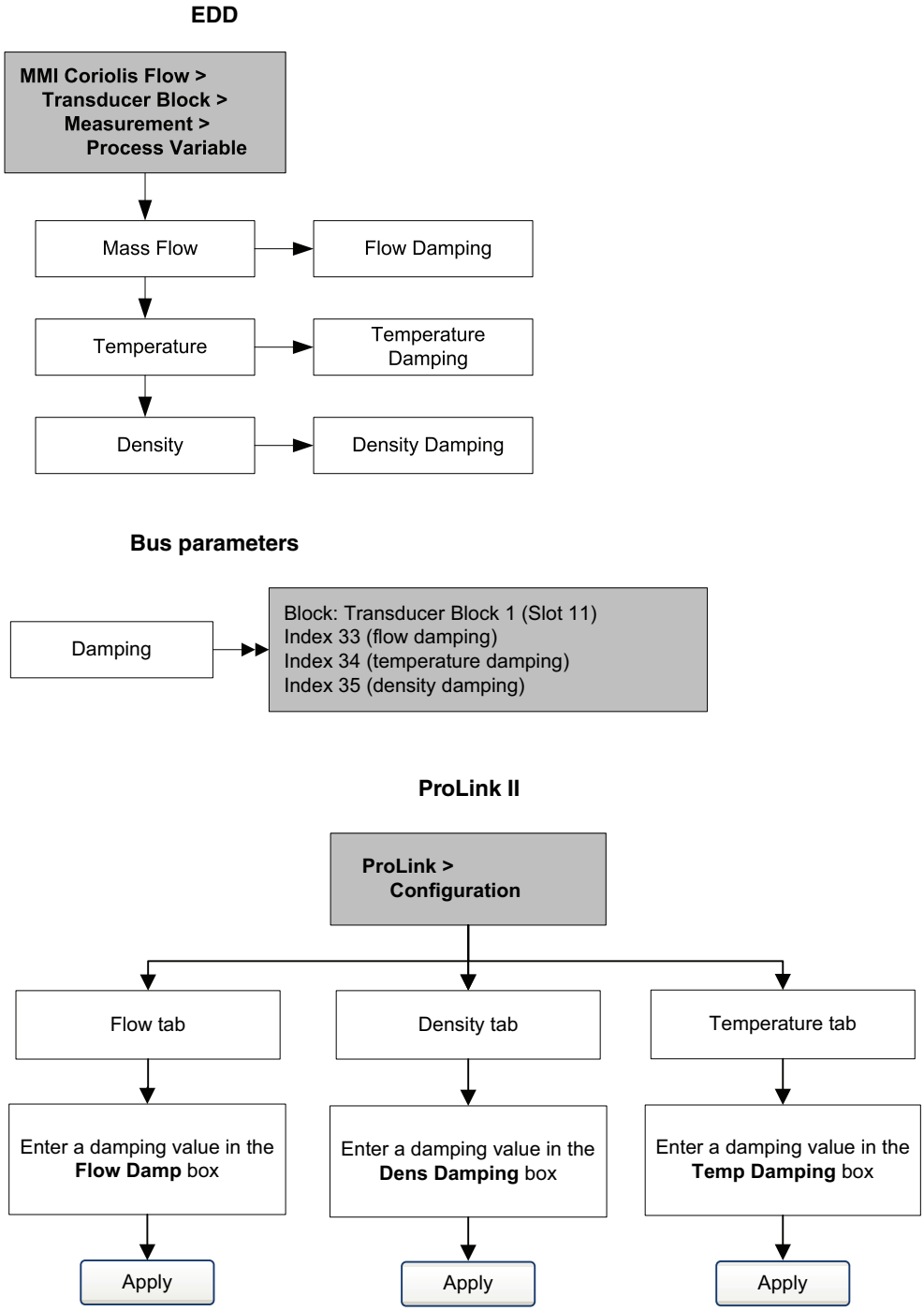
A damping value is a period of time, in seconds, over which the process variable value will change to reflect 63% of the change in the actual process. Damping helps the transmitter smooth out small, rapid measurement fluctuations.

- 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.

To configure damping, refer to the flowcharts in Figure 4-12.

Note: There is also a "damping" parameter in each AI block called AI PV Filter Time (index 32). In order to avoid having two (potentially conflicting) damping values, you should set damping values only in the transducer block. The AI PV Filter Time parameter for each AI block should be set to 0.

Figure 4-12 **Changing the damping values**



When you specify a new damping value, it is automatically rounded down to the nearest valid damping value. Valid damping values are listed in Table 4-13.

Table 4-13 Valid damping values

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

4.11.1 Damping and volume measurement

When configuring damping values, note the following:

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

Be sure to set damping values accordingly.

4.12 Changing 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.

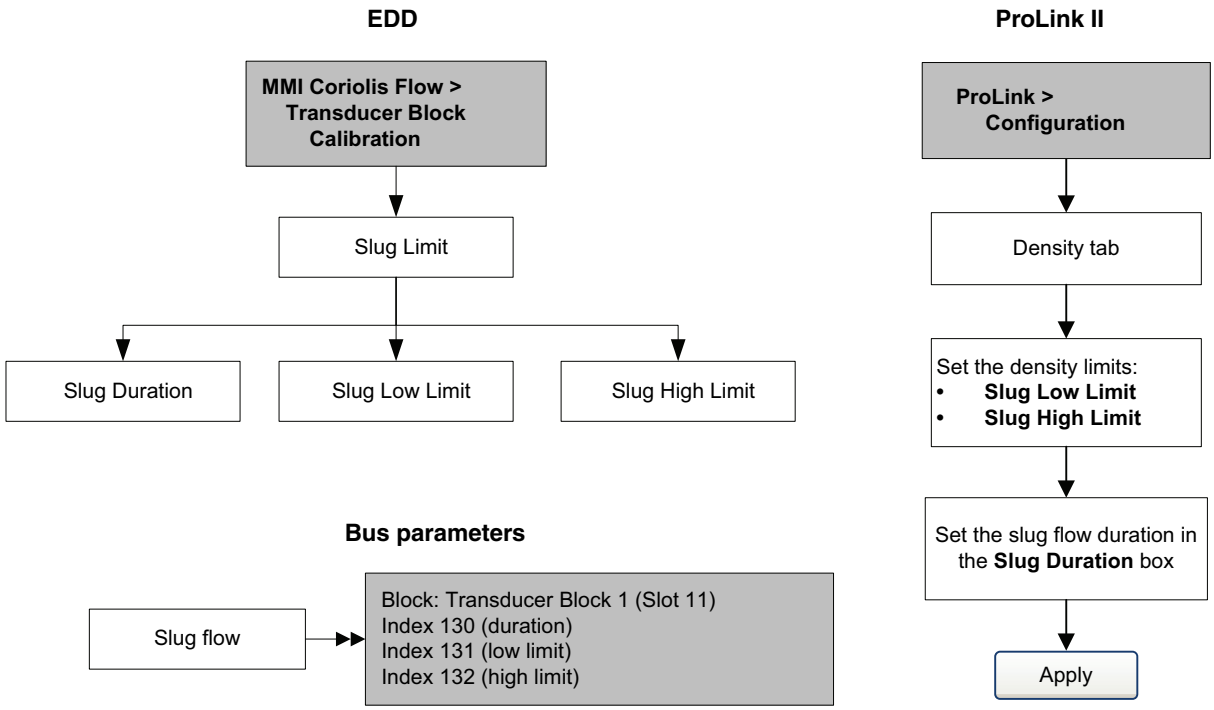
Slug flow parameters are as follows:

- *Low slug flow limit* — the point below which a condition of slug flow will exist. Typically, this is the lowest density you expect to observe for your process. The default value is 0.0 g/cm^3. The valid range is 0.0–10.0 g/cm^3.
- *High slug flow limit* — the point above which a condition of slug flow will exist. Typically, this is the highest density you expect to observe for your process. The default value is 5.0 g/cm^3. The valid range is 0.0–10.0 g/cm^3.
- *Slug flow duration* — the number of seconds the transmitter waits for a slug flow condition to clear. If the transmitter detects slug flow, it will post a slug flow alarm and hold its last "pre-slug" flow rate until the end of the slug flow duration and the measurement quality will be marked "uncertain." If slugs are still present after the slug flow duration has expired, the transmitter will report a flow rate of zero (the measurement quality will remain at "uncertain"). The default value for slug flow duration is 0.0 seconds. The valid range is 0.0–60.0 seconds.

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.

To configure slug flow limits and duration, refer to the flowcharts in Figure 4-13.

Figure 4-13 Configuring slug flow limits and duration



4.13 Configuring cutoffs

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

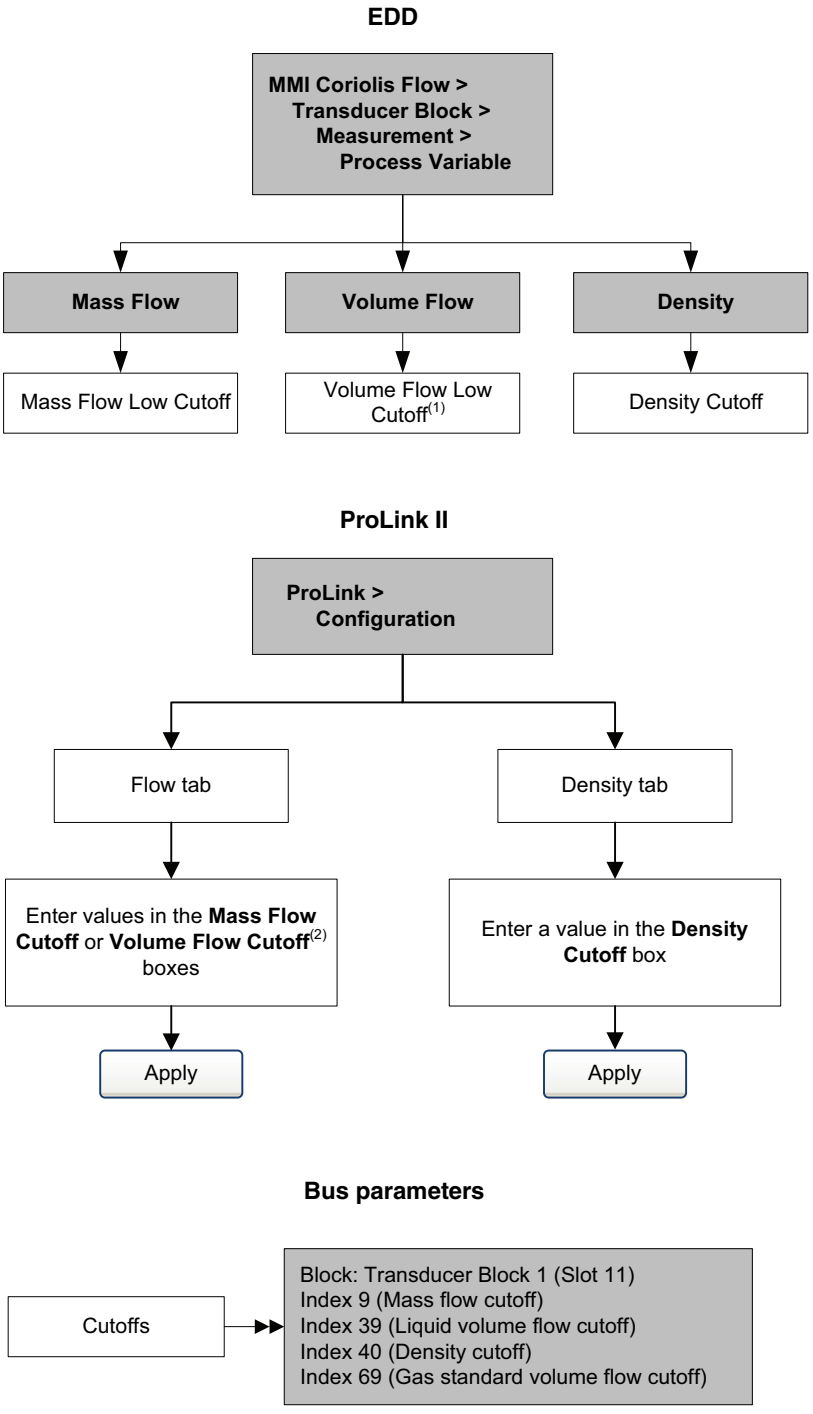
Table 4-14 lists the default values and relevant comments for each cutoff. Note that the mass flow cutoff is not applied to the volume flow calculation. Even if the mass flow drops below the cutoff, and therefore the mass flow indicators go to zero, the volume flow rate will be calculated from the actual mass flow process variable.

Table 4-14 Cutoff default values and comments

Cutoff	Default value	Comments
Mass	0.0 g/s	Micro Motion recommends a mass flow cutoff value of 0.2% of the sensor's maximum flow rate for standard operation, and 2.5% of the sensor's maximum flow rate for empty-full-empty batching.
Liquid volume	0.0 L/s	The lower limit for volume flow cutoff is 0. The upper limit for volume flow cutoff is the sensor's flow calibration factor, in L/s, multiplied by 0.2.
Density	0.2 g/cm^3	The range for density cutoff is 0.0–0.5 g/cm^3

To configure cutoffs, refer to the flowcharts in Figure 4-14.

Figure 4-14 Configuring cutoffs



Notes:
(1) When Gas Standard Volume is configured, this option will be displayed as Gas Std Vol Flow Cutoff.
(2) When Gas Standard Volume is configured, this box will be labeled Std gas vol flow cutoff.

4.14 Changing the measurement mode parameter

The measurement mode parameter defines how the flow is added to or subtracted from the totalizers.

- *Forward flow* moves in the direction of the arrow on the sensor.
- *Reverse flow* moves in the direction opposite from the arrow on the sensor.

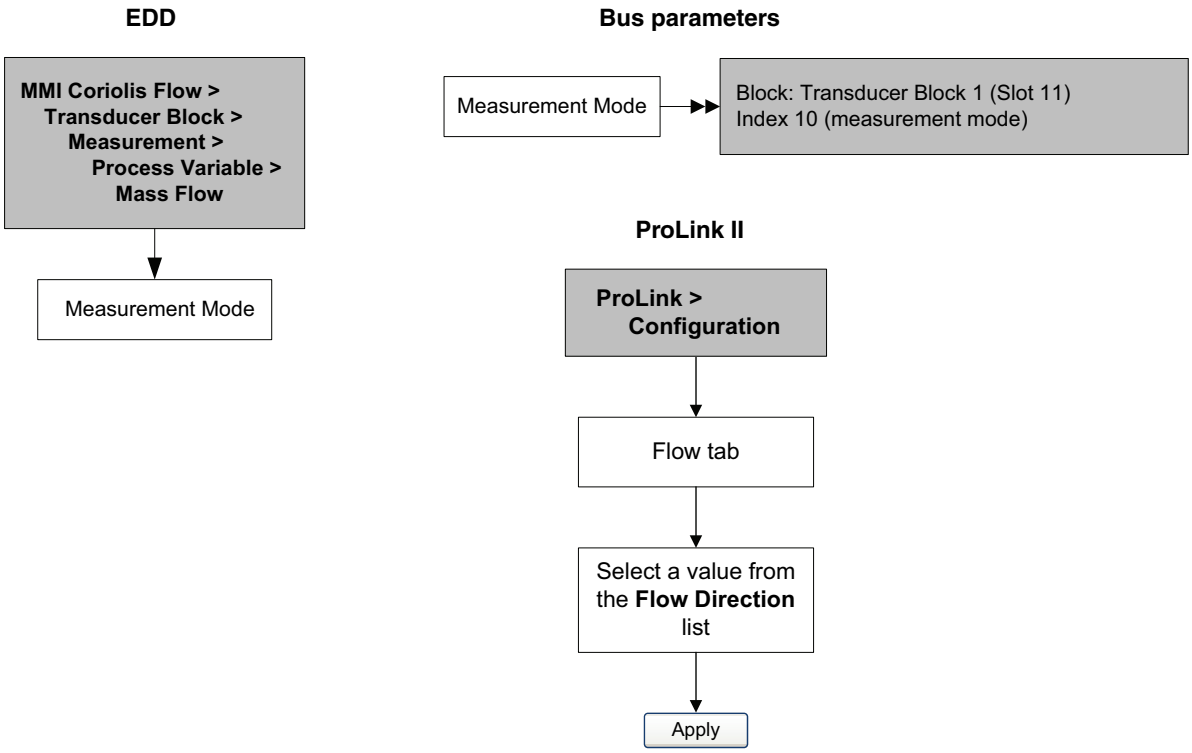
Table 4-15 shows the possible values for the measurement mode parameter and the transmitter's behavior when the flow is positive or negative. Only the *unidirectional* and *bidirectional* values are recognized by the PROFIBUS specification, so other values will be unrecognized by a PROFIBUS host or configuration tool. However, the transmitter will operate correctly in any of the modes listed in Table 4-15.

Table 4-15 Totalizer behavior for each measurement mode value

Measurement mode value	Bus index	Forward flow	Reverse flow
Unidirectional (forward only)	0	Increase	No change
Reverse only	1	No change	Increase
Bidirectional	2	Increase	Decrease
Absolute value	3	Increase	Increase
Negate/forward only	4	No change	Increase
Negate/bidirectional	5	Decrease	Increase

To change the measurement mode parameter, refer to the flowcharts in Figure 4-15.

Figure 4-15 Changing the measurement mode parameter



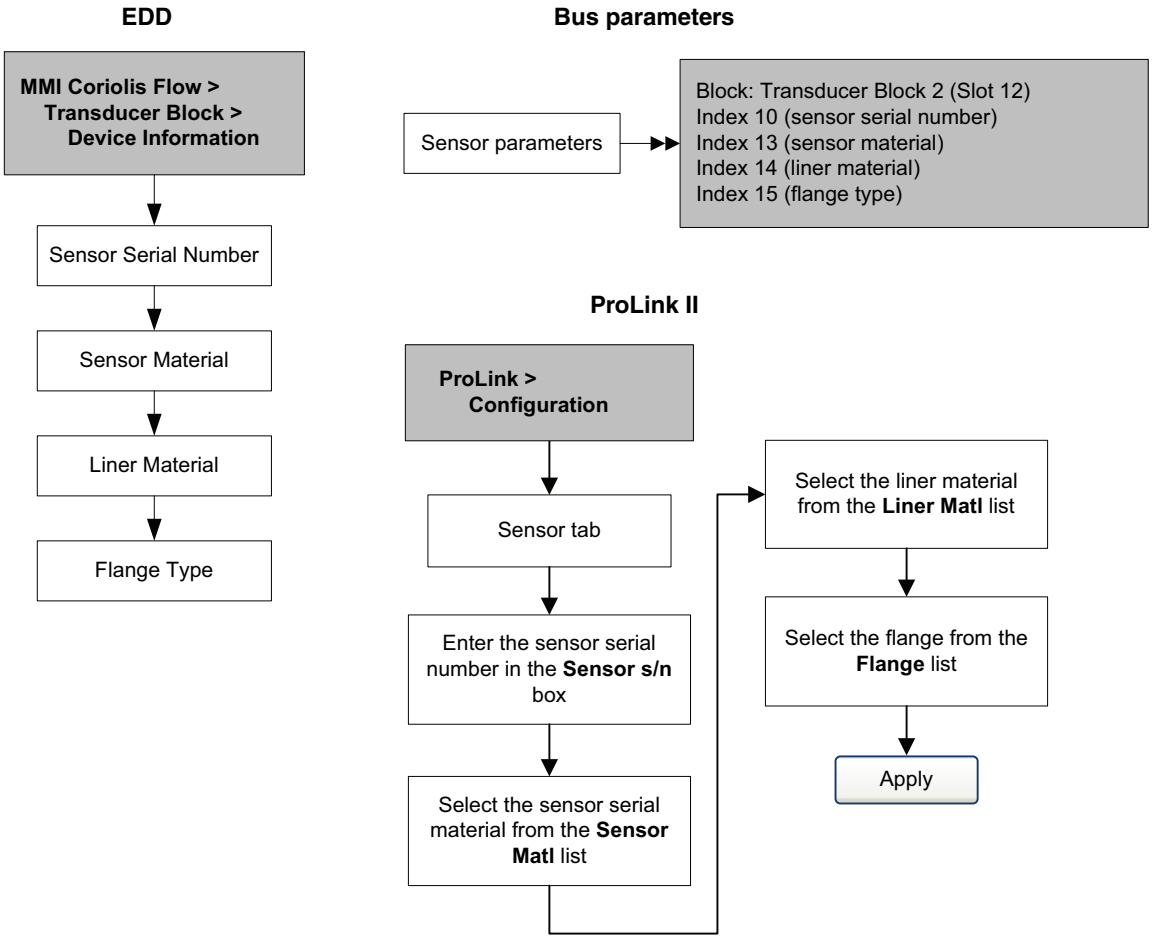
4.15 Configuring sensor parameters

The sensor parameters are used to describe the sensor component of your flowmeter. These sensor parameters are not used in transmitter processing, and are not required:

- Serial number
- Sensor material
- Liner material
- Flange

To configure the sensor parameters, refer to the flowcharts in Figure 4-16.

Figure 4-16 Configuring sensor parameters



4.16 Configuring the display

You can restrict the display functionality or change the variables that are shown on the display.

4.16.1 Enabling and disabling display functions

Each display function and its associated parameter are listed in Table 4-16.

Table 4-16 Display functions and parameters

Display function	EDD name	Display code	Enabled	Disabled
Totalizer reset	Totalizer Reset	TOTALS RESET	Resetting mass and volume totalizers is permitted.	Resetting mass and volume totalizers is not possible.
Start/stop totalizers	Start/Stop Totalizer	TOTALS STOP	Operator can start and stop totalizers from the display.	Operator cannot start or stop totalizers from the display.
Auto scroll(1)	Auto Scroll	AUTO SCRLL	The display automatically scrolls through each process variable.	Operators must **Scroll** to view process variables.
Off-line menu	Offline Menu	DISPLAY OFFLN	Operators have access to the off-line menu.	No access to the offline menu.
Off-line password(2)	Offline Password	OFFLINE PASSW	Password required for offline menu. See Section 4.16.4.	Offline menu accessible without a password.
Alarm menu	Alarm Menu	DISPLAY ALARM	Operator has access to alarm menu.	No access to the alarm menu.
Acknowledge all alarms	ACK All Alarms	DISPLAY ACK	Operator can acknowledge all current alarms at once.	Alarms must be acknowledged individually.
Display backlight	Backlight	DISPLAY BKLT	Display backlight is ON.	Display backlight is OFF.

(1) If enabled, you may want to configure Scroll Rate. See Section 4.16.2.
(2) If enabled, the display offline password must also be configured. See Section 4.16.4.

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).
- 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.

To enable or disable display functions:

- With the EDD, refer to Figure 4-17.
- With bus parameters, refer to Figure 4-18.
- With ProLink II, refer to Figure 4-19.
- With the display, refer to Figure B-13.

Figure 4-17 Configuring the display – EDD menus

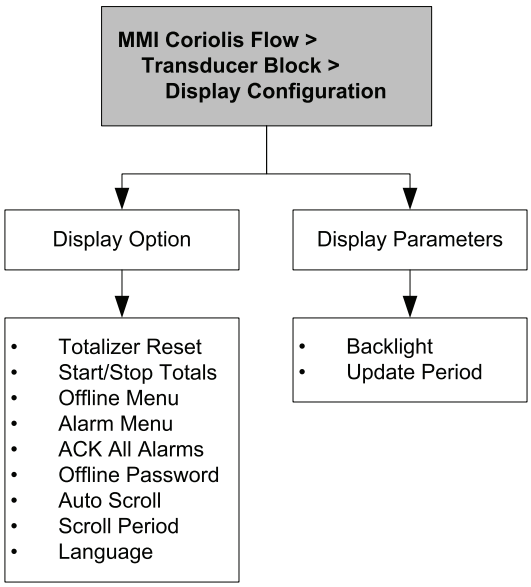


Figure 4-18 Configuring the display – bus parameters

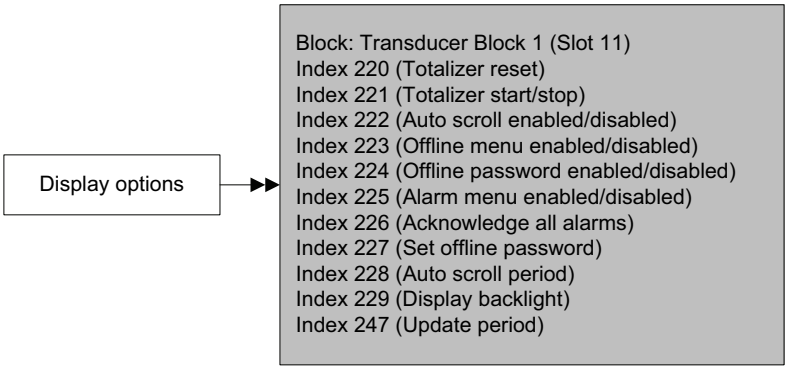
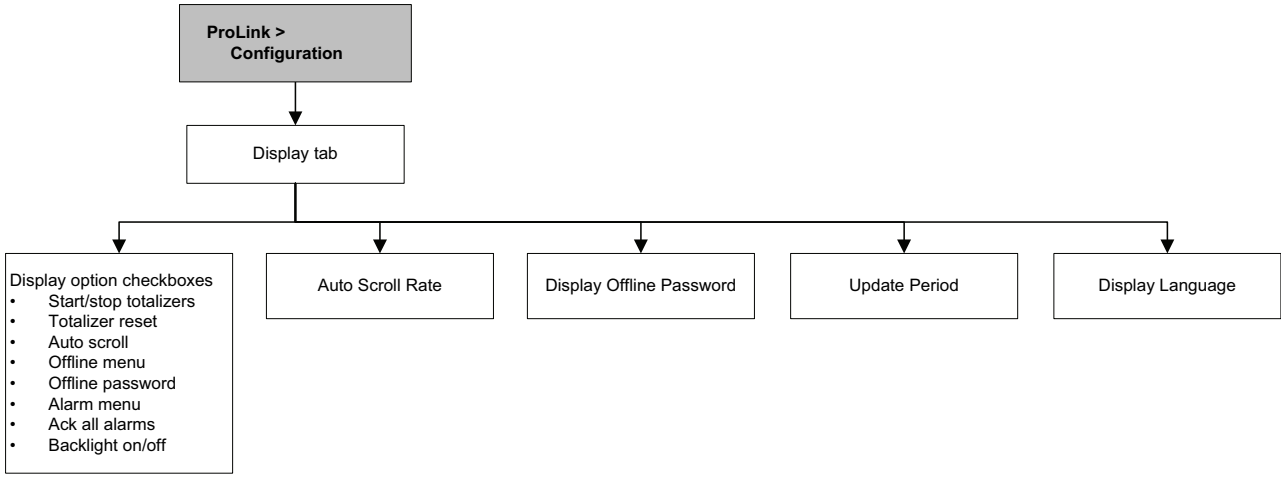


Figure 4-19 Configuring the display – ProLink II



4.16.2 Changing the scroll rate

The *scroll rate* is used to control the speed of scrolling when auto scroll is enabled. Scroll rate defines how long each display variable 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 valid range is from 0 to 10 seconds.

To change the scroll rate:

- With the EDD, refer to Figure 4-17.
- With bus parameters, refer to Figure 4-18.
- With ProLink II, refer to Figure 4-19.
- With the display, refer to Figure B-13.

4.16.3 Changing the 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 to 10,000 milliseconds. The update period value applies to all displayed process variables.

To change the update period:

- With the EDD, refer to Figure 4-17.
- With bus parameters, refer to Figure 4-18.
- With ProLink II, refer to Figure 4-19.
- With the display, refer to Figure B-13.

4.16.4 Changing the off-line password

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

To change the off-line password:

- With the EDD, refer to Figure 4-17.
- With bus parameters, refer to Figure 4-18.
- With ProLink II, refer to Figure 4-19.
- With the display, refer to Figure B-13.

4.16.5 Changing the display language

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

- English
- French
- German
- Spanish

To change the display language:

- With the EDD, refer to Figure 4-17.
- With bus parameters, refer to Figure 4-18.
- With ProLink II, refer to Figure 4-19.
- With the display, refer to Figure B-13.

4.16.6 Changing the display variables and precision

The display can scroll through up to 15 process variables in any order. You can select the process variables you wish to see and the order in which they should appear.

Additionally, you can configure display precision for each display variable. Display precision controls the number of digits to the right of the decimal place. The range of the display precision is 0 to 5.

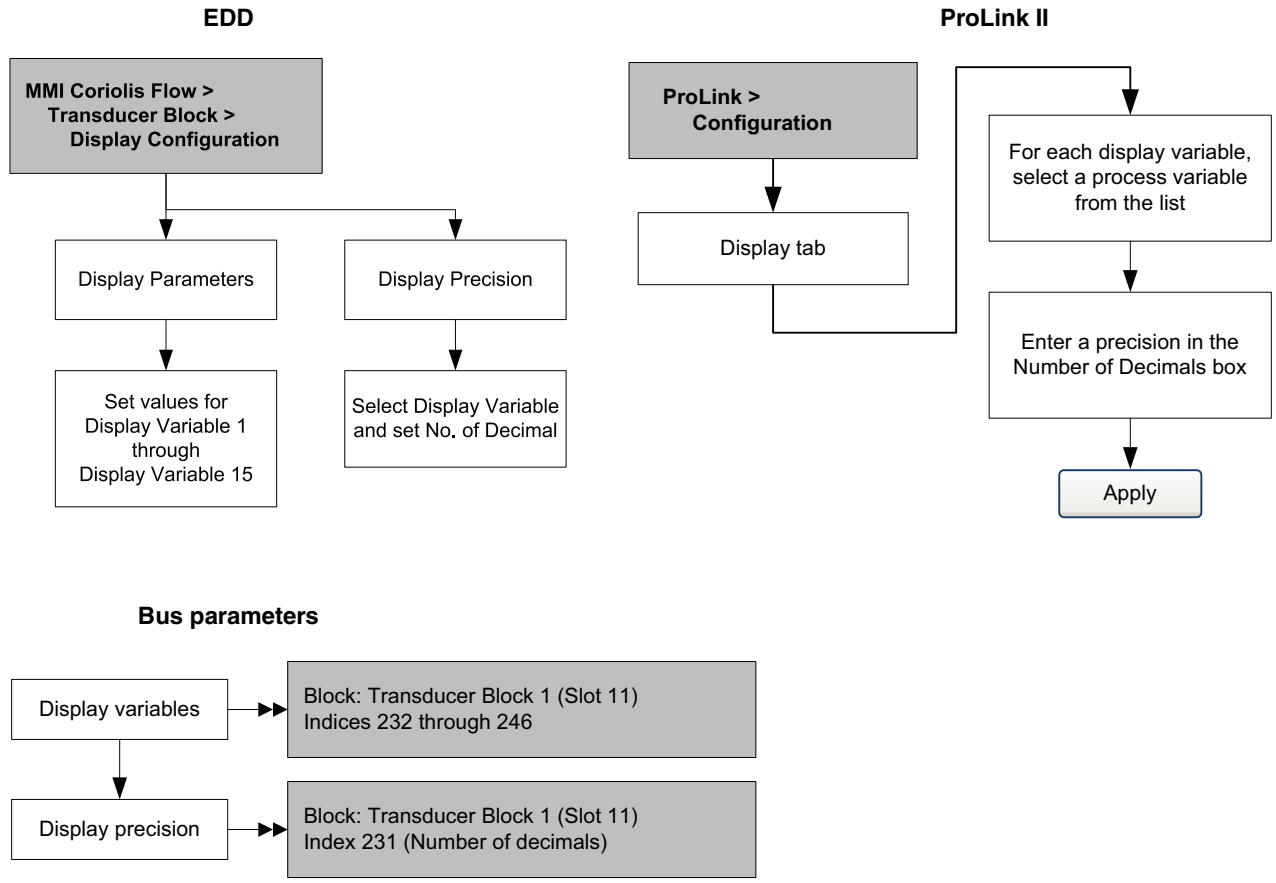
Table 4-17 shows an example of a display variable configuration. Notice that you can repeat variables and you can choose a value of "None." The actual appearance of each process variable on the display is described in Appendix B.

Table 4-17 Example of a display variable configuration

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

To change the display variables, refer to the flowcharts in Figure 4-20.

Figure 4-20 Changing the display variables and precision



4.17 Enabling LD Optimization

LD Optimization is a special compensation is that is specifically for hydrocarbon liquids. LD Optimization should not be used with any other process fluids. LD Optimization is available only with certain large sensor sizes. If your sensor can benefit from LD Optimization, the enable/disable option will appear in ProLink II or on the display.

If you send the transmitter to a calibration facility to perform a water calibration, either during startup or any time thereafter, LD Optimization must be disabled. When you have completed the calibration, re-enable LD Optimization.

To enable LD Optimization, see Figures 4-21 and 4-22.

Figure 4-21 LD Optimization – ProLink II

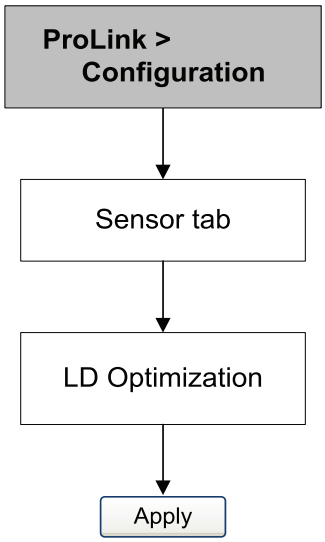
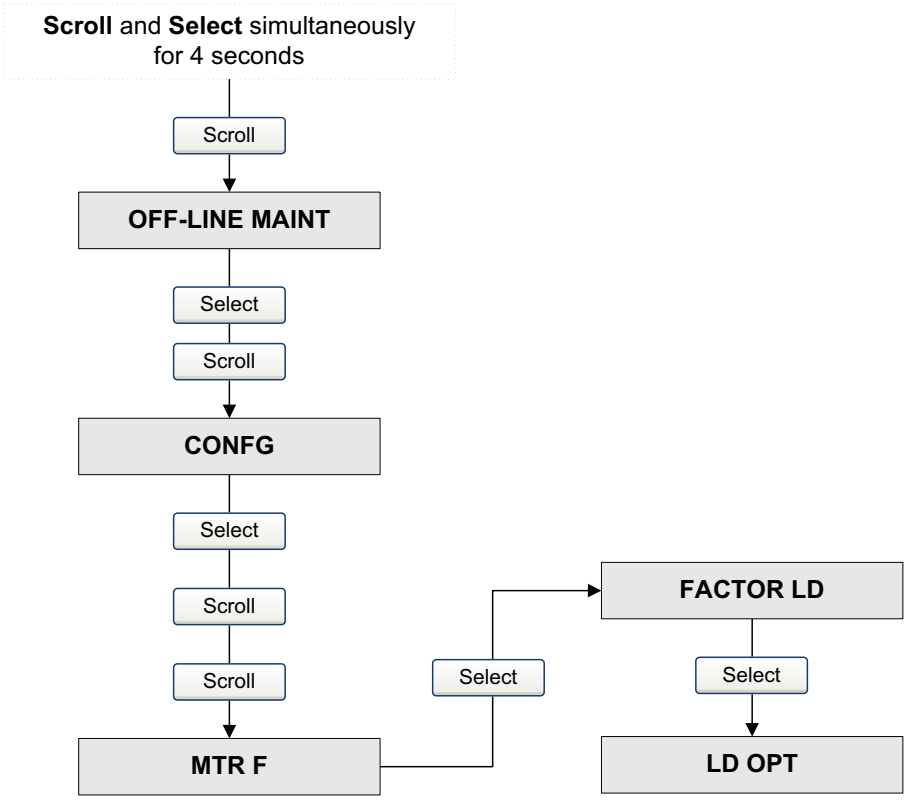


Figure 4-22 **LD Optimization – Display**



Chapter 5
Operation

5.1 Overview

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

- Using the I&M functions (Section 5.2)
- Recording process variables (Section 5.3)
- Viewing process variables (Section 5.4)
- Using sensor simulation mode (Section 5.5)
- Accessing diagnostic information with a PROFIBUS host (Section 5.6)
- Viewing transmitter status and alarms (Section 5.7)
- Viewing and using the totalizers and inventories (Section 5.8)

Note: All procedures provided in this chapter assume that you have established communication with the transmitter and that you are complying with all applicable safety requirements. See Appendix C or the documentation for your PROFIBUS host or configuration tool.

5.2 Using the I&M functions

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

- I&M 0
- I&M 1
- I & M 2
- PA I & M 0

Refer to Amendment 3 to the PROFIBUS Profile for Process Control Devices V 3.01: Identification and Maintenance Functions Version 1.0, December 2004 Order No. 3.042.

The I&M functions contain a variety of device and manufacturer information, all of which is hard-coded (read only). 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.

Refer to Appendix F for the bus parameters associated with the I&M functions.

5.3 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, refer to Section 5.4.

5.4 Viewing process variables

Process variables include measurements such as mass flow rate, volume flow rate, temperature, and density. You can view process variables with the display (if your transmitter has a display), ProLink II, a PROFIBUS configuration tool (e.g., Simatic PDM) using the EDD, or from a Class 2 PROFIBUS host using bus parameters.

5.4.1 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 4.16.5.

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 B for information on the codes and abbreviations used for display variables.

To view a process variable with the display:

- 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 precision of variables shown on the display is configurable. See Section 4.16.5. The display precision affects only the value shown on the display, and does not affect the actual process value stored in the transmitter.

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.

5.4.2 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). If you have closed the Process Variables window, select **ProLink > Process Variables**.

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

To view concentration measurement process variables (if the concentration measurement application is enabled), select **ProLink > CM Process Variables**. The concentration measurement process variables that are displayed depend on the configuration of the concentration measurement application.

5.4.3 With PROFIBUS EDD

Select **View > Process Variables** to view standard process variables. petroleum measurement and concentration measurement variables are not displayed on this screen.

Select **Device > API** to view petroleum measurement variables. Select **Device > CM Process Variables** to view concentration measurement variables.

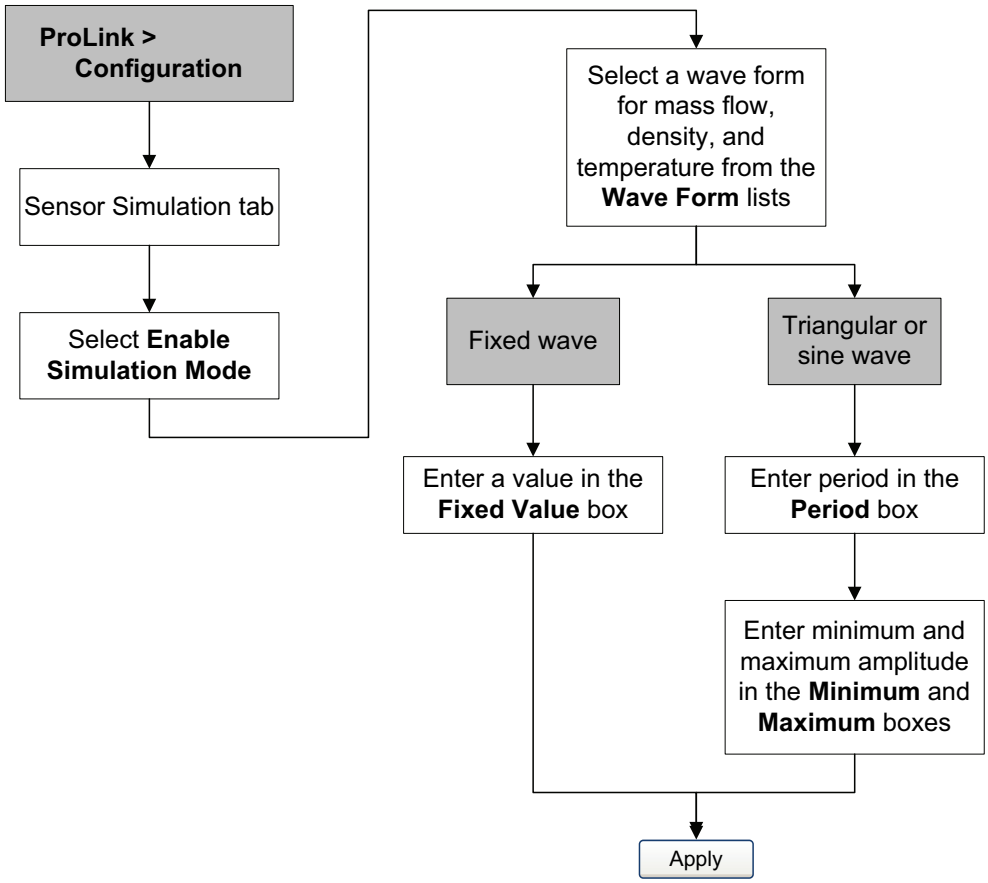
5.4.4 With bus parameters

To view standard process variables, examine index 26 (AI Out) of the appropriate AI function block. Refer to Section 2.5 for information about how slots correspond to AI function blocks.

5.5 Using sensor simulation mode

Sensor simulation mode causes simulated values to be substituted for actual process data from the sensor. Sensor simulation mode can be enabled only with ProLink II (Figure 5-1).

Figure 5-1 Sensor simulation mode – ProLink II



5.6 Accessing diagnostic information with a PROFIBUS host

The transmitter sends diagnostic information to a PROFIBUS host in the form of slave diagnostic response bytes. The number of bytes sent depends on whether the transmitter is configured for Manufacturer-specific or Profile-specific mode. See Section 2.5 for information about the mode, and Appendix E for information on interpreting the diagnostic bytes.

5.7 Viewing transmitter status and alarms

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

5.7.1 With the display

The display reports alarms in two ways:

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

Note: If access to the alarm menu from the display has been disabled (see Section 4.16), then the display will not list alarm codes in an alarm queue and the status LED will not flash. The status LED will indicate status using solid green, yellow, or red.

The status LED is located at the top of the display (Figure 5-2). The status LED can be in one of six possible states, as listed in Table 5-1. The procedure for responding to alarms is shown in Figure B-5.

Figure 5-2 Status LED

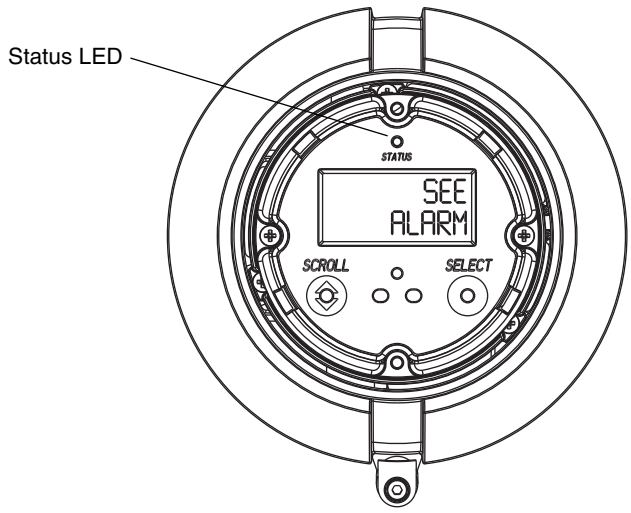


Table 5-1 Status LED states

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

(1) If the display alarm menu has been disabled, alarms cannot be acknowledged. In this case, the status LED will never flash to indicate an unacknowledged alarm.

5.7.2 With ProLink II

ProLink II provides two ways to view alarm information:

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

Note: The location of alarms in the Status and Alarm Log windows is not affected by the configured alarm severity (see Section 4.10). Alarms in the Status window are predefined as Critical, Informational, or Operational. Alarms in the Alarm Log window are predefined as High Priority or Low Priority.

5.7.3 With EDD

The transmitter sets its PROFIBUS output status to *bad* or *uncertain* whenever an alarm condition occurs. You can view the current alarms by selecting **View > Device Status** and then selecting **Critical**, **Informational**, or **Operational**. All possible alarms are shown, independent of configured alarm severity. Currently active alarms are shown by a check mark.

5.7.4 With bus parameters

The transmitter sets its PROFIBUS output status to *bad* or *uncertain* whenever an alarm condition occurs. You can view alarms by reading the status words of the block where the alarm originated. The *status words* are one or more parameters whose bits indicate alarm conditions:

- Index 23 (Alarm summary) of each AI function block (Slot 1, 2, 3, and 5).
- Indices 139–146 of transducer block 1 (Slot 11).

You must view all of the status words to get a comprehensive list of current alarms.

5.8 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 petroleum measurement volume inventory and concentration measurement 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.

You can view all totalizer and inventory values using any of the communication tools: the display, ProLink II, the EDD, or bus parameters. Specific starting, stopping, and resetting functionality depends on the tool you are using.

5.8.1 Viewing current values 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, PROFIBUS EDD, or PROFIBUS bus parameters.

With the display

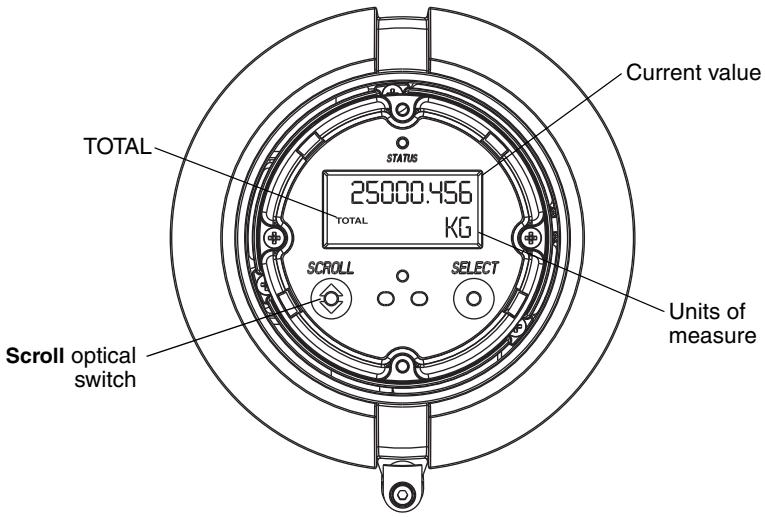
You cannot view current totals with the display unless the display has been configured to show them. See Section 4.16.1.

To view a totalizer or inventory value, **Scroll** until the LCD panel shows the word TOTAL in the lower left and the desired units in the lower right. Refer to Table 5-2 and Figure 5-3.

Table 5-2 Totalizer and inventory display unit names

Totalizer/inventory	Unit name on display
Mass total	Mass unit
Mass inventory	Mass unit alternating with **MASSI**
Volume total (liquid)	Volume unit
Volume inventory (liquid)	Volume unit alternating with **LVOLI**
Gas standard volume total	Volume unit
Gas standard volume inventory	Volume unit alternating with **GSV I**
Petroleum measurement corrected volume total	Volume unit alternating with **TCORR**
Petroleum measurement corrected volume inventory	Volume unit alternating with **TCORI**
ED net mass total	Mass unit alternating with **NET M**
ED net volume total	Mass unit alternating with **NETMI**
ED net volume inventory	Mass unit alternating with **NET V**
ED standard volume total	Mass unit alternating with **STD V**
ED standard volume inventory	Mass unit alternating with **STDVI**

Figure 5-3 Totalizer and inventory values on display



With ProLink II

To view the current value of the totalizers and inventories with ProLink II, select **ProLink > Totalizer** or **ProLink > API Totalizer**, or **ProLink > CM Totalizer**.

With EDD

To view the current value of the totalizers and inventories:

- For standard mass, liquid standard volume, and gas standard volume, select **View > Process Variables > Totalizer** and then select **Mass** or **Volume**. (If the transmitter is configured to use gas standard volume, then **Volume** will be replaced by **Gas Standard Volume**.) Totals and inventories are displayed together.
- For petroleum measurement, select **Device > Device > API Totalizer**.
- For concentration measurement, select **Device > Device > CM Totalizer**.

With bus parameters

To view the current value of the totalizers and inventories, examine index 26 (TOT Total) of each totalizer function block (Slots 4, 6, 7, and 8).

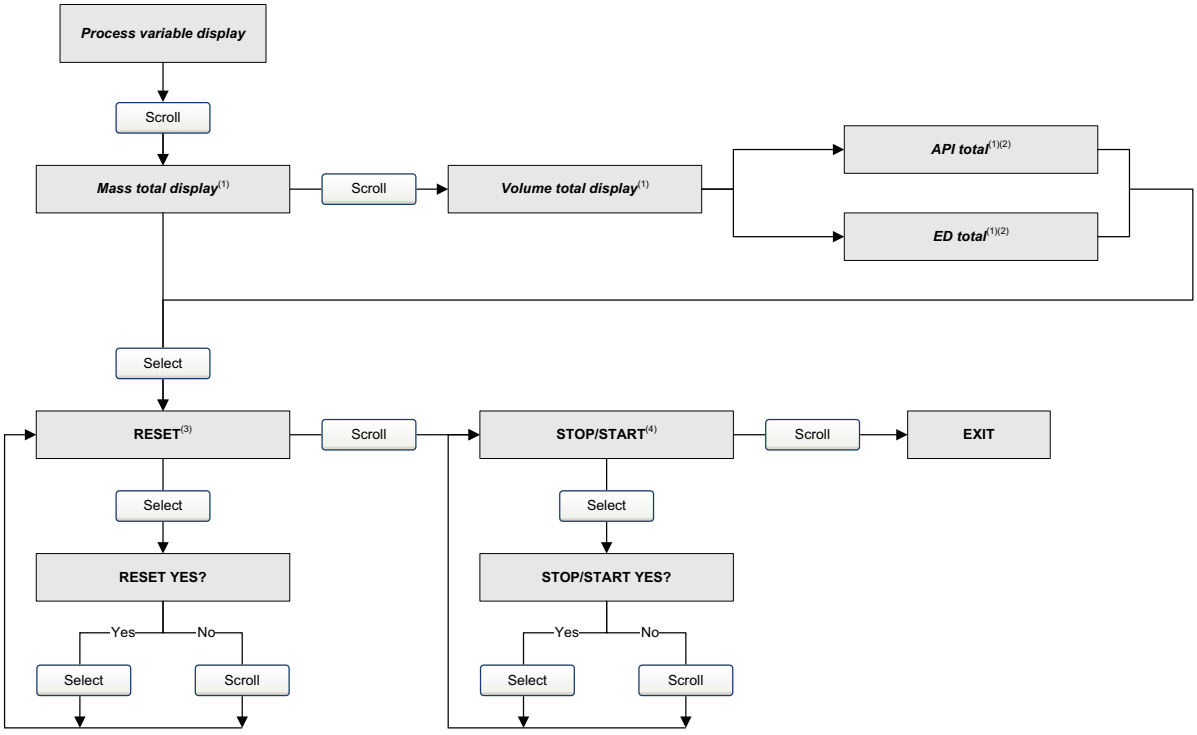
5.8.2 Controlling the totalizers and inventories

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 5-4. You cannot reset any inventories with the display.

Figure 5-4 Controlling totalizers and inventories with the display



(1) Displayed only if configured as a display variable (see Section 4.16.6).
(2) The petroleum measurement application or concentration measurement application must be enabled.
(3) The display must be configured to allow totalizer resetting (see Section 4.16).
(4) The display must be configured to allow stopping and starting (see Section 4.16).

With Prolink II

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

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

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

With PROFIBUS EDD

To start and stop totals and inventories, to reset all totals and inventories simultaneously, or to reset individual mass or volume totals and inventories, select **Device > Device > Totalizer**.

To reset petroleum measurement totals and inventories alone, select **Device > Device > API Totalizer**.

To reset concentration measurement totals and inventories alone, select **Device > Device > CM Totalizer**.

With PROFIBUS bus parameters

If the totalizer blocks are configured to report the status of one of the internal totalizers (i.e., not *Standard* mode) (see Section 2.6), you can reset that total or inventory by setting index 29 of the appropriate totalizer function block to 1.

You can also control the internal totalizers directly with the transducer block parameters shown in Table 5-3. Except where specified, enabling each function means setting its value to 0x0001.

Table 5-3 Stopping, starting, and resetting totalizers and inventories

	Use this transducer block parameter:	
To accomplish this:	**Slot**	**Index**
Stop all totalizers and inventories	11	49 (value = 0x0000)
Start all totalizers and inventories	11	49 (value = 0x0001)
Reset all totals	11	50
Reset all inventories	11	51
Reset mass total	11	52
Reset mass inventory	11	60
Reset liquid volume total	11	53
Reset liquid volume inventory	11	61
Reset gas standard volume total	11	70
Reset gas standard volume inventory	11	71
Reset petroleum measurement volume totalizer	12	36
Reset petroleum measurement volume inventory	12	37
Reset ED standard volume total	12	60
Reset ED standard volume inventory	12	63
Reset ED net mass total	12	61
Reset ED net mass inventory	12	64
Reset ED net volume total	12	62
Reset ED net volume inventory	12	65

Chapter 6
Troubleshooting

6.1 Overview

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

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

Note: All procedures provided in this chapter assume that you have established communication with the transmitter and that you are complying with all applicable safety requirements. See Appendix B or the documentation for your PROFIBUS host or configuration tool.

6.2 Guide to troubleshooting topics

Refer to Table 6-1 for a list of troubleshooting topics discussed in this chapter.

Table 6-1 Troubleshooting topics

Topic	Section
Transmitter does not operate	Section 6.3
Transmitter does not communicate	Section 6.4
Function blocks stuck in OOS mode	Section 6.5
Zero or calibration failure	Section 6.6
Output problems	Section 6.7
Status alarms	Section 6.8
Diagnosing wiring problems	Section 6.9
Checking slug flow	Section 6.10
Restoring a working configuration	Section 6.11
Checking the test points	Section 6.12
Checking the core processor	Section 6.13
Checking sensor coils and RTD	Section 6.14

6.3 Transmitter does not operate

If the transmitter is not receiving power and cannot communicate over the network or display, then perform all of the procedures under Section 6.9.

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

6.4 Transmitter does not communicate

If the transmitter does not appear to be communicating on the network, then:

- Make sure the PROFIBUS network has proper termination.
- Check the PROFIBUS wiring between the transmitter and the DP/PA coupler, and between the DP/PA coupler and the host system.
- Perform the procedures under Section 6.9.4.
- Make sure the node address is set correctly. The node address is set to a default value of 126 at the factory. See Section 2.3.
- If using a configuration tool such as Simatic PDM, check whether the transmitter shows up in the live devices list.
- Make sure the I/O configuration is set up properly. See Section 2.5.

6.5 Function blocks in Out-of-Service mode

If all of the transmitter function blocks (AI, AO, and totalizer) are stuck in Out-of-Service mode, there may be a fault alarm active. The status alarms that will trigger OOS mode are shown in Table 6-2. Refer to Section 6.8 for a full description of status alarms and possible remedies.

Table 6-2 OOS-mode alarms

Alarm	Description
A001	EPROM checksum error
A002	RAM test error (core processor)
A003	Sensor failure (no tube interrupt)
A004	Temperature sensor out-of-range
A005	Input over-range
A008	Density over-range
A016	Line RTD temperature out-of-range
A017	Meter RTD temperature out-of-range
A022	(E)EPROM configuration DB interrupt (core processor)
A023	(E)EPROM totals corrupt (core processor)
A024	(E)EPROM program corrupt (core processor)
A025	Protected boot sector fault

6.6 Zero or calibration failure

If a zero or calibration procedure fails, the transmitter will send one or more status alarms indicating the cause of failure. Refer to Table 6-4 for descriptions of status alarms and possible remedies.

6.7 Output problems

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

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

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

Unusual values for process variables may indicate a variety of different problems. Table 6-3 lists several possible problems and remedies.

Table 6-3 Output problems and possible remedies

Symptom	Cause	Possible remedies
No output or incorrect process variable	CHANNEL parameter set incorrectly	Verify the CHANNEL parameter in the AI block matches the correct transducer block measurement channels.
Steady non-zero flow rate under no-flow conditions	Misaligned piping (especially in new installations)	Correct the piping.
	Open or leaking valve	Check or correct the valve mechanism.
	Bad sensor zero	Rezero the flowmeter. See Section 3.6.
	Bad flow cal factor	Verify characterization. See Section 6.7.4.

Table 6-3 Output problems and possible remedies (continued)

Symptom	Cause	Possible remedies
Erratic non-zero flow rate under no-flow conditions	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact. Refer to the installation manual.
	Incorrectly grounded 9-wire cable (only in 9-wire remote and remote core processor with remote transmitter installations)	Verify 9-wire cable installation. Refer to the installation manual.
	Noise in PROFIBUS wiring	Verify that the wiring is properly shielded against noise.
	Vibration in pipeline at rate close to sensor frequency	Check the environment and remove the source of vibration.
	Leaking valve or seal	Check pipeline.
	Inappropriate measurement unit	Check measurement units using a PROFIBUS host or configuration tool.
	Inappropriate damping value	Check damping. See Section 6.7.1.
	Slug flow	Section 6.10.
	Plugged flow tube	Check drive gain and frequency. Purge the flow tubes.
	Moisture in sensor junction box (only for 9-wire remote and remote core processor with remote transmitter installations)	Open junction box and allow it to dry. Do not use contact cleaner. When closing, ensure integrity of gaskets and O-rings, and grease all O-rings.
	Mounting stress on sensor	Check sensor mounting. Ensure that: • Sensor is not being used to support pipe. • Sensor is not being used to correct misaligned pipe. • Sensor is not too heavy for pipe.
	Sensor cross-talk	Check environment for sensor with similar (±0.5 Hz) tube frequency.
	Improper sensor grounding	Check the sensor grounding. Refer to the installation manual.
	Incorrect sensor orientation	Not all orientations work with all process fluids. See the installation manual for your sensor.
Erratic non-zero flow rate when flow is steady	Output wiring problem	Verify PROFIBUS wiring.
	Inappropriate measurement unit	Check measurement units using a PROFIBUS host or configuration tool.
	Inappropriate damping value	Check damping. See Section 6.7.1.
	Excessive or erratic drive gain	See Sections 6.12.3 and 6.12.4.
	Slug flow	See Section 6.10.
	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes. Sensor may need to be replaced.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact. Refer to the installation manual.

Table 6-3 Output problems and possible remedies (continued)

Symptom	Cause	Possible remedies
Inaccurate flow rate	Bad flow cal factor	Verify characterization. See Section 6.7.4.
	Inappropriate measurement unit	Check measurement units using a PROFIBUS host or configuration tool.
	Bad sensor zero	Rezero the flowmeter. See Section 3.6.
	Bad density calibration factors	Verify characterization. See Section 6.7.4.
	Bad flowmeter grounding	See Section 6.9.3.
	Slug flow	See Section 6.10.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact. Refer to the installation manual.
Inaccurate density reading	Problem with process fluid	Use standard procedures to check quality of process fluid.
	Bad density calibration factors	Verify characterization. See Section 6.7.4.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact. Refer to the installation manual.
	Bad flowmeter grounding	See Section 6.9.3.
	Slug flow	See Section 6.10.
	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. Sensor may need to be replaced.
Temperature reading significantly different from process temperature	RTD failure	Check for alarm conditions and follow troubleshooting procedure for indicated alarm.
	Incorrect calibration factors	Perform temperature calibration. See Section 3.8.
		Verify characterization. See Section 3.3.
Temperature reading slightly different from process temperature	Incorrect calibration factors	Perform temperature calibration. See Section 3.8.
		Verify characterization. See Section 3.3.
Unusually high density reading	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes.
	Incorrect K2 value	Verify characterization. See Section 6.7.4.
Unusually low density reading	Slug flow	See Section 6.10.
	Incorrect K2 value	Verify characterization. See Section 6.7.4.
Unusually high tube frequency	Sensor erosion	Contact Micro Motion Customer Service.
Unusually low tube frequency	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes. Sensor may need to be replaced.
Unusually low pickoff voltages	Several possible causes	See Section 6.12.5.
Unusually high drive gain	Several possible causes	See Section 6.12.3.

6.7.1 Damping

An incorrectly set damping value may make the transmitter's output appear too sluggish or too jumpy. Adjust the damping parameters in the transducer block to achieve the damping effect you want. See Section 4.11.

Other damping problems

If the transmitter appears to be applying damping values incorrectly or the damping effects do not appear to be changed by adjustments to the damping parameters, then the AI PV Filter Time parameter in an AI function block may be improperly set. Inspect each AI function block, and ensure that AI PV Filter Time is set to zero.

6.7.2 Low-flow cutoff

If the transmitter is sending an output of zero unexpectedly, then one of the low-flow cutoff parameters may be set incorrectly. Verify that the cutoff parameters in the transducer block are set to appropriate levels. See Section 4.13.

6.7.3 Output scale

An incorrectly configured output scale can cause the transmitter to report unexpected output levels. Verify that the AI Out Scale values are set up correctly for each AI block. See Section 4.8.

6.7.4 Characterization

Incorrect characterization parameters can cause the transmitter to send unexpected output values. However, you should suspect an incorrect characterization only if the transmitter and sensor have recently been paired together for the first time. Refer to Section 3.3 for more information about characterization.

6.7.5 Calibration

Improper calibration may cause the transmitter to send unexpected output values. However, you should suspect an improper calibration only if the transmitter has been field-calibrated recently. Refer to Sections 3.7 and 3.8 for more information about calibration.

Note: Micro Motion recommends using meter factors, rather than calibration, to prove the meter against a regulatory standard or to correct measurement error. Contact Micro Motion before calibrating your flowmeter. Refer to Section 3.5 for information about meter factors.

6.8 Status alarms

Status alarms are reported by a PROFIBUS host, the display, and ProLink II software. Remedies for the alarm states appear in Table 6-4.

Note: Some status alarms will cause all of the function blocks (AI, AO, and totalizer) to change to Out of Service mode.

Table 6-4 Status alarms and remedies

Display code	Description	Possible remedies
A001	EEPROM checksum	Cycle power to the transmitter.
		The flowmeter might need service. Contact Micro Motion Customer Service.
A002	RAM error	Cycle power to the transmitter.
		The flowmeter might need service. Contact Micro Motion Customer Service.
A003	Sensor failure	Check the test points. See Section 6.12.
		Check the sensor coils. See Section 6.14.
		Check wiring to sensor. See Section 6.9.2.
		Check for slug flow. See Section 6.10.
		Check sensor tubes.
A004	Temperature overrange	Check the test points. See Section 6.12.
		Check the sensor coils. See Section 6.14.
		Check wiring to sensor. See Section 6.9.2.
		Verify process temperature range is within limits for sensor and transmitter.
		Verify flowmeter characterization. See Section 6.7.4.
		Contact Micro Motion Customer Service.
A005	Input overrange	Check the test points. See Section 6.12.
		Check the sensor coils. See Section 6.14.
		Verify process conditions.
		Verify that transmitter is configured to use appropriate measurement units. See Section 4.5.
		Verify flowmeter characterization. See Section 6.7.4.
		Re-zero the flowmeter. See Section 3.6.
A006	Transmitter not configured	Check the characterization. Specifically, verify the FCF and K1 values. See Section 3.3.
		Contact Micro Motion Customer Service.
A008	Density overrange	Check the test points. See Section 6.12.
		Check the sensor coils. See Section 6.14.
		Check for air in flow tubes, tubes not filled, foreign material in tubes, coating in tubes.
		Verify characterization. See Section 6.7.4.
A009	Transmitter initializing/warming up	Allow the transmitter to warm up. The error should disappear from the status words once the transmitter is ready for normal operation. If alarm does not clear, make sure sensor is completely full or completely empty. Verify sensor configuration and transmitter wiring to sensor (refer to installation manual).

Table 6-4 Status alarms and remedies (continued)

Display code	Description	Possible remedies
A010	Calibration failure	If alarm appears during zero, ensure there is no flow through the sensor, then retry.
		Cycle power to the flowmeter, then retry.
A011	Calibration too low	Ensure there is no flow through sensor, then retry.
		Cycle power to the flowmeter, then retry.
A012	Calibration too high	Ensure there is no flow through sensor, then retry.
		Cycle power to the flowmeter, then retry.
A013	Zero too noisy	Remove or reduce sources of electromechanical noise, then attempt the calibration or zero procedure again. Possible sources of noise include: • Mechanical pumps • Electrical interference • Vibration effects from nearby machinery
		Cycle power to the flowmeter, then retry.
A014	Transmitter failed	Cycle power to the transmitter.
		The transmitter might need service. Contact Micro Motion Customer Service.
A016	Line temp out-of-range	Check the test points. See Section 6.12.
		Check the sensor coils. See Section 6.14.
		Check wiring to sensor. See Section 6.9.2.
		Verify characterization. Section 6.7.4.
		Contact Micro Motion Customer Service.
A017	Meter RTD temperature out-of-range	Check the test points. See Section 6.12.
		Check the sensor coils. See Section 6.14.
		Contact Micro Motion Customer Service.
A020	Calibration factors unentered	Check the characterization. Specifically, verify the FCF value. See Section 3.3.
A021	Incorrect sensor type	Check the characterization. Specifically, verify the K1 value. See Section 3.3.
A022	Configuration corrupt	The flowmeter needs service. Contact Micro Motion Customer Service.
A023	Totals corrupt	The flowmeter needs service. Contact Micro Motion Customer Service.
A024	CP program corrupt	The flowmeter needs service. Contact Micro Motion Customer Service.
A025	Boot sector fault	Cycle power to the meter.
		The flowmeter might need service. Contact Micro Motion Customer Service.
A026	Sensor/transmitter communication failure	Check wiring between transmitter and core processor (see Section 6.9.2). The wires may be swapped. After swapping wires, cycle power to the flowmeter.
		Check for noise in wiring or transmitter environment.
		Check core processor LED. See Section 6.13.2.
		Perform the core processor resistance test. See Section 6.13.3.

Table 6-4 Status alarms and remedies (continued)

Display code	Description	Possible remedies
A028	Sensor/transmitter write failure	Cycle power to the meter.
		The flowmeter might need service. Contact Micro Motion Customer Service.
A030	Hardware/software incompatible	The loaded software is not compatible with the programmed board type. Contact Micro Motion.
A031	Low Power	The core processor is not receiving enough power. Check the power supply to the transmitter, and check power wiring between the transmitter and the core processor (4-wire remote installations only).
A032	Smart Meter Verification in progress and outputs fixed	Allow the procedure to complete.
		If desired, abort the procedure and restart with outputs set to Continue Measurement.
A033	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.
A034	Smart Meter Verification failed	Rerun the test. If the test fails again, see Section 3.4.3.
A035	Smart Meter Verification aborted	If desired, read the abort code. See Section 3.4.3, and perform the appropriate action.
A102	Drive overrange	Excessive or erratic drive gain. See Section 6.12.3.
		Check the sensor coils. See Section 6.14.
A103	Data loss possible	Cycle power to the transmitter.
		The transmitter might need service. Contact Micro Motion Customer Service.
A104	Calibration in progress	Allow the flowmeter to complete calibration.
A105	Slug flow	Allow slug flow to clear from the process.
		See Section 6.10.
A107	Power reset occurred	No action is necessary.
A116	API temperature outside standard range	Verify process.
		Verify API reference table and temperature configuration. See Section 4.6.
A117	API density out of limits	Verify process.
		Verify API reference table and temperature configuration. See Section 4.6.
A120	Concentration measurement: unable to fit curve data	Verify enhanced density configuration.
A121	Concentration measurement: extrapolation alarm	Verify process temperature.
		Verify process density.
		Verify enhanced density configuration.
A131	Smart Meter Verification in progress	Allow the procedure to complete.
		If desired, abort the procedure and restart with outputs set to Fault.
A132	Simulation mode active	Disable sensor simulation mode. See Section 5.5.

6.9 Diagnosing wiring problems

Use the procedures in this section to check the transmitter installation for wiring problems. Installation procedures are provided in the manual entitled *Model 1700 and Model 2700 Transmitters: Installation Manual*.

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

6.9.1 Checking the power-supply wiring

To check the power-supply wiring:

1. Verify that the correct external fuse is used. An incorrect fuse can limit current to the transmitter and keep it from initializing.
2. Power down the transmitter.
3. If the transmitter is in a hazardous area, wait five minutes.
4. Ensure that the power supply wires are connected to the correct terminals. Refer to the installation manual.
5. Verify that the power-supply wires are making good contact and are not clamped to the wire insulation.
6. Inspect the voltage label on the inside of the field-wiring compartment. Verify that the voltage supplied to the transmitter matches the voltage specified on the label.
7. Use a voltmeter to test the voltage at the transmitter's power supply terminals. Verify that it is within specified limits. For DC power, you may need to size the cable. Refer to the installation manual for information about the transmitter power supply.

6.9.2 Checking the sensor-to-transmitter wiring

Note: This does not apply to flowmeters with an integrally mounted transmitter.

To check the sensor-to-transmitter wiring, verify that:

- The transmitter is connected to the sensor according to the wiring information provided in the installation manual.
- The wires are making good contact with the terminals.
- For 4-wire connections, the mating connector between the core processor and the transmitter is securely plugged into its socket.

If the wires are incorrectly connected:

1. Power down the transmitter.
2. Wait five minutes before opening the transmitter compartment if the transmitter is in a hazardous area.
3. Correct the wiring.
4. Restore power to the transmitter.

6.9.3 Checking the grounding

The sensor and the transmitter must be grounded. If the core processor is installed as part of the transmitter or the sensor, it is grounded automatically. If the core processor is installed separately, it must be grounded separately. Refer to the installation manual.

6.9.4 Checking the communication wiring

To check the communication wiring, verify that:

- Communication wires and connections meet PROFIBUS wiring standards.
- Wires are connected according to instructions provided in the installation manual.
- Wires are making good contact with the terminals.

6.10 Checking slug flow

The dynamics of slug flow are described in Section 4.12. If the transmitter is reporting a slug flow alarm, first check the process and possible mechanical causes for the alarm:

- Actual changes in process density
- Cavitation or flashing
- Leaks
- Sensor orientation — sensor tubes should normally be down when measuring liquids, and up when measuring gases. Refer to the sensor documentation for more information about orientation.

If there are no mechanical causes for the slug flow alarm, the slow flow limits and duration may be set too high or too low. The high limit is set by default to 5.0 g/cm^3, and the low limit is set by default to 0.0 g/cm^3. Lowering the high limit or raising the low limit will cause the transmitter to be more sensitive to changes in density. If you expect occasional slug flow in your process, you may need to increase the slug flow duration. A longer slug flow duration will make the transmitter more tolerant of slug flow.

6.11 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. In ProLink II, select **File > Send to Xmtr from File**.
- Restore the factory configuration (ProLink II v2.6 or later required; transmitter must be connected to an enhanced core processor). In ProLink II, select **ProLink > Configuration**, click the **Device** tab, and click **Restore Factory Configuration**.

Neither of these methods will restore all of the transmitter's configuration. For example, neither method will restore the configuration of the AI, AO, and totalizer function blocks. Using the restore factory configuration option will also not restore such things as the configuration of the display.

6.12 Checking the test points

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.

6.12.1 Obtaining the test points

You can obtain the test points with the PROFIBUS EDD, PROFIBUS bus parameters, or ProLink II.

With PROFIBUS EDD

To obtain the test points, select **View > Diagnostics > Meter Diagnostics**. Record the LPO Amplitude, RPO Amplitude, Drive Gain, and Tube Frequency values.

With PROFIBUS bus parameters

To obtain the test points, examine the indices listed in Table 6-5.

Table 6-5 Bus parameter test points

Slot	Index	Description
11	160	Drive gain
11	161	Tube frequency
11	163	LPO amplitude
11	164	RPO amplitude

With ProLink II

To obtain the test points, select **ProLink > Diagnostic Information**. Record the Left Pickoff, Right Pickoff, Drive Gain, and Tube Frequency values.

6.12.2 Evaluating the test points

Use the following guidelines to evaluate the test points:

- If the drive gain is at 100%, refer to Section 6.12.3.
- If the drive gain is unstable, refer to Section 6.12.4.
- If the value for the left or right pickoff does not equal the appropriate value from Table 6-6, based on the sensor flow tube frequency, refer to Section 6.12.5.
- If the values for the left and right pickoffs equal the appropriate values from Table 6-6, based on the sensor flow tube frequency, contact the Micro Motion Customer Service Department for assistance.

Table 6-6 Sensor pickoff values

Sensor model[1]	Pickoff value
ELITE Model CMF sensors	3.4 mV peak to peak per Hz based on flow tube frequency
Model CMF400 I.S.	2.7 mV peak to peak per Hz based on flow tube frequency
Model CMF400 with booster amplifier	3.4 mV peak to peak per Hz based on flow tube frequency
Model D, DL, and DT sensors	3.4 mV peak to peak per Hz based on flow tube frequency
Model F025, F050, and F100 sensors	3.4 mV peak to peak per Hz based on flow tube frequency

Table 6-6 Sensor pickoff values (continued)

Sensor model[1]	Pickoff value
Model F200 sensors	2.0 mV peak to peak per Hz based on flow tube frequency
Model H025, H050, and H100 sensors	3.4 mV peak to peak per Hz based on flow tube frequency
Model H200 sensors	2.0 mV peak to peak per Hz based on flow tube frequency
Model R025, R050, or R100 sensor	3.4 mV peak to peak per Hz based on flow tube frequency
Model R200 sensor	2.0 mV peak to peak per Hz based on flow tube frequency
Micro Motion T-Series sensors	0.5 mV peak to peak per Hz based on flow tube frequency

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

6.12.3 Excessive drive gain

The causes and possible solutions of excessive drive gain are listed in Table 6-7.

Table 6-7 Excessive drive gain causes and solutions

Cause	Solution
Excessive slug flow	Eliminate slugs.
	Change the sensor orientation.
Plugged flow tube	Purge the flow tubes. Sensor may need to be replaced.
Cavitation or flashing	Increase inlet or back pressure at the sensor.
	If a pump is located upstream from the sensor, increase the distance between the pump and sensor.
Drive board or module failure, cracked flow tube, or sensor imbalance	Contact Micro Motion Customer Service.
Mechanical binding at sensor	Ensure sensor is free to vibrate.
Open drive or left pickoff sensor coil	Contact Micro Motion Customer Service.
Flow rate out of range	Ensure flow rate is within sensor limits.
Incorrect sensor characterization	Verify characterization. See Section 3.3.

6.12.4 Erratic drive gain

The causes and possible solutions of erratic drive gain are listed in Table 6-8.

Table 6-8 Erratic drive gain causes and solutions

Cause	Solution
Wrong K1 characterization constant for sensor	Re-enter the K1 characterization constant. See Section 3.3.
Polarity of pick-off reversed or polarity of drive reversed	Contact Micro Motion Customer Service.
Slug flow	Verify flow tubes are completely filled with process fluid, and that slug flow limits and duration are properly configured. See Section 4.12.
Foreign material caught in flow tubes	Purge flow tubes. Sensor may need to be replaced.

6.12.5 Low pickoff voltage

The causes and possible solutions of low pickoff voltage are listed in Table 6-9.

Table 6-9 Low pickoff voltage causes and solutions

Cause	Solution
Faulty wiring runs between the sensor and core processor	Refer to the sensor manual and transmitter installation manual.
Process flow rate beyond the limits of the sensor	Verify that the process flow rate is not out of range of the sensor
Slug flow	Verify the flow tubes are completely filled with process fluid, and that slug flow limits and duration are properly configured. See Section 4.12.
No tube vibration in sensor	Check for plugging.
	Ensure sensor is free to vibrate (no mechanical binding).
	Verify wiring.
	Test coils at sensor. See Section 6.14.
Process beyond the limits of the sensor	Verify that the process flow rate is not out of range of the sensor.
Moisture in the sensor electronics	Eliminate the moisture in the sensor electronics.
The sensor is damaged	Contact Micro Motion Customer Service.

6.13 Checking the core processor

Two core processor procedures are available:

- You can check the core processor LED. The core processor has an LED that indicates different flowmeter conditions.
- You can perform the core processor resistance test to check for a damaged core processor.

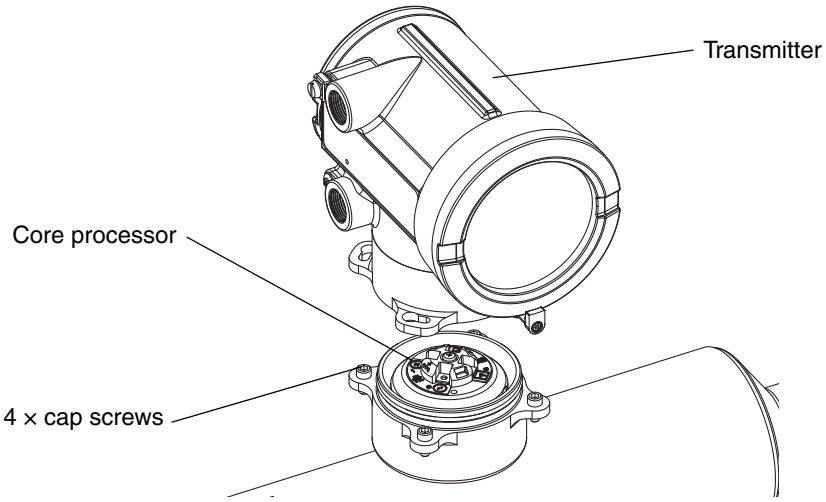
For both tests you will need to expose the core processor.

6.13.1 Exposing the core processor

Follow these procedures to expose the core processor.

1. Determine your installation type. See Appendix A.
2. If you have a 4-wire remote installation or a remote core processor with remote transmitter installation, simply remove the core processor lid. The core processor is intrinsically safe and can be opened in all environments.
3. If you have an integral installation:
   a. Loosen the four cap screws that fasten the transmitter to the base (Figure 6-1).
   b. Rotate the transmitter counter-clockwise so that the cap screws are in the unlocked position.
   c. Gently lift the transmitter straight up, disengaging it from the cap screws. Do not disconnect or damage the wires that connect the transmitter to the core processor.
4. If you have a 9-wire remote installation:
   a. Remove the end-cap.
   b. Inside the core processor housing, loosen the three screws that hold the core processor mounting plate in place. Do not remove the screws. Rotate the mounting plate so that the screws are in the unlocked position.
   c. Holding the tab on the mounting plate, slowly lower the mounting plate so that the top of the core processor is visible. Do not disconnect or damage the wires that connect the core processor to the transmitter.

Figure 6-1 Integral installation components



When reassembling components, take care not to pinch or stress the wires. Grease all O-rings.

6.13.2 Checking the core processor LED

Do not shut off power to the transmitter when checking the core processor LED. To check the core processor LED:

1. Expose the core processor according to the instructions in Section 6.13.1.
2. Check the core processor LED against the conditions listed in Table 6-10 (standard core processor) or Table 6-11 (enhanced core processor).

Table 6-10 Standard core processor LED behavior, flowmeter conditions, and remedies

LED behavior	Condition	Possible remedy
1 flash per second (75% off, 25% on)	Normal operation	No action required
1 flash per second (25% off, 75% on)	Slug flow	See Section 6.10.
Solid on	Zero or calibration in progress	If zero or calibration procedure is in progress, no action is required. If these procedures are not in progress, contact Micro Motion Customer Service.
	Core processor receiving between 11.5 and 5 volts	Check power supply to transmitter. See Section 6.9.1.
3 rapid flashes followed by a pause	Sensor not recognized	Check wiring between transmitter and sensor (9-wire remote installation or remote core processor with remote transmitter installation). Refer to the installation manual.
	Improper configuration	Verify characterization. See Section 3.3.
	Broken pin between sensor and core processor	Contact Micro Motion Customer Service.
4 flashes per second	Fault condition	Check alarm status.
OFF	Core processor receiving less than 5 volts	Verify power supply wiring to core processor. Refer to the installation manual.
		If status LED is lit, transmitter is receiving power. Check voltage across terminals 1 (VDC+) and 2 (VDC–) in core processor. Normal reading is approximately 14 VDC. If reading is normal, internal core processor failure is possible — contact Micro Motion Customer Service. If reading is 0, internal transmitter failure is possible — contact Micro Motion Customer Service. If reading is less than 1 VDC, verify power supply wiring to core processor. Wires may be switched. Refer to the installation manual.
		If status LED is not lit, transmitter is not receiving power. Check power supply. If power supply is operational, internal transmitter, display, or LED failure is possible. Contact Micro Motion Customer Service.
	Core processor internal failure	Contact Micro Motion Customer Service.

Table 6-11 Enhanced core processor LED behavior, meter conditions, and remedies

LED behavior	Condition	Possible remedy
Solid green	Normal operation	No action required.
Flashing yellow	Zero in progress	If calibration is in progress, no action required. If no calibration is in progress, contact Micro Motion.
Solid yellow	Low severity alarm	Check alarm status.

Table 6-11 Enhanced core processor LED behavior, meter conditions, and remedies (continued)

LED behavior	Condition	Possible remedy
Solid red	High severity alarm	Check alarm status.
Flashing red (80% on, 20% off)	Tubes not full	If alarm A105 (slug flow) is active, see Section 6.10.
		If alarm A033 (tubes not full) is active, verify process. Check for air in the flow tubes, tubes not filled, foreign material in tubes, or coating in tubes.
Flashing red (50% on, 50% off)	Electronics failed	Contact Micro Motion Customer Service.
Flashing red (50% on, 50% off, skips every 4th)	Sensor failed	Contact Micro Motion Customer Service.
OFF	Core processor receiving less than 5 volts	• Verify power supply wiring to core processor. Refer to Appendix A for diagrams. • If transmitter status LED is lit, transmitter is receiving power. Check voltage across terminals 1 (VDC+) and 2 (VDC–) in core processor. If reading is less than 1 VDC, verify power supply wiring to core processor. Wires may be switched. See Section 6.9.1. Otherwise, contact Micro Motion Customer Service. • If transmitter status LED is not lit, transmitter is not receiving power. Check power supply. See Section 6.9.1. If power supply is operational, internal transmitter, display, or LED failure is possible. Contact Micro Motion Customer Service.
	Core processor internal failure	Contact Micro Motion Customer Service.

6.13.3 Core processor resistance test

To perform the core processor resistance test:

1. Disconnect power to the transmitter and core processor.
2. Expose the core processor according to the instructions in Section 6.13.1.
3. Measure the resistance across the following terminal pairs:
   - The resistance across terminals 3 and 4 (RS-485A and RS-485B) should be 40–50 kilo-ohms.
   - The resistance across terminals 2 and 3 (VDC– and RS-485A) should be 20–25 kilo-ohms.
   - The resistance across terminals 2 and 4 (VDC– and RS-485B) should be 20–25 kilo-ohms.

If any of the resistance measurements are lower than specified, the core processor may not be able to communicate with a transmitter or remote host. Contact Micro Motion Customer Service.

6.14 Checking sensor coils and RTD

Problems with sensor coils can cause several alarms, including sensor failure and a variety of out-of-range conditions. Checking the sensor coils involves testing the terminal pairs and testing for shorts to the case.

6.14.1 9-wire remote or remote core processor with remote transmitter installation

If you have a 9-wire remote or a remote core processor with remote transmitter installation:

1. Power down the transmitter.
2. If the transmitter is in a hazardous area, wait five minutes.
3. Remove the end-cap from the core processor housing.
4. Unplug the terminal blocks from the terminal board.
5. Using a digital multimeter (DMM), check the circuits listed in Table 6-12 by placing the DMM leads on the unplugged terminal blocks for each terminal pair.

Table 6-12 Circuit terminal pairs

Circuit	Test terminal pair
Drive coil	Brown to red
Left pickoff coil (LPO)	Green to white
Right pickoff coil (RPO)	Blue to gray
Resistance temperature detector (RTD)	Yellow to violet
Lead length compensator (LLC) (All sensors except CMF400 IS and T-Series) Composite RTD (T-Series only) Fixed resistor (CMF400 IS only)	Yellow to orange

6. There should be no open circuits (i.e., no infinite resistance readings). The LPO and RPO readings should be the same or very close (±5 ohms). If there are any unusual readings, repeat the coil measurement tests at the sensor junction box to eliminate the possibility of faulty cable. The readings for each coil pair should match at both ends.

   If the cable is faulty, replace the cable.

7. Leave the core processor terminal blocks disconnected. At the sensor, remove the lid of the junction box and test each sensor terminal for a short to case by placing one DMM lead on the terminal and the other lead on the sensor case. With the DMM set to its highest range, there should be infinite resistance on each lead. If there is any resistance at all, there is a short to the case.

8. Test the terminal pairs as follows:
   - Brown against all other terminals except Red
   - Red against all other terminals except Brown
   - Green against all other terminals except White
   - White against all other terminals except Green
   - Blue against all other terminals except Gray
   - Gray against all other terminals except Blue
   - Orange against all other terminals except Yellow and Violet
   - Yellow against all other terminals except Orange and Violet
   - Violet against all other terminals except Yellow and Orange

Note: D600 sensors and CMF400 sensors with booster amplifiers have different terminal pairs. Contact Micro Motion Customer Service for assistance.

   There should be infinite resistance for each pair. If there is any resistance at all, there is a short between terminals.

9. See Table 6-13 for possible causes and solutions.
10. If the problem is not resolved, contact Micro Motion Customer Service.

Note: When reassembling the meter components, be sure to grease all O-rings.

Table 6-13 Sensor and cable short to case possible causes and remedies

Possible cause	Solution
Moisture inside the sensor junction box	Make sure that the junction box is dry and no corrosion is present.
Liquid or moisture inside the sensor case	Contact Micro Motion Customer Service.
Internally shorted feedthrough (sealed passage for wiring from sensor to sensor junction box)	Contact Micro Motion Customer Service.
Faulty cable	Replace cable.
Improper wire termination	Verify wire terminations inside sensor junction box. See the *Micro Motion 9-Wire Flowmeter Cable Preparation and Installation Guide* or the sensor documentation.

6.14.2 4-wire remote or integral installation

If you have a 4-wire remote installation or an integral installation:

1. Power down the transmitter.
2. If the transmitter is in a hazardous environment, wait five minutes.
3. If you have a 4-wire remote installation, remove the core processor lid.
4. If you have an integral installation:
   a. Loosen the four cap screws that fasten the transmitter to the base (Figure 6-1).
   b. Rotate the transmitter counter-clockwise so that the cap screws are in the unlocked position.
   c. Gently lift the transmitter straight up, disengaging it from the base.

Note: You have the option of disconnecting the 4-wire cable or leaving it connected.

5. If you have a standard core processor, loosen the captive screw (2,5 mm) at the center of the core processor. Carefully remove the core processor from the sensor by grasping it and lifting it straight up. **Do not twist or rotate the core processor**.
6. If you have an enhanced core processor, loosen the two captive screws (2,5 mm) that hold the core processor in the housing. Gently lift the core processor out of the housing, then disconnect the sensor cable from the feedthrough pins. **Do not damage the feedthrough pins**.

If the core processor (feedthrough) pins are bent, broken, or damaged in any way, the core processor will not operate. Do not twist or rotate the core processor when lifting it. When replacing the core processor (or sensor cable) on the pins, be sure to align the guide pins and mount the core processor (or sensor cable) carefully.

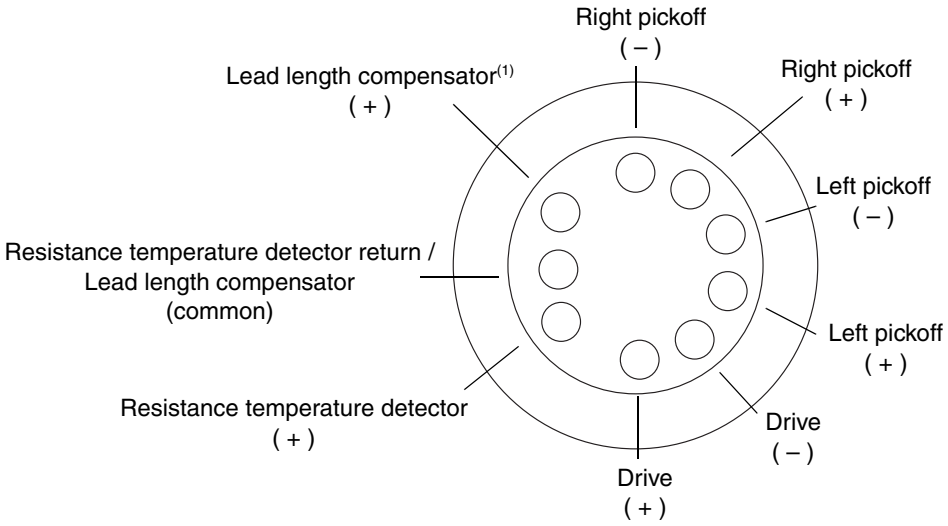
7. Use a digital multimeter (DMM) to check the resistance across the right and left pickoff coils. See Figure 6-2. Neither pair should be an open circuit (i.e., infinite resistance). The resistance values should be the same or very close (±5 ohms).
8. Use the DMM to check the resistance across the RTD and LLC (lead length compensation) circuits. See Figure 6-2. Neither pair should be an open circuit (i.e., infinite resistance).
9. Test for a ground to case by checking the resistance between each pin and the sensor case. With the DMM set to its highest range, there should be infinite resistance on each lead. If there is any resistance at all, there is a short to case.

   If a short to case is indicated, check for moisture or corrosion. If you are unable to determine the source of the problem, contact Micro Motion Customer Service.
10. Test for shorts across terminals by testing resistance across the following terminal pairs (see Figures 6-2 and 6-3). There should be infinite resistance in each case. If there is any resistance at all, there is a short between the terminals.
    - Brown against all other terminals except Red
    - Red against all other terminals except Brown
    - Green against all other terminals except White
    - White against all other terminals except Green
    - Blue against all other terminals except Gray
    - Gray against all other terminals except Blue
    - Orange against all other terminals except Yellow and Violet
    - Yellow against all other terminals except Orange and Violet
    - Violet against all other terminals except Yellow and Orange

Note: D600 sensors and CMF400 sensors with booster amplifiers have different terminal pairs. Contact Micro Motion Customer Service for assistance.

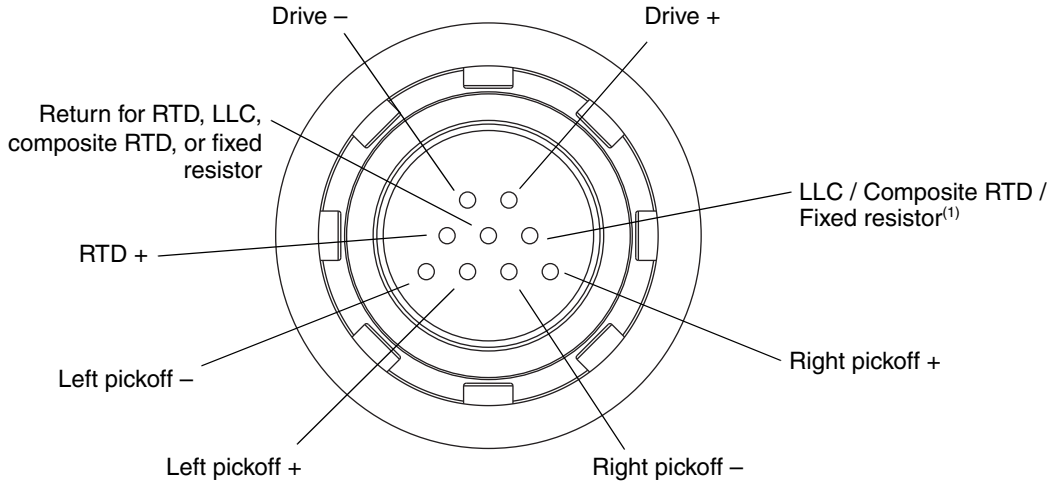
If a short between terminals is indicated, contact Micro Motion Customer Service.

Figure 6-2 Sensor pins – Standard core processor



(1) LLC for all sensors except T-Series and CMF400 I.S. For T-Series sensors, functions as composite RTD. For CMF400 I.S. sensors, functions as fixed resistor.

Figure 6-3 Sensor pins – Enhanced core processor



(1) Lead length compensator (LLC) for all sensors except T-Series, CMF400 I.S., and F300. For T-Series sensors, functions as composite RTD. For CMF400 I.S. and F300 sensors, functions as fixed resistor.

Note: The pins are shown as they appear while looking at the feedthrough on the sensor.

Reinstalling the core processor

If you removed the core processor, replace the core processor according to the instructions below.

1. If you have a standard core processor:
   a. Align the three guide pins on the bottom of the core processor with the corresponding holes in the base of the core processor housing.
   b. Carefully mount the core processor on the pins, taking care not to bend any pins.
2. If you have an enhanced core processor:
   a. Plug the sensor cable onto the feedthrough pins, being careful not to bend or damage any pins.
   b. Replace the core processor in the housing.
3. Tighten the captive screw(s) to 6 to 8 in-lbs (0,7 to 0,9 N-m) of torque.
4. If you have a 4-wire remote installation, replace the core processor lid.
5. If you have an integral installation:
   a. Gently lower the transmitter onto the base, inserting the cap screws into the slots. Do not pinch or stress the wires.
   b. Rotate the transmitter clockwise so that the cap screws are in the locked position.
   c. Tighten the cap screws, torquing to 20 to 30 in-lbs (2,3 to 3,4 N-m).

Note: When reassembling the flowmeter components, grease all O-rings.

Appendix A
Flowmeter Installation Types and Components

A.1 Overview

This appendix provides illustrations of different flowmeter installations and components for the Model 2700 transmitter.

A.2 Installation diagrams

Model 2700 transmitters can be installed in four different ways (see Figure A-1):

- Integral
- 4-wire remote
- 9-wire remote
- Remote core processor with remote transmitter

A.3 Component diagrams

Figure A-2 shows the transmitter and core processor components in integral installations.

Figure A-3 shows the transmitter components in 4-wire remote installations and remote core processor with remote transmitter installations.

Figure A-4 shows the transmitter/core processor assembly in 9-wire remote installations.

In remote core processor with remote transmitter installations, the core processor is installed stand-alone. See Figure A-5.

A.4 Wiring and terminal diagrams

In 4-wire remote and remote core processor with remote transmitter installations, a 4-wire cable is used to connect the core processor to the transmitter's mating connector. See Figure A-6.

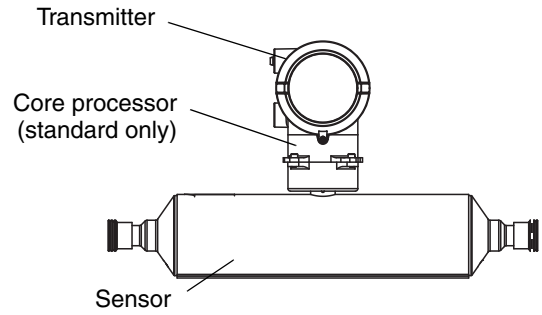
In 9-wire remote installations, a 9-wire cable is used to connect the junction box on the sensor to the terminals on the transmitter/core processor assembly. See Figure A-8.

Figure A-9 shows the transmitter's power supply terminals.

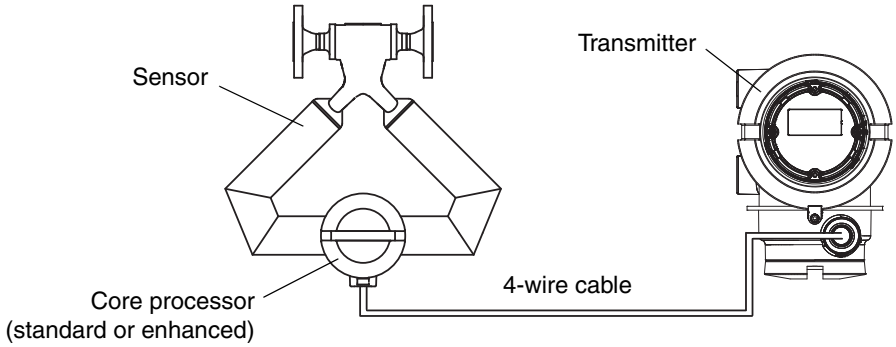
Figure A-9 shows the output terminals for the Model 2700 transmitter.

Figure A-1 Installation types

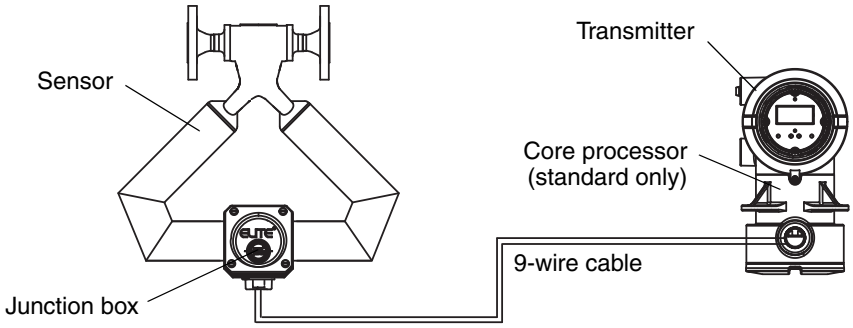
Integral



4-wire remote



9-wire remote



Remote core processor with remote transmitter

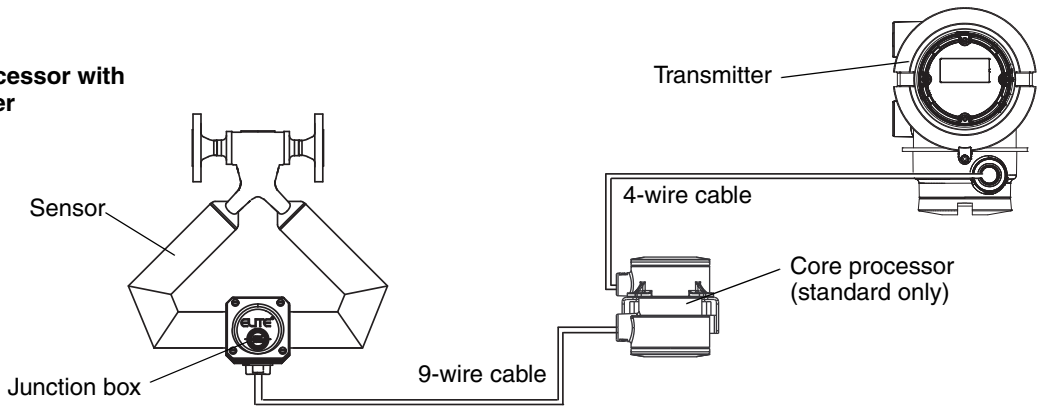


Figure A-2 Transmitter and core processor components — Integral installations

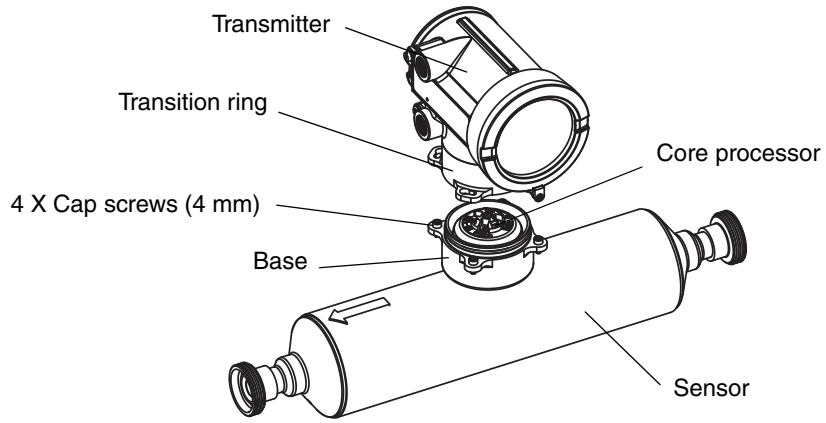


Figure A-3 Transmitter components, junction end-cap removed — 4-wire remote and remote core processor with remote transmitter installations

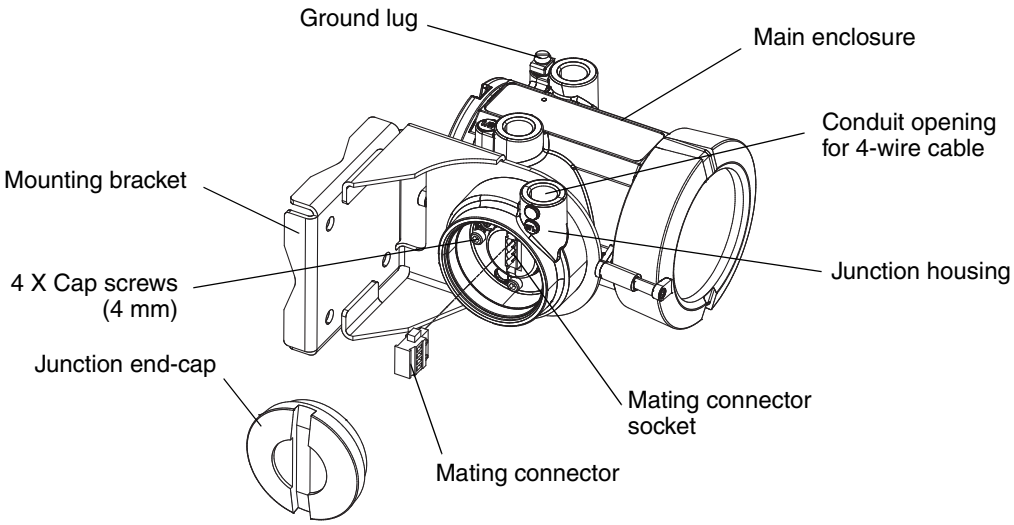


Figure A-4 Transmitter/core processor assembly exploded view — 9-wire remote installations

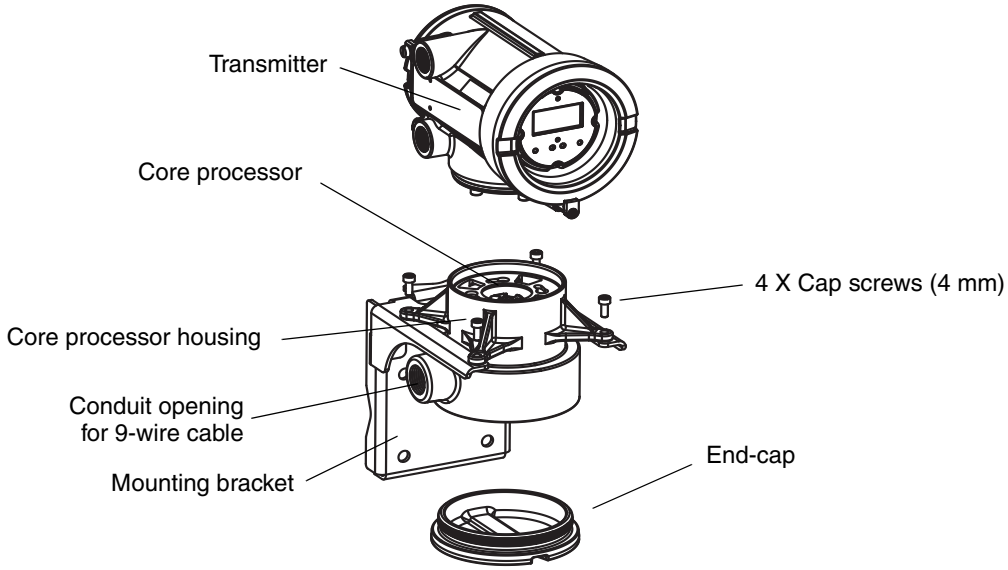


Figure A-5 Remote core processor components

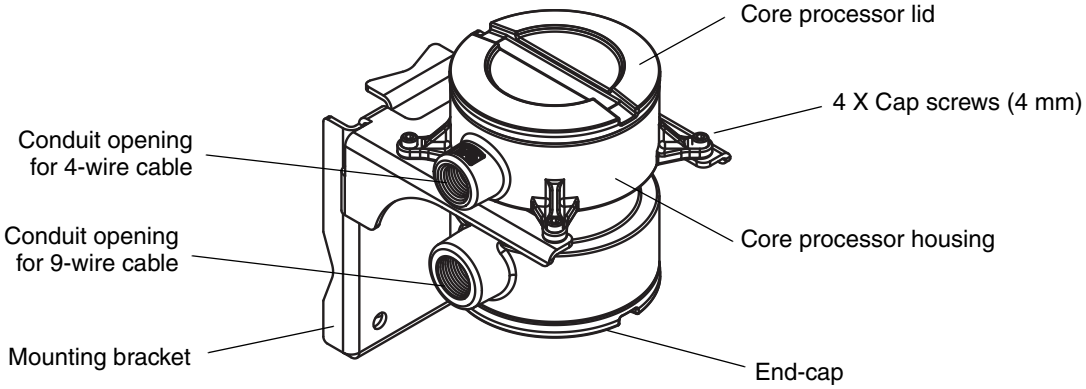


Figure A-6 4-wire cable between Model 2700 transmitter and standard core processor

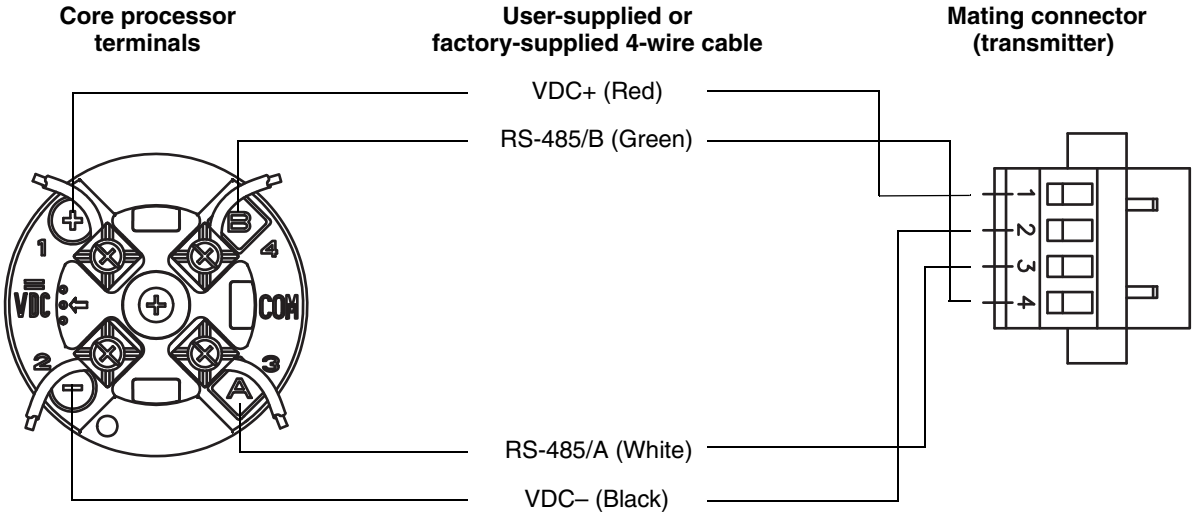


Figure A-7 4-wire cable between Model 2700 transmitter and enhanced core processor

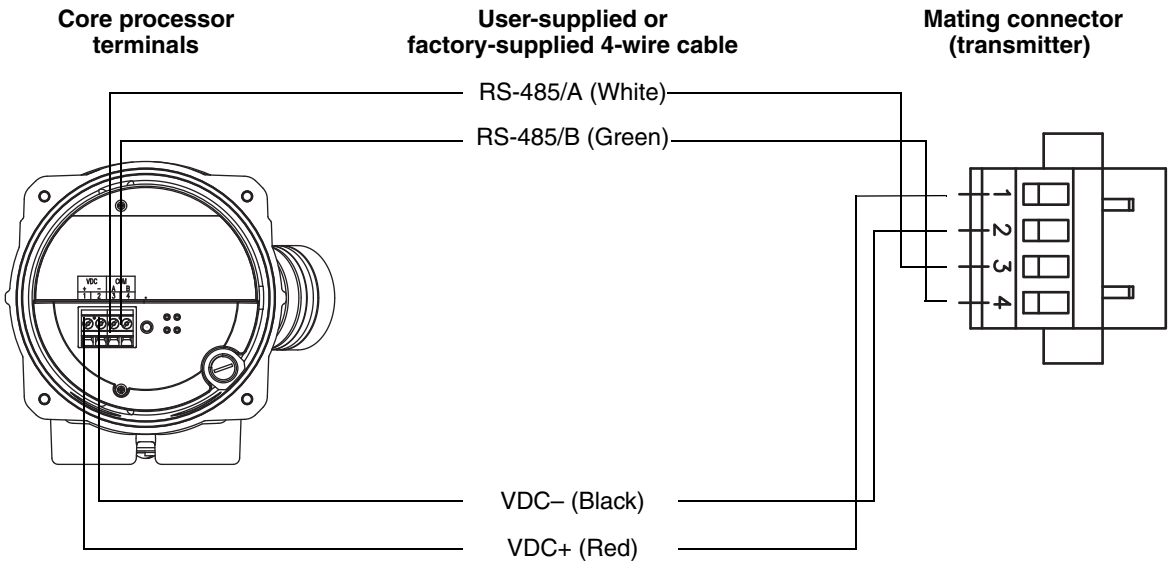


Figure A-8 9-wire cable between sensor junction box and core processor

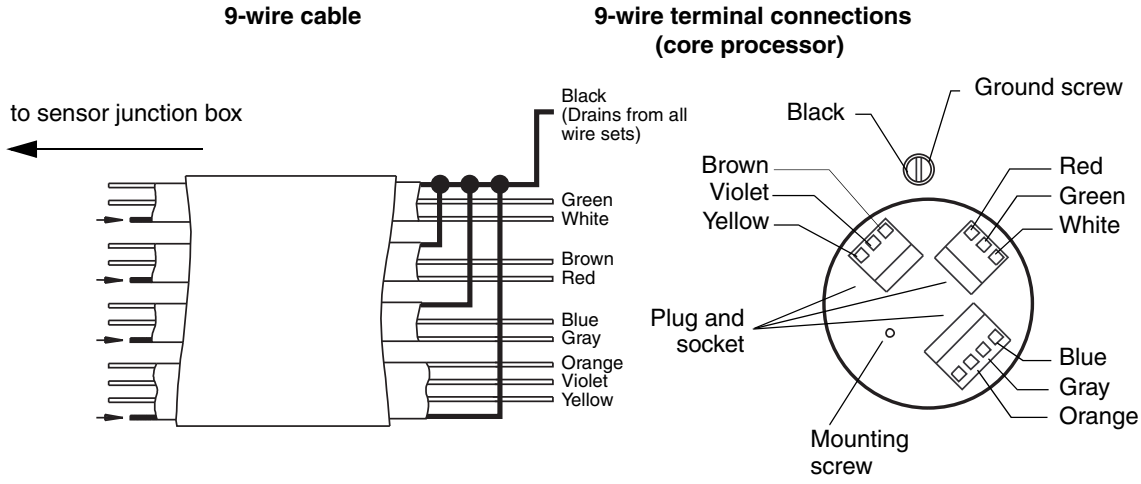
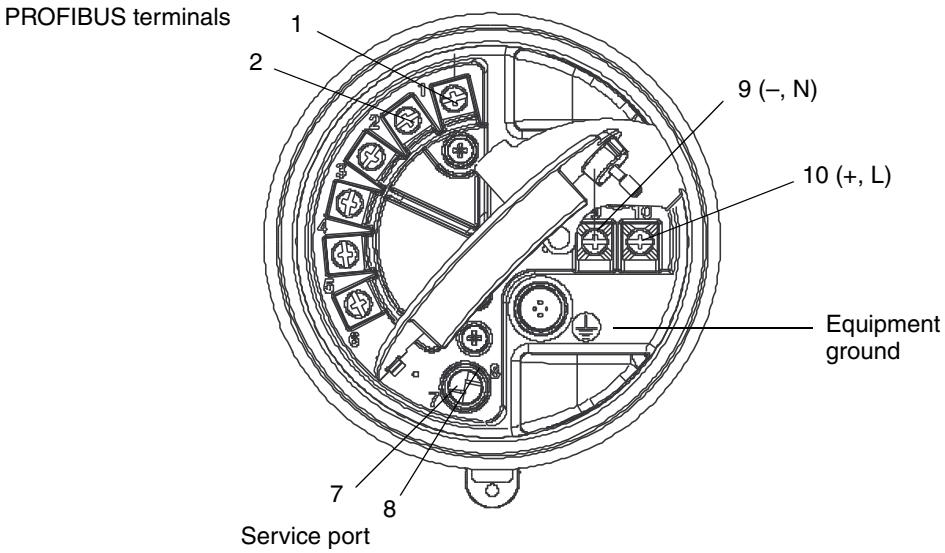


Figure A-9 Output and power supply terminals



Appendix B
Using the Display

B.1 Overview

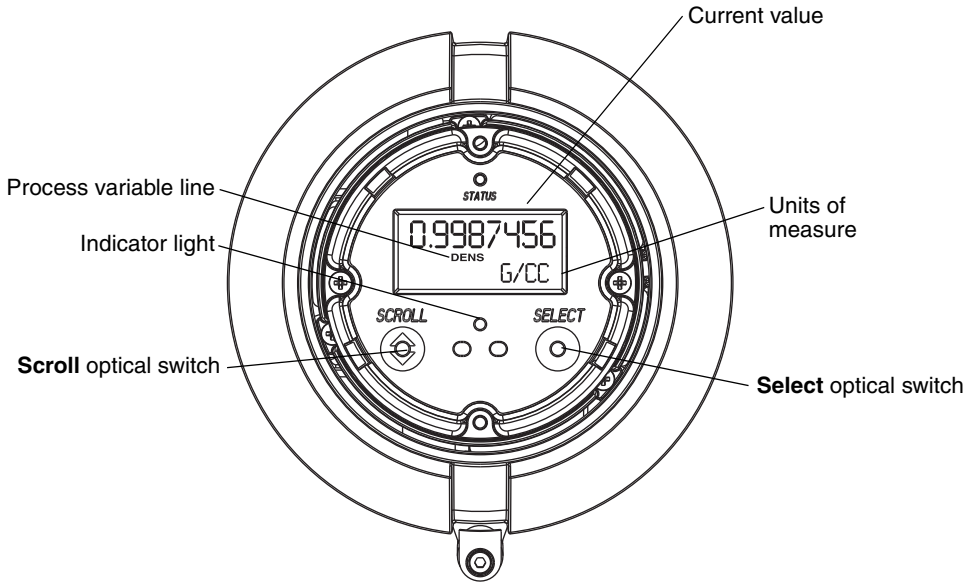
This appendix describes the basic use of the display and provides a menu tree for the display. You can use the menu tree to locate and perform display commands quickly.

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

B.2 Components

Figure B-1 illustrates the display components.

Figure B-1 Display components



B.3 Using the optical switches

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 is an optical switch indicator between the optical switches. When an optical switch is activated, the optical switch indicator is a solid red.

Attempting to activate an optical switch by inserting an object into the opening can damage the equipment. Do not insert an object into the openings. Use your fingers to activate the optical switches.

B.4 Using the display

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

B.4.1 Display language

The display can be configured for the following languages:

- English
- French
- Spanish
- German

Due to software and hardware restrictions, some English words and terms may appear in the non-English display menus. For a list of the codes and abbreviations used on the display, see Table B-1.

For information on configuring the display language, see Section 4.16.5.

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

B.4.2 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 4.16.5 for information on configuring the display variables.
- See Table B-1 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 manage totalizers and inventories, see Section 5.8.

B.4.3 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 a PROFIBUS host, PROFIBUS configuration tool, or ProLink II

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 4.16.1.

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.

B.4.4 Display password

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

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

For information about enabling and setting the display password, refer to Section 4.16.4.

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

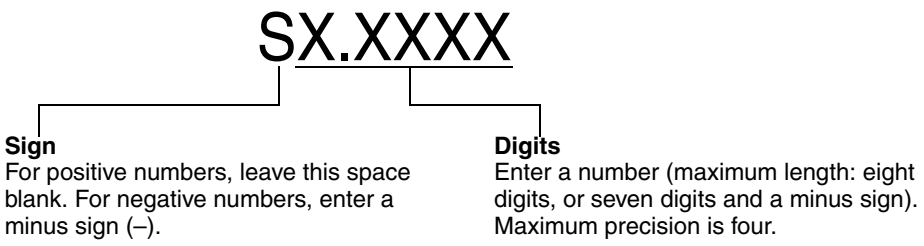
If a password is required, the word **CODE?** appears at the top of the password screen. Enter the digits of the password one at a time by using **Scroll** to choose a number and **Select** to move to the next digit.

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

B.4.5 Entering floating-point values with the display

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

Figure B-2 Numeric values in decimal notation



To change the value:

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

To change the sign of a value:

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

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

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

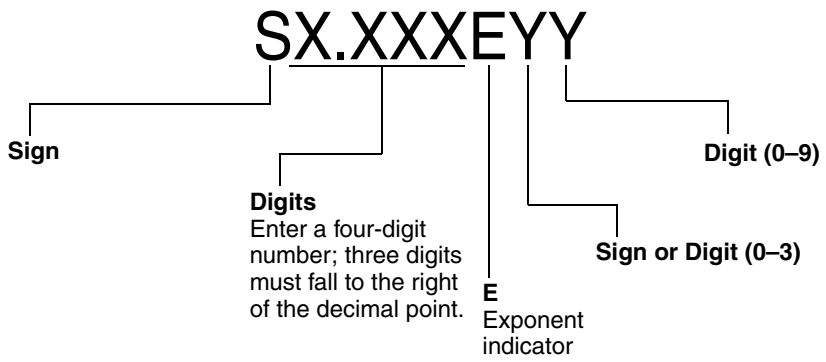
To change from decimal to exponential notation (see Figure B-3):

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

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

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

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



To change from exponential to decimal notation:

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

To exit the menu:

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

B.5 Abbreviations

The display uses a number of abbreviations. Table B-1 lists the abbreviations used by the display.

Table B-1 Display codes and abbreviations

Abbreviation	Definition	Abbreviation	Definition
ACK ALARM	Acknowledge alarm	LPO_A	Left pickoff amplitude
ACK ALL	Acknowledge all alarms	LVOLI	Volume inventory
ADDR	Address	LZERO	Live zero flow
AUTO SCRLL	Auto scroll	MAINT	Maintenance
AVE_D	Average density	MASS	Mass flow
AVE_T	Average temperature	MASSI	Mass inventory
BRD_T	Board temperature	MFLOW	Mass flow
BKLT	Backlight	MSMT	Measurement
CAL	Calibrate	MTR F	Meter factor
CHANGE CODE	Change display password	MTR_T	Case temperature (T-Series only)
CODE	Display password	NET M	CM net mass flow rate
CONC	Concentration	NET V	CM net volume flow rate
CONFG	Configure (or configuration)	NETMI	CM net mass inventory
CORE	Core processor	NETVI	CM net volume inventory
CUR Z	Current zero	OFFLN	Offline
DENS	Density	PASSW	Password
DGAIN	Drive gain	PRESS	Pressure
DISBL	Disable	PWRIN	Input voltage
DRIVE%	Drive gain	r.	Revision
DSPLY	Display	RDENS	Density at reference temperature
ENABL	Enable	RPO_A	Right pickoff amplitude
ENABLE ACK	Enable the ACK ALL function	SGU	Specific gravity units
ENABLE ALARM	Enable the alarm menu	SIM	Simulated
ENABLE AUTO	Enable auto scroll	SPECL	Special
ENABLE OFFLN	Enable the offline menu	STD M	Standard mass flow rate
ENABLE PASSW	Enable the display password	STD V	Standard volume flow rate
ENABLE RESET	Enable resetting of totals	STDVI	Standard volume inventory
ENABLE START	Enable stopping/starting of totals	TCDENS	Temperature-corrected density
EXT_P	External pressure	TCORI	Temperature-corrected inventory
EXT_T	External temperature	TCORR	Temperature-corrected total
EXTRN	External	TCVOL	Temperature-corrected volume
FAC Z	Factory zero	TEMPR	Temperature
FCF	Flow calibration factor	TUBEF	Raw tube frequency
FLDIR	Flow direction	VER	Version
GSV	Gas standard volume	VERFY	Verify
GSV F	Gas standard volume flow	VFLOW	Volume flow
GSV I	Gas standard volume inventory	VOL	Volume flow
GSV T	Gas standard volume total	WRPRO	Write protect
INTERN	Internal	WTAVE	Weighted average
LANG	Language	XMTR	Transmitter
LOCK	Write protect		

B.6 Display menus

Figures B-4 through B-16 show the commands accessible through the display.

Figure B-4 Display menu – Main

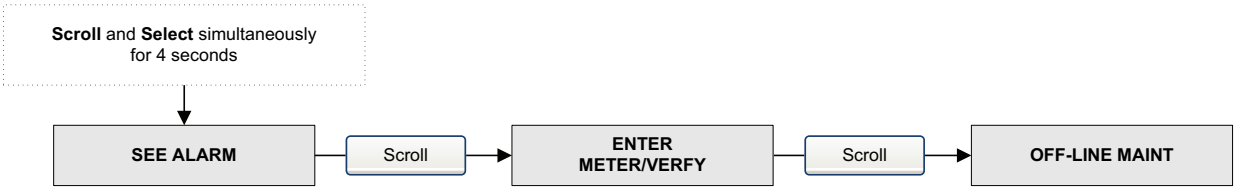


Figure B-5 Display menu – Alarms

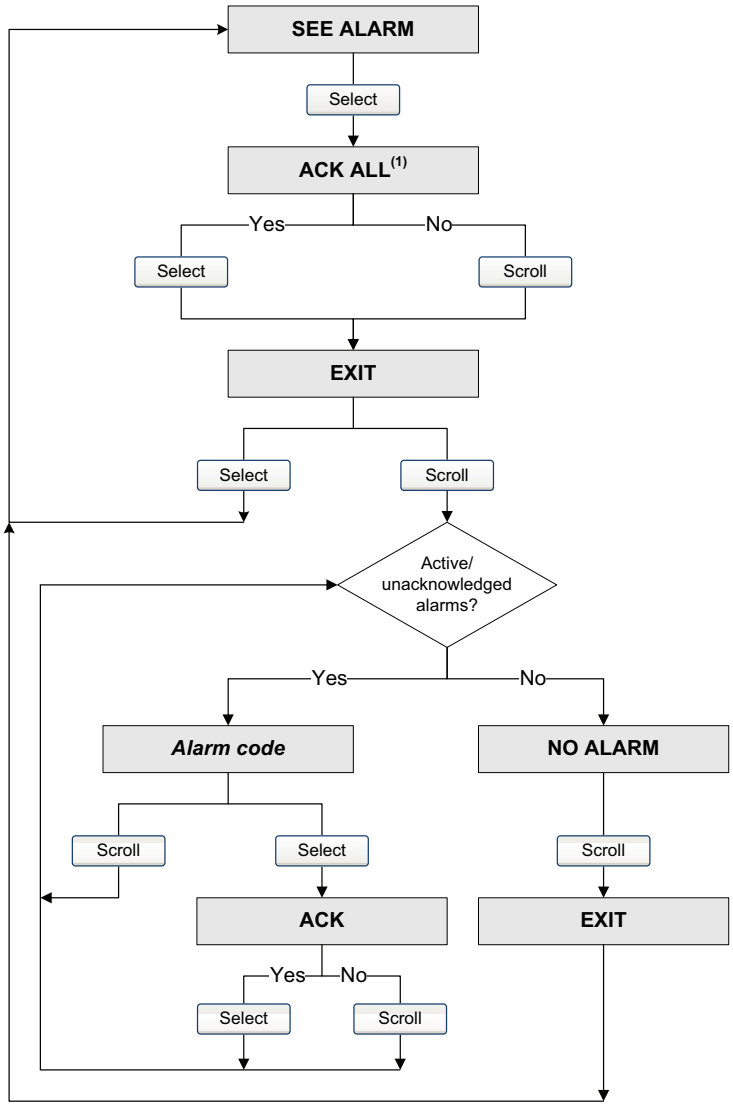


Figure B-6 Display menu – Smart Meter Verification: Run verification

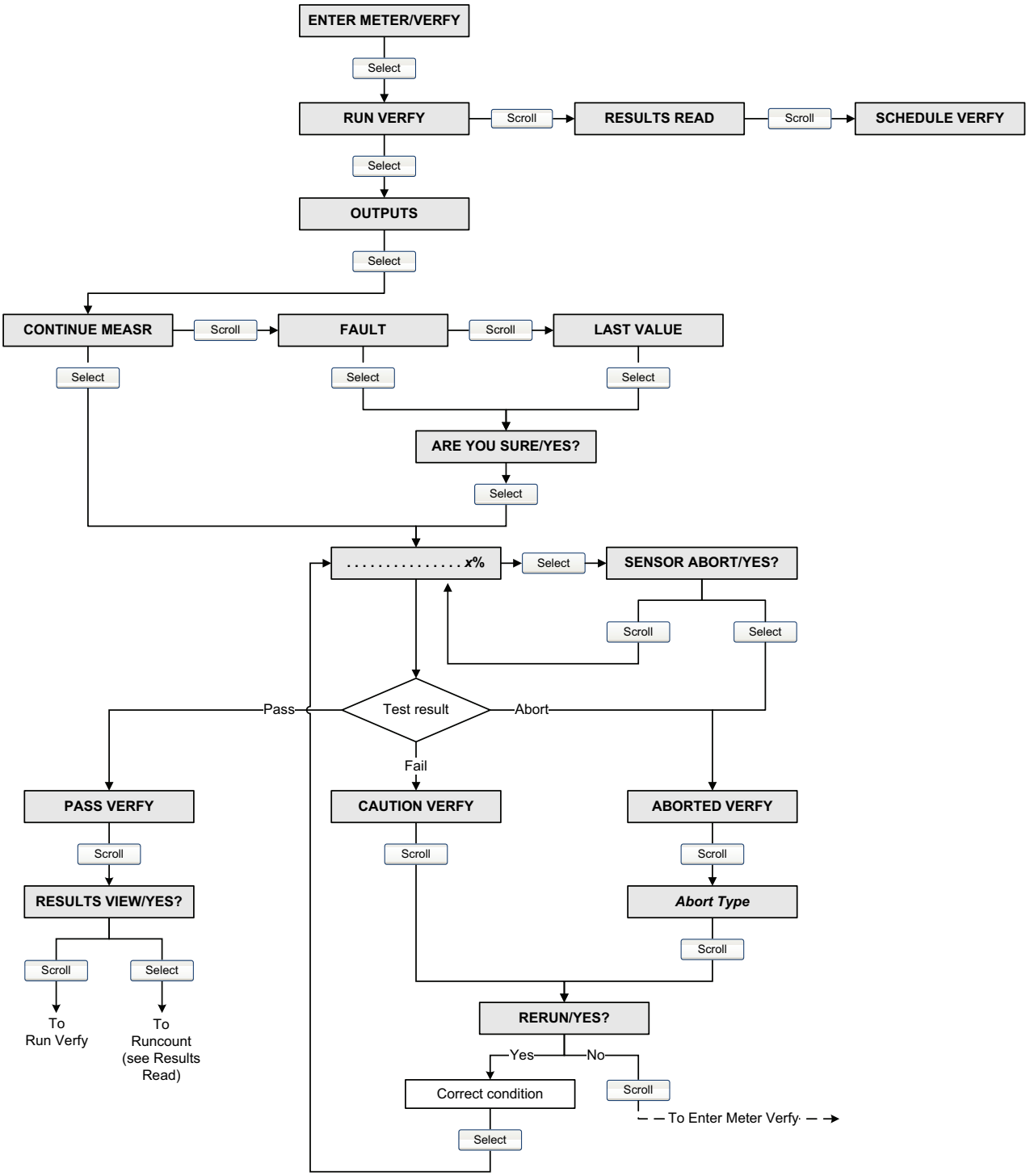


Figure B-7 **Display menu – Smart Meter Verification: Read results**

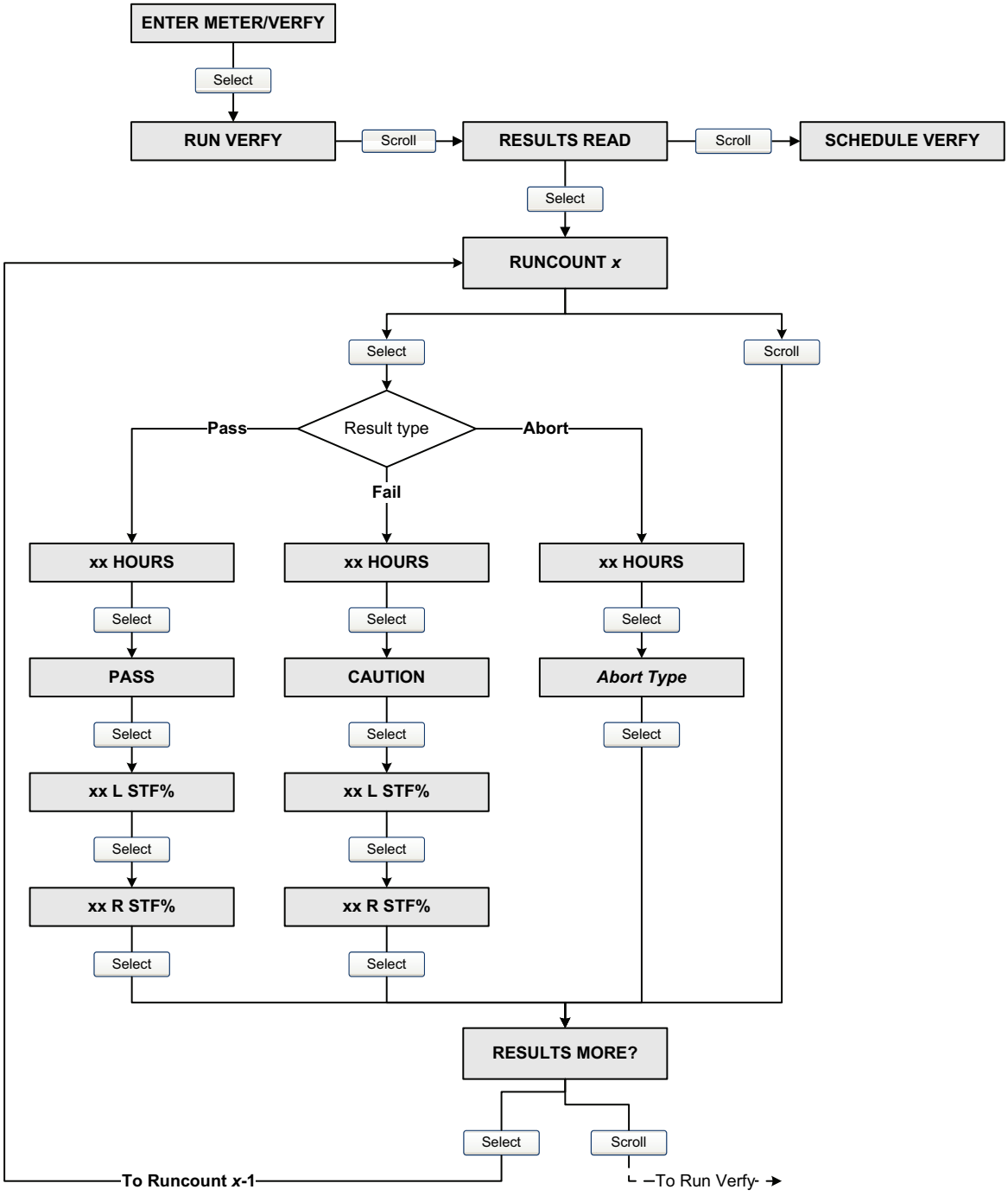


Figure B-8 Display menu – Smart Meter Verification: Scheduling

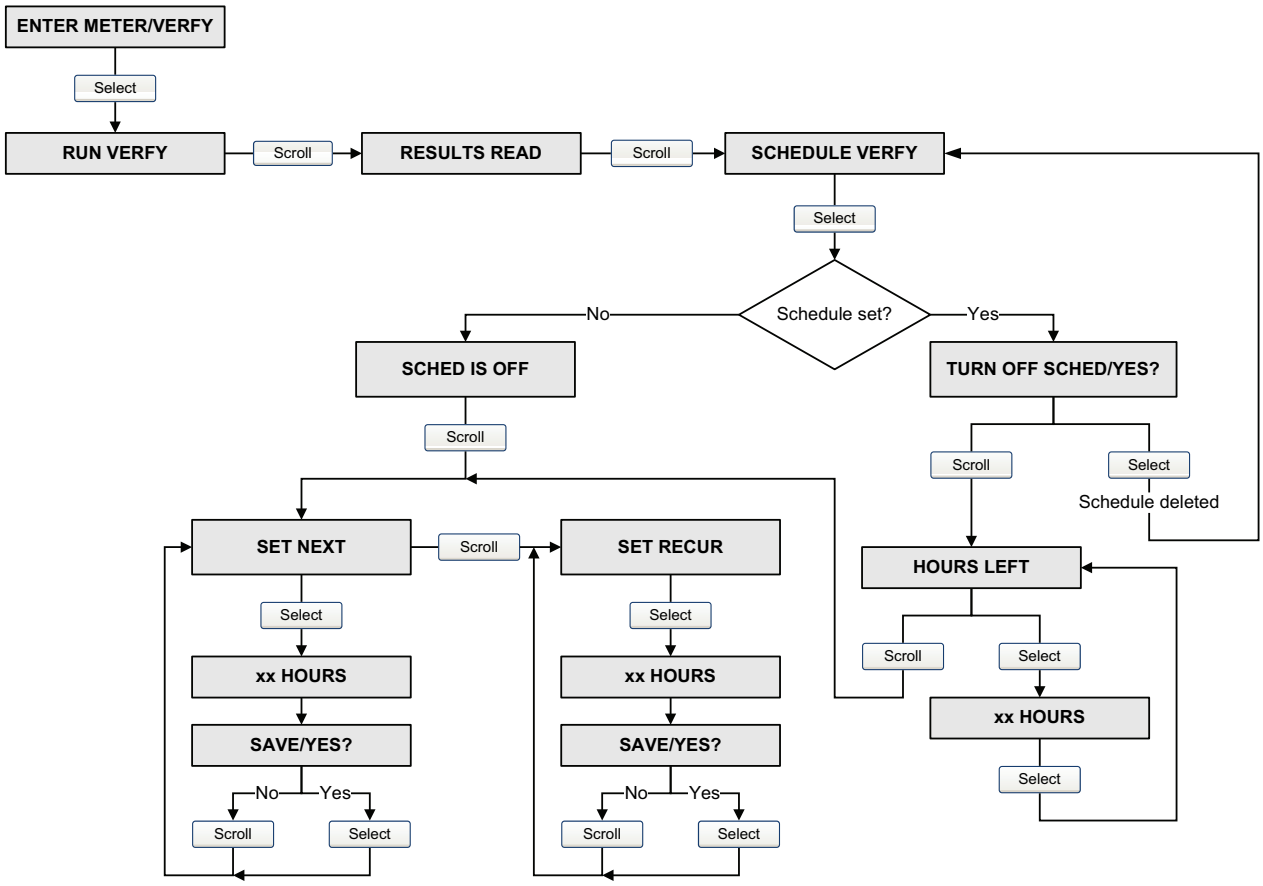


Figure B-9 Display menu – Off-line Maintenance

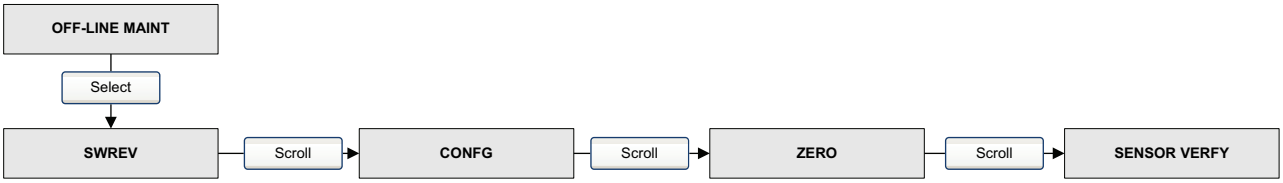


Figure B-10 Display menu – Off-line Maintenance: Configuration

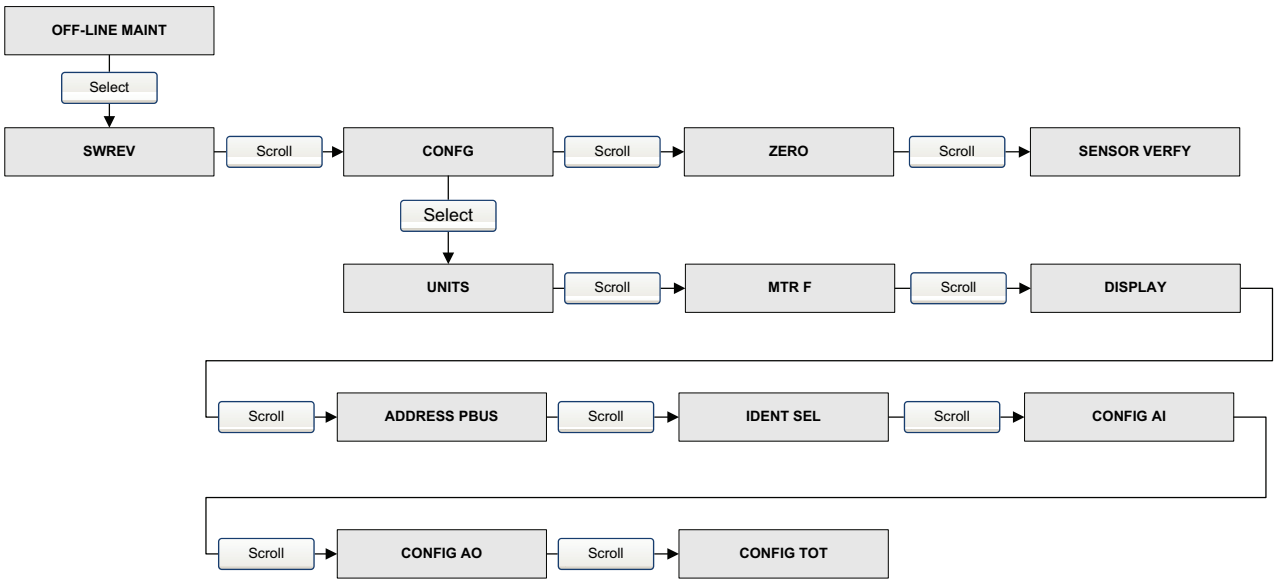


Figure B-11 Display menu – Off-line Maintenance: Configuration: Units

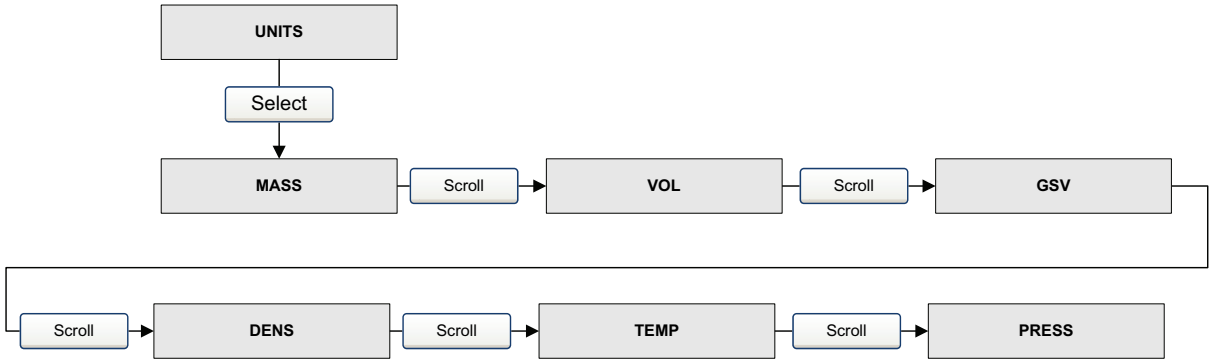


Figure B-12 Display menu – Off-line Maintenance: Configuration: Meter factors



Figure B-13 **Display menu – Off-line Maiintenance: Configuration: Display**

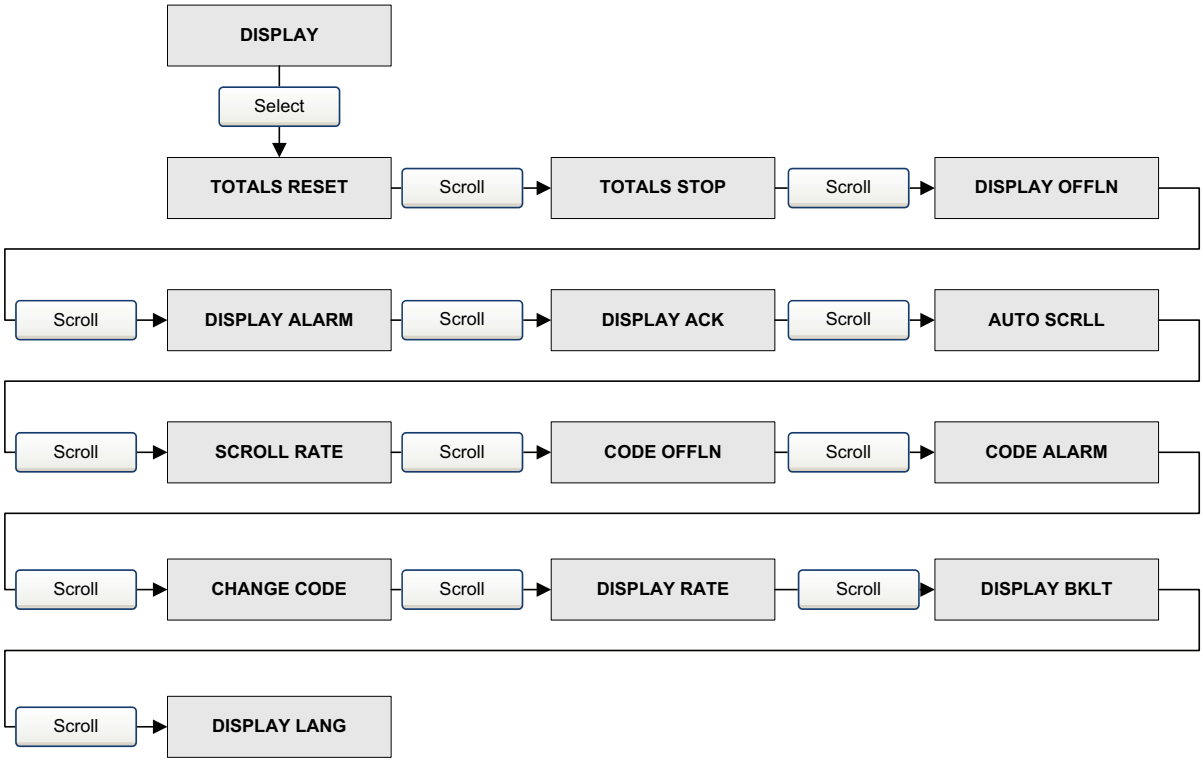


Figure B-14 **Display menu – Off-line Maintenance: Configuration: AI blocks**

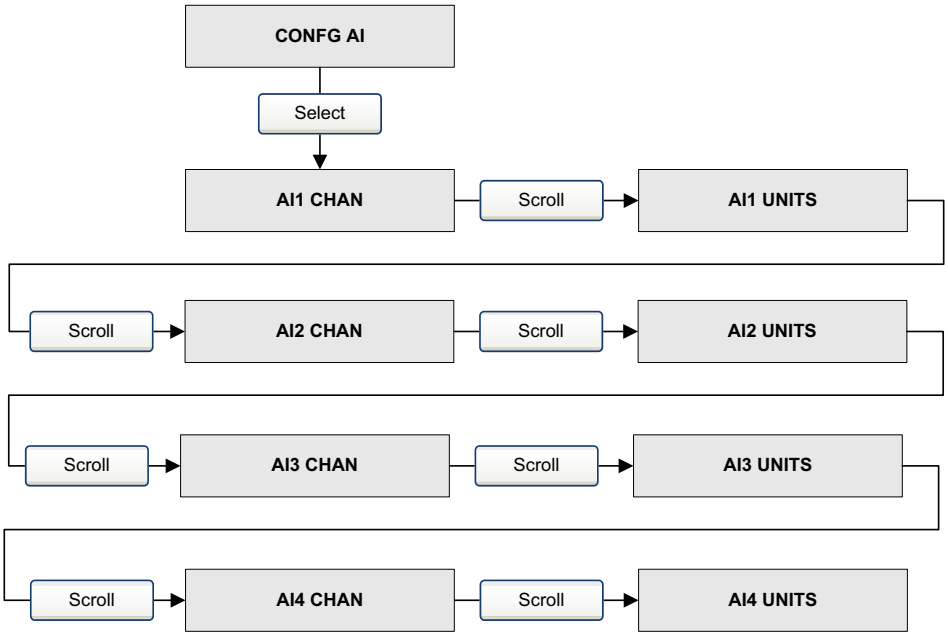


Figure B-15 **Display menu – Off-line Maintenance: Configuration: AO blocks**

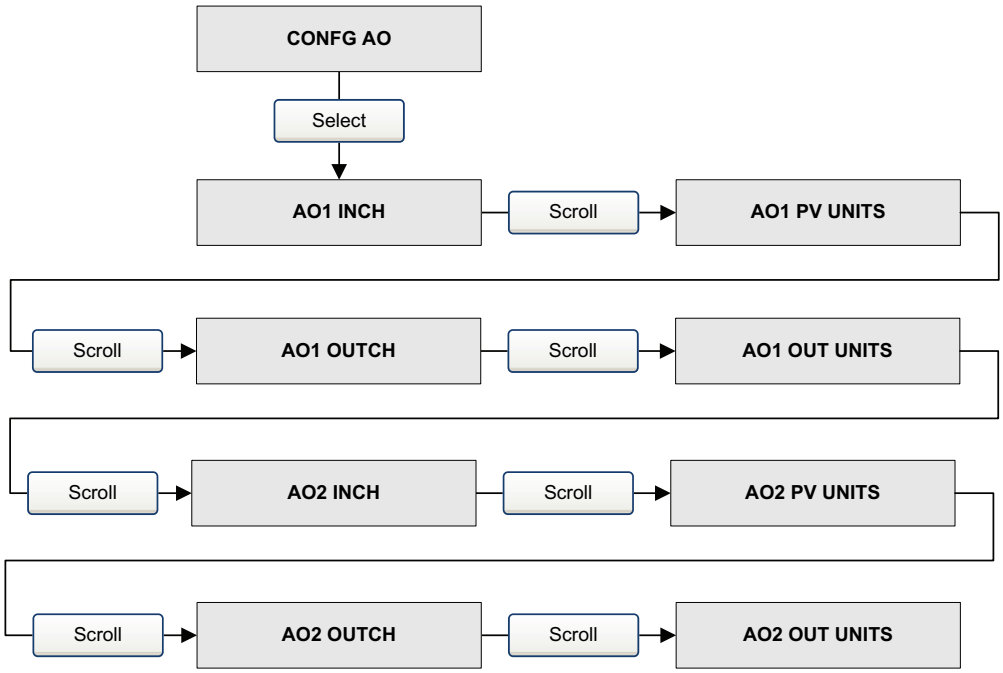


Figure B-16 **Display menu – Off-line Maintenance: Configuration: Totalizers**

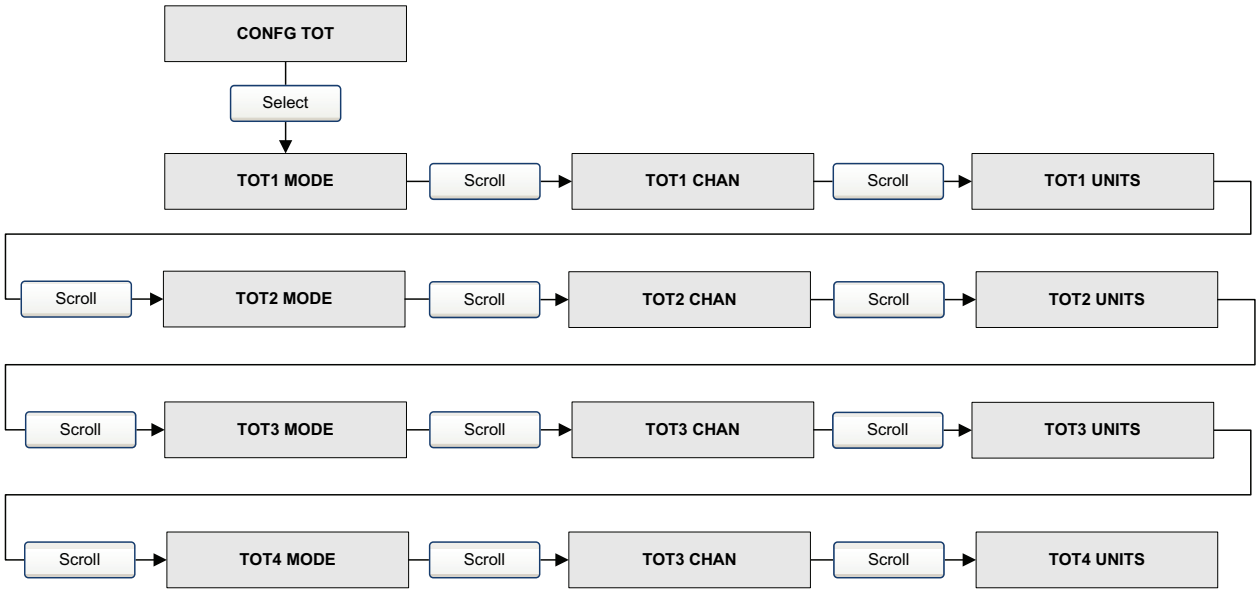
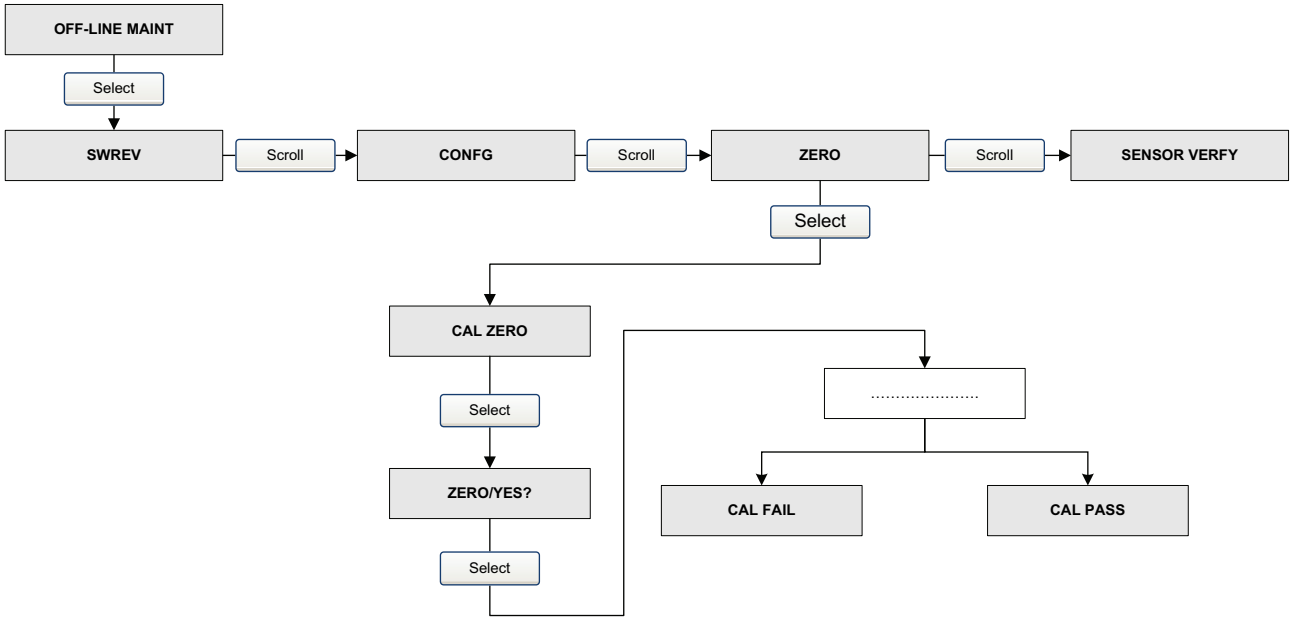


Figure B-17 Display menu – Off-line Maintenance: Zeroing



Appendix C
Connecting with ProLink II

C.1 Overview

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

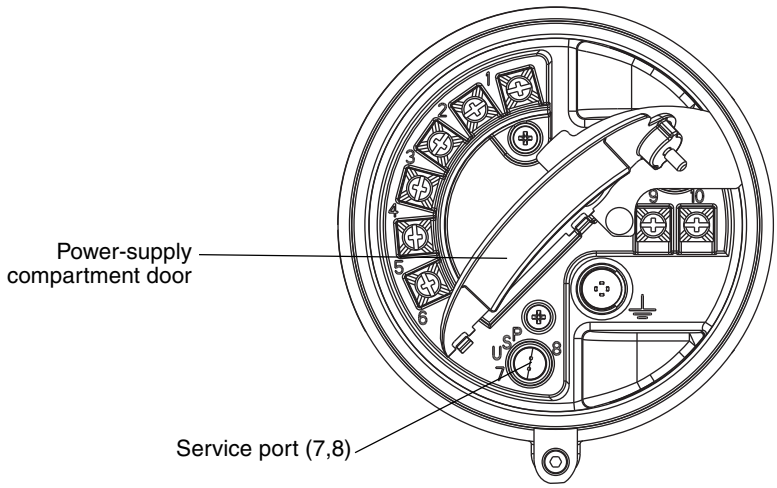
- Start and navigate in ProLink II software
- Establish communication between ProLink II software and compatible devices
- Transmit and receive configuration information between ProLink II software and compatible devices

If you are unable to perform the tasks listed above, consult the ProLink II software manual before attempting to use the software to configure a transmitter.

C.2 Connecting to a personal computer

You can temporarily connect a personal computer (PC) to the transmitter's service port. The service port is located within the transmitter wiring compartment, beneath the intrinsic safety cover. See Figure C-1.

Figure C-1 Service port



C.2.1 Connecting to the service port

To temporarily connect to the service port, which is located in the non-intrinsically safe power-supply compartment:

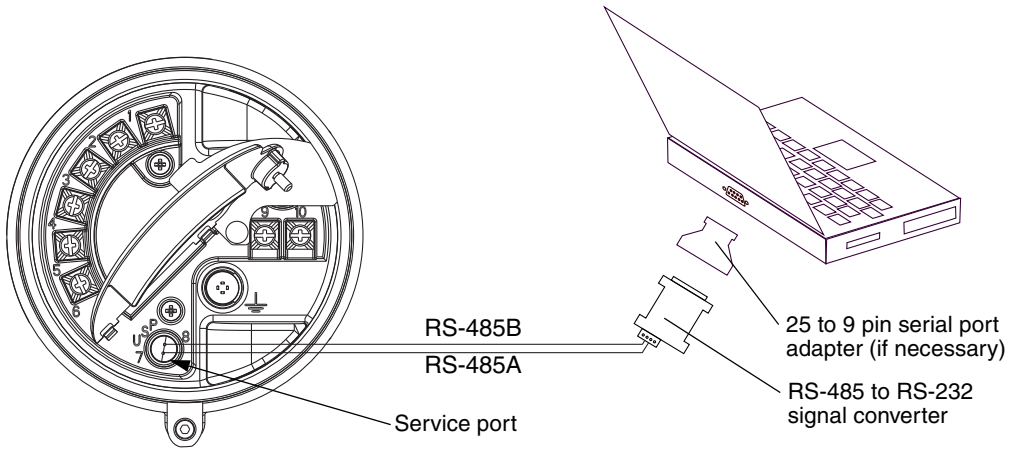
1. Open the cover to the intrinsically safe wiring compartment.

Opening the wiring compartment in a hazardous area can cause an explosion. The service port should only be used for temporary connections. When the transmitter is in an explosive atmosphere, do not use the service port to connect to the transmitter.

2. Open the transmitter's power-supply compartment door.
3. Connect one end of the signal converter leads to the RS-485 terminals on the signal converter.
4. Connect the other end of the signal converter leads to the service-port terminals. See Figure C-2.

Opening the power supply compartment can expose the operator to electric shock. To avoid the risk of electric shock, do not touch the power supply wires or terminals while using the service port.

Figure C-2 Connecting to the service port



Appendix D
PROFIBUS-PA Status Byte

D.1 Overview

This appendix describes the status byte reported by the transmitter to a PROFIBUS host. The output of each AI, AO, and totalizer function block is a 5-byte package: four bytes of process information and one byte indicating measurement quality, also called the status byte. The format of the status byte depends on whether the transmitter is configured for classic mode or condensed mode.

D.2 Classic-mode status byte format

Tables D-1 through D-6 describes the format of the status byte when the transmitter is configured for classic mode. Refer to Section 3.7.3.6 of the PROFIBUS-PA Profile for Process Control Devices v3.01 for more information.

Table D-1 Classic-mode status byte format

Status bits	Meaning	Comment
00	Bad	The measurement is not useful.
01	Uncertain	The quality of the measurement is below normal, but may still be useful.
10	Good – Non-cascade	The quality of the measurement is good, but alarms may be indicated by the sub-status.
11	Good – Cascade	The measurement is good.

Table D-2 Sub-status format – Bad status

Bits	Meaning	Comment
0011	Device failure	TRUE if the following alarm codes are active: A001, A002, A014, A029, or A030.
0100	Sensor failure	TRUE if the following alarm codes are active: A003, A004, A005, A016, or A017.
0111	Out of service	See the profile specification for details.

Table D-3 Sub-status format – Uncertain status

Bits	Meaning	Comment
0000	Non-specific	TRUE if the following alarm codes are active: A005, A008, A010, A011, A012, A013, A021, A033, or A102.
0011	Initial value	TRUE if the following alarm codes are active: A006 or A120.
1000	Simulated value	TRUE if the following alarm codes are active: A132.
1001	Sensor calibration	TRUE if the following alarm codes are active: A104.

Table D-4 Sub-status format – Good status (non-cascade)

Bits	Meaning	Comment
0001	Update event	
0010	Active advisory alarm	
0011	Active critical alarm	

Table D-5 Sub-status format – Good status (cascade)

Bits	Meaning	Comment
0000	OK	This bit is set if no alarms are active.

Table D-6 Limit bits

Bits	Meaning	Comment
00	OK	
01	Low limited	
10	High limited	
11	Constant	

D.3 Condensed-mode status byte format

Table D-7 describes the format of the status byte when the transmitter is configured for condensed mode. Refer to the PROFIBUS Specification Profile for Process Control Devices Version v3.01 December 2004 and the PROFIBUS Specification June 2005 Amendment 2 to the PROFIBUS Profile for Process Control Devices v3.01, Condensed Status and Diagnostic Messages v1.0 for additional information.

Table D-7 Condensed-mode status byte format

Expanded status	Condensed status	Alarms
BAD_DEVICE_FAIL (0x0C)	C_BAD_MAINTENANCE_ALARM (0x24…..0x27)[1][2]	A001, A002, A014, A029, A030
BAD_SENSOR_FAIL (0x10)	C_BAD_PROCESS_RELATED (0x2B)[2]	A003, A004, A016, A017
BAD_CFG_ERROR (0x04)	C_BAD_FUNCTION_CHECK (0x3C ……0x3F)[1][2]	A006, A020, A021
BAD_NON_SPECIFIC (0x00)	BAD_NON_SPECIFIC (0x00)	All remaining fault alarms under this category.
UC_SIMULATED_VALUE (0x60)	C_UNCERTAIN_SIMULATED_VALUE_START (0x73)	A132
UC_SENSOR_CAL (0x64)	C_BAD_FUNCTION_CHECK (0x3C ……0x3F)[1][2]	A104
UC_CFG_ERROR (0x5C)	C_BAD_FUNCTION_CHECK (0x3C……0x3F)[1][2]	A006, A020, A021
UC_NON_SPECIFIC (0x40)	C_UNCERTAIN_PROCESS_RELATED (0x78.. …0x7B)[1]	A005, A008, A010, A011, A012, A013, A033, A102
GOOD_NC_ADV_ALARM (0x88)	C_GOOD_ACTIVE_ADVISORY_ALARM (0x88…..0x91)[1]	All informational alarms.
GOOD_NC_UPDATE_EVT (0x84)	C_GOOD_UPDATE_EVENT (0x84)	ST revision update for transducer blocks.
GOOD_CAS_OK (0xC0)	C_GOOD_CAS_OK (0xC0)	None of the alarms stated above are active.
BAD_OUT_OF_SERVICE I LIMIT_CONSTANT (0x1C)	C_BAD_PASSIVATED (0x23)	Actual mode of AI, AO, or totalizer blocks is Out of Service.
Totalizer Fail Safe: UC_NON_SPECIFIC (0x40)	C_UNCERTAINC_SUBSTITUTE_SET (0x4B)	Failsafe – RUN mode
Totalizer Fail Safe: UC_LUV (0x44)	C_UNCERTAINC_PROCESS_RELATED (0x78….0x7B)[1]	Failsafe – HOLD_LUV mode

Table D-7 Condensed-mode status byte format (continued)

Expanded status	Condensed status	Alarms
Totalizer Fail Safe: UC_NON_SPECIFIC (0x40)	C_UNCERTAINC_SUBSTITUTE_SET (0x4B)	Failsafe – MEMORY mode
UC_INITIAL_VAL (0x4C)	C_UNCERTAIN_INITIAL_VALUE (0x4F)	When reset or preset totals.
UC_SUBSTITUTE_VAL (0x48)	C_UNCERTAIN_SUBSTITUTE_SET (0x4B)	AO failsafe active.

(1) Limits status as applicable.

(2) AI function block FB behaves like FSAFE_TYPE = 1 as per Section 3.3.1 (Table 19) of the PROFIBUS Specification June 2005, Order no. 3.042, Amendment 2 to the PROFIBUS Profile for Process Control Devices v3.01, Condensed Status and Diagnostic Messages v1.0.

Appendix E
Slave Diagnostic Response Bytes

E.1 Overview

This appendix describes the diagnostic bytes reported by the transmitter to a PROFIBUS host. There are two sets of diagnostic bytes sent:

- Bytes 1–6 conform to the standard PROFIBUS specification.
- Byte 7 is the extended diagnostic header byte.
- Bytes 8–15 are extended diagnostic bytes that conform to the Profile 3.01 specification and the Diagnosis, Alarms, and Timestamping Profile Guidelines.
- The final 10 bytes are extended diagnostic bytes that correspond to alarms in the transmitter. Alarm codes referenced in these bytes are the codes shown on the transmitter display. Refer to Section 6.8 for more information about alarm codes.

Note: AI, AO, and totalizer function blocks will go into Out of Service mode when any of the following diagnostics bits are set: 24 (hardware failure), 28 (memory error), or 29 (measurement failure).

Note: There can be as many as 62 device-related diagnostic bytes.

E.2 PROFIBUS specification diagnostic bytes

Tables E-1 through E-6 describe the PROFIBUS diagnostic response bytes.

Table E-1 Byte 1

Bit	Indication
0	Station not existent (this is set by the master if the slave does not respond)
1	Station not ready for data exchange
2	Configuration fault: slave did not accept last configuration data
3	Slave has extended diagnostic data to report
4	Slave does not support requested parameter function
5	Invalid slave response (this is set by the master)
6	Parameter fault: slave did not accept last parameterization data
7	Slaved is locked or controlled by another master (this is set by the master)

Table E-2 Byte 2

Bit	Indication
0	Slave must be parameterized
1	Static diagnostic: master requesting diagnostics until bit is reset
2	This bit is always set to 1
3	Response monitoring/watchdog (1 = ON; 0 = OFF)
4	Slave is in freeze mode (1 = ON; 0 = OFF)
5	Slave is in sync mode (1 = ON; 0 = OFF)
6	Reserved
7	Slave is deactivated in master parameter set (this is set by the master)

Table E-3 Byte 3

Bit	Indication
0	Reserved (this is always set to 0)
1	Reserved (this is always set to 0)
2	Reserved (this is always set to 0)
3	Reserved (this is always set to 0)
4	Reserved (this is always set to 0)
5	Reserved (this is always set to 0)
6	Reserved (this is always set to 0)
7	Diagnostic overflow—transmitter has more diagnostic data than it can report

Table E-4 Byte 4

Bit	Indication
0	Master station address • An address in the range of 0–125 decimal (0x0–0x7D hex) is the address of the controlling master. • An address of 255 decimal (0xFF hex) means the slave is not controlled or parameterized by a master.
1	
2	
3	
4	
5	
6	
7	

Table E-5 Byte 5

Bit	Indication
0	Ident number (MSB)(1)
1	
2	
3	
4	
5	
6	
7	

(1) The identification number will be 0x9742 when in profile-specific I/O mode and 0x057A when in manufacturing-specific I/O mode. Refer to Section 2.5 for information about I/O modes.

Table E-6 Byte 6

Bit	Indication
0	Ident number (LSB)
1	
2	
3	
4	
5	
6	
7	

Table E-7 Byte 7 – Extended diagnostic header byte

Bit	Indication
0	Number of extended diagnostic bytes (including this header byte)
1	
2	
3	
4	
5	
6	Identifier for device-related diagnostics status model (0x00)
7	

Table E-8 Byte 8

Bit	Indication
8	Status type = manufacturer-specific (32 decimal, 0x20 hex)
9	
10	
11	
12	
13	
14	
15	Identifier for status—always set to 1

Table E-9 Byte 9

Bit	Indication
8	Slot number of physical block (per Profile 3.01 this is 0)
9	
10	
11	
12	
13	
14	
15	

Table E-10 Byte 10

Bit	Indication
16	Error appears (when any new alarm is activated)
17	Error disappears (when an alarm is deactivated)
18	Reserved
19	Reserved
20	Reserved
21	Reserved
22	Reserved
23	Reserved

Table E-11 Byte 11

Bit	Indication
24	Reserved (always set to 0)
25	Reserved (always set to 0)
26	Reserved (always set to 0)—Not used
27	Reserved (always set to 0)
28	Reserved (always set to 0)
29	Reserved (always set to 0)
30	Reserved (always set to 0)
31	Reserved (always set to 0)

Table E-12 Byte 12

Bit	Indication
32	Reserved
33	Reserved
34	Reserved
35	Restart (A107)
36	Cold start (A107)
37	Maintenance required—Not used
38	Reserved
39	Ident_Number violation

Table E-13 Byte 13

Bit	Indication
40	Maintenance alarm (A014, A001, A002, A003, A022, A023, A024, A026)
41	Maintenance demanded (A103)
42	Function check (A106 if any function block is in simulation mode)
43	PRO_COND (not used)
44	Reserved (always set to 0)
45	Reserved (always set to 0)
46	Reserved (always set to 0)
47	Reserved (always set to 0)

Table E-14 Byte 14

Bit	Indication
48	Reserved (always set to 0)
49	Reserved (always set to 0)
50	Reserved (always set to 0)
51	Reserved (always set to 0)
52	Reserved (always set to 0)
53	Reserved (always set to 0)
54	Reserved (always set to 0)
55	Extension available

Table E-15 Byte 15

Bit	Indication
56	Undefined (A000)
57	EEPROM checksum error (A001)
58	RAM test error (A002)
59	Sensor not responding (no tube interrupt) (A003)
60	Temperature sensor out-of-range (A004)
61	Input over-range (A005)
62	Transmitter not characterized (A006)
63	Reserved

Table E-16 Byte 16

Bit	Indication
64	Density outside limits (A008)
65	Transmitter initializing/warming up (A009)
66	Calibration failure (A010)
67	Excess calibration correction, zero too low (A011)
68	Excess calibration correction, zero too high (A012)
69	Process too noisy to perform auto zero (A013)
70	Transmitter failed (A014)
71	Reserved

Table E-17 Byte 17

Bit	Indication
72	Line RTD temperature out-of-range (A016)
73	Meter RTD temperature out-of-range (A017)
74	Reserved
75	Reserved
76	Calibration factors unentered (A020)
77	Unrecognized/unentered sensor type (A021)
78	Reserved
79	Reserved

Table E-18 Byte 18

Bit	Indication
80	Reserved
81	Reserved
82	Sensor/xmtr communication failure (A026)
83	Reserved
84	Sensor/xmtr write failure (A028)
85	Internal communication failure (A029)
86	Hardware/software incompatible (A030)
87	Low power (A031)

Table E-19 Byte 19

Bit	Indication
88	Meter verification fault alarm (A032)
89	Sensor OK/tubes stopped by process (A033)
90	Reserved
91	Reserved
92	Reserved
93	Reserved
94	Reserved
95	Reserved

Table E-20 Byte 20

Bit	Indication
96	Reserved
97	Reserved
98	Drive overrange/partially full tube (A102)
99	Data loss possible (A103)
100	Calibration in progress (A104)
101	Slug flow (A105)
102	Reserved
103	Power reset occurred (A107)

Table E-21 Byte 21

Bit	Indication
104	Reserved
105	Reserved
106	Reserved
107	Reserved
108	Reserved
109	Reserved
110	Reserved
111	Reserved

Table E-22 Byte 22

Bit	Indication
112	Petroleum measurement: temperature out-of-limits (A116)
113	Petroleum measurement: density out-of-limits (A117)
114	Reserved
115	Reserved
116	Concentration measurement: Unable to fit curve data (A120)
117	Concentration measurement: Extrapolation alarm (A121)
118	Reserved
119	Reserved

Table E-23 **Byte 23**

Bit	Indication
120	Reserved
121	Reserved
122	Reserved
123	Reserved
124	Reserved
125	Reserved
126	Reserved
127	Meter verification info alarm (A131)

Table E-24 **Byte 24**

Bit	Indication
128	Simulation mode active (A132)
129	Reserved
130	Reserved
131	Reserved
132	Reserved
133	Reserved
134	Reserved
135	Reserved

Appendix F
Model 2700 PROFIBUS Block Parameters

F.1 Overview

This appendix describes the block parameters of the Model 2700 transmitter with PROFIBUS-PA.

F.2 Slot identification

Table F-1 shows the slot assignment for blocks.

Table F-1 Block slot assignment

Slot	Assigned block
0	Physical block
1	Analog input block 1
2	Analog input block 2
3	Analog input block 3
4	Totalizer block 1
5	Analog input block 4
6	Totalizer block 2
7	Totalizer block 3
8	Totalizer block 4
9	Analog output block 1
10	Analog output block 2
11	Transducer block 1
12	Transducer block 2

F.3 Physical block

Table F-2 shows the parameters for the physical block.

Table F-2 Physical block parameters

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
	Standard Parameters									
16	BLOCK_OBJECT	This object contains the characteristics of the block	RECORD	DS-32	20	Cst	----	R	NA	NA
17	ST_REV	A block has static block parameters that are not changed by the process. Values are assigned to this parameter during the configuration of optimization. The value of ST_REV increases by 1 after every change of a static block parameter.	SIMPLE	Unsigned16	2	N	0	R	NA	NA
18	TAG_DESC	Every block can be assigned a textual TAG description. The TAG_DESC must be unambiguous and unique in the field bus system.	SIMPLE	Visible STRING	32	S	‘ ’	R/W	NA	NA
19	STRATEGY	Grouping of function block. The STRATEGY field can be used to group blocks.	SIMPLE	Unsigned16	2	S	0	R/W	NA	NA

Table F-2 Physical block parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
20	ALERT_KEY	This parameter contains the identification number of the plant unit.	SIMPLE	Unsigned8	1	S	0	R/W	NA	NA
21	TARGET_MODE	This parameter contains desired mode normally set by a control application of an operator. The modes are valid alternatively only, i.e. only one mode can be set at one time. A write access to this parameter with more than one mode is out of the range of the parameter and has to be rejected.	SIMPLE	Unsigned8	1	S	AUTO (0x08)	R/W	AUTO (0x08)	NA
22	MODE_BLK	This parameter contains the current mode and the permitted and normal mode of the block.	RECORD	DS-37	3	D	---	R	NA	NA
23	ALARM_SUM	This parameter contains the current states of the block alarms.	RECORD	DS-42	8	D	0,0,0,0	R	NA	NA
	Physical block parameters									
24	SOFTWARE_REVISION (DD Name: Software Revision)	Revision-number of the software of the field device.	Simple	Visible String	16	Cst	---	R	NA	R-1200
25	HARDWARE_REVISION (DD Name: Hardware Revision)	Revision-number of the hardware of the field device.	Simple	Visible String	16	Cst	1.0	R	NA	Hard Coded
26	DEVICE_MAN_ID (DD Name: Manufacturing ID)	Identification code of the manufacturer of the field device.	Simple	Unsigned16	2	Cst	----	R	NA	R-121
27	DEVICE_ID (DD Name: Device ID)	Manufacturer specific identification of the device.	Simple	Visible String	16	Cst	----	R	NA	2545-2554
28	DEVICE_SER_NUM (DD Name: PB Serial Number)	Serial number of the field device.	Simple	Visible String	16	Cst	----	R	NA	R122-123
29	DIAGNOSIS(DD Name: Physical Block Diagnosis)	Detailed information of the device, bitwise coded. More than one message possible at once. If MSB of byte 4 is set to 1 than more diagnose information is available in the DIAGNOSIS_EXTENSION parameter.	Simple	Octet String byte4,MSB=1 more diag available	4	D	----	R	Refer byte 11 to 14 of Extended Diagnostics bytes in Appendix A	NA
30	EMPTY									
31	DIAGNOSIS_MASK(DD Name: Diagnosis Mask)	Definition of supported DIAGNOSIS information-bits.	Simple	Octet string	4	Cst	----	R	Out of Mandatory Alarms out of 4 Octets only Ident No. violation Alarm is supported. And Extension Available Alarm is supported 0: not supported 1: supported	Hard Coded 0x00 0x80 0x00 0x80
32	EMPTY									
33	EMPTY									
34	EMPTY									
35	EMPTY									
36	Reserved									
37	Reserved									
38	DEVICE_INSTALL_DATE	Device Installation Date	Simple	Octect String	16	S	Blank	R/W		2278-2285
40	IDENT_NUMBER_ SELECTOR (DD Name: Ident Number)	Each PROFIBUS-DP /IEC 61158/ device shall have an Ident_Number provided by the PNO. There are profile specific Ident_Numbers. A device may have profile specific and manufacturer specific ones. The user is able to choose one of these using this parameters.	Simple	Unsigned8	1	S	----	R/W	0: profile specific Ident_Number V3.01 (mandatory) 1: manufacturer specific Ident_Number V3.01	NA
42	FEATURE (DD Name: phys Feature)	Indicates optional features implemented in the device and the status of these Features which indicates if the feature is supported or not supported.	Record	DS-68	8	N	0x03, 0x00, 0x00, 0x00, 0x02, 0x00, 0x00, 0x00	R	PROFIBUS Specification June 2005 Order No: 3.042 Amendment 2 to the Profibus Profile for Process Control Devices V 3.01 Condensed Status and Diagnostic Messages V 1.0	NA

Table F-2 Physical block parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
43	COND_STATUS_DIAG	Condensed Status Diagnostics	Simple	Unsigned-8	1	S	0	R/W	0: Status and Diagnosis is provided as defined in -PROFIBUS Profile: "PROFIBUS-PA Profile for Process Control Devices" V3.01, December 2004. PNO-Order-No. 3.042. 1: Condensed Status and Diagnosis information is provided. NA	NA
44	Reserved									
45	Reserved									
46	Reserved									
47	Reserved									
48	Reserved									
49	Physical Block Views									

F.3.1 Physical block object

Table F-3 shows the physical block object.

Table F-3 Physical block object

Slot/Index	Element name	Data type	Size in bytes	Value
Slot 0/Index 16	Reserved	Unsigned 8	1	250 (default)
	Block_Object	Unsigned 8	1	01
	Parent_Class	Unsigned 8	1	01
	Class	Unsigned 8	1	250 (default)
	DD_Refrence	Unsigned 32	4	00 ,00, 00, 00 (Reserved)
	DD_Revision	Unsigned 16	2	00 ,00 (reserved)
	Profile	Octet String	2	64 02 (compact class B)
	Profile_Revision	Unsigned 16	2	03 01 (3.01)
	Execution_Time	Unsigned 8	1	00 (for future use)
	Number_Of_Parameters	Unsigned 16	2	00 26 (Max no of Physical Block Parameters)
	Address_of_View_1	Unsigned 16	2	00 49 (slot, index)
	Number_of_Views	Unsigned 8	1	01 (1 view)

F.3.2 Physical block views

Table F-4 shows the physical block views.

Table F-4 Physical block views

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
16	BLOCK_OBJECT				
17	ST_REV	2			
18	TAG_DESC				
19	STRATEGY				
20	ALERT_KEY				
21	TARGET_MODE				
22	MODE_BLK	3			
23	ALARM_SUM	8			
	Overall sum of bytes in View Object	13			

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
29	DIAGNOSIS	4			
	Overall sum of bytes in View Object (+ 13 Standard parameters bytes)	4+13			

F.4 Transducer block 1 (measurement, calibration, and diagnosis)

Table F-5 shows the parameters for transducer block 1.

Table F-5 Transducer block 1 parameters

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
	Standard PA parameters									
0	BLOCK_OBJECT	This object contains the characteristics of the block	RECORD	DS-32	20	CSt	----	R	NA	NA
1	ST_REV	A block has static block parameters, that are not changed by the process. Values are assigned to this parameter during the configuration of optimization. The value of ST_REV increases by 1 after every change of a static block parameter.	SIMPLE	Unsigned16	2	N	0	R	NA	NA
2	TAG_DESC	Every block can be assigned a textual TAG description. The TAG_DESC must be unambiguous and unique in the field bus system.	SIMPLE	OCTET STRING	32	S	' '	R/W	NA	NA
3	STRATEGY	Grouping of function block. The STRATEGY field can be used to group blocks.	SIMPLE	Unsigned16	2	S	0	R/W	NA	NA
4	ALERT_KEY	This parameter contains the identification number of the plant unit.	SIMPLE	Unsigned8	1	S	0	R/W	NA	NA
5	TARGET_MODE	This parameter contains desired mode normally set by a control application of an operator. The modes are valid alternatively only, i.e. only one mode can be set at one time. A write access to this parameter with more than one mode is out of the range of the parameter and has to be rejected.	SIMPLE	Unsigned8	1	S	AUTO (0x08)	R/W	AUTO (0x08)	NA
6	MODE_BLK	This parameter contains the current mode and the permitted and normal mode of the block.	RECORD	DS-37	3	D	---	R	NA	NA
7	ALARM_SUM	This parameter contains the current states of the block alarms.	RECORD	DS-42	8	D	0,0,0, 0	R	NA	NA
	Standard Flow Transducer block Parameters									

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
8	CALIBR_FACTOR (DD Name :Flow Cal Factor)	Gain compensation value for the flow sensor, so that flow indication is accurate as specified by the manufacturer.	SIMPLE	Float	4	S	---	R/W		R-0407
9	LOW_FLOW_CUTOFF (DD Name : Mass Flow Cutoff)	Mass Flow can have an hysteresis. If the value has a hysteresis, this parameter defines the lower switching point. The unit of this value is the mass flow units	SIMPLE	Float	4	S	0	R/W		R-0195
10	MEASUREMENT_MODE (DD Name: Measurement Mode)	Mode of flow measurement	SIMPLE	Unsigned8	1	S	0	R/W	0 = Forward Only 1 = Reverse Only 2 = Bi-Directional 3 = Absolute Value 4 = Negate/Forward Only 5 = Negate/ Bi-Directional	R-0017
11	FLOW_DIRECTION (DD Name :Flow Direction)	Assigns an arbitrary positive or negative sign to the mass flow value	SIMPLE	Unsigned8	1	S	0	R/W	0 = positive 1 = negative	NA
12	ZERO_POINT (DD Name: Zero Point)	Offset compensation value for the flow sensor, so that true zero flow value can be indicated during no flow condition	SIMPLE	Float	4	S	----	R/W		R-0233
13	ZERO_POINT_ADJUST (DD Name: Zero Calibration)	Initiates a device specific adjustment cycle that determines the true ZERO_POINT value during no flow process conditions. The result is shown in ZERO_POINT	SIMPLE	Unsigned8	1	N	0	R/W	0 = cancel 1 = execute	NA
14	ZERO_POINT_UNIT (DD Name: Zero Point Unit)	Selected unit code for ZERO_POINT parameter	SIMPLE	Unsigned16	2	S	1057	R/W	1057 = microseconds	NA
15	NOMINAL_SIZE (DD Name: Nominal Size)	Ideal size of the measuring pipe or process pipe size for insertion type flow transmitter	SIMPLE	Float	4	S	---	R/W		NA
16	NOMINAL_SIZE_UNITS (DD Name: Nominal Size Units)	Selects the units for NOMINAL_SIZE parameter	SIMPLE	Unsigned16	2	S	1019	R/W	1019 = inch	NA
17	VOLUME_FLOW (DD Name : Volume Flow Rate)	Measure volume flow. This is an optional parameter for this device	RECORD	101	5	D	---	R/W		NA
18	VOLUME _FLOW_UNITS (DD Name :Volume Flow Units)	Selected unit code for VOLUME_FLOW, VOLUME_FLOW_LO_LIMIT and VOLUME_FLOW_HI_LIMIT	SIMPLE	Unsigned16	2	S	1349	R/W	0000 = None 1347 = m3/s 1348 = m 3/min 1349 = m3/hr 1350 = m3/day 1351 = L/s 1352 = L/min 1353 = L/hr 1355 = Ml/day 1356 = CFS 1357 = CFM 1358 = CFH 1359 = ft3/day 1362 = gal/s 1363 = GPM 1364 = gal/hour 1365 = gal/day 1366 = Mgal/day 1367 = ImpGal/s 1368 = ImpGal/min 1369 = ImpGal/hr 1370 = Impgal/day 1371 = bbl/s 1372 = bbl/min 1373 = bbl/hr 1374 = bbl/day 1642 = beer bbl/s 1643 = beer bbl/min 1644 = beer bbl/hr 1645 = beer bbl/day	R-0042
21	MASS_FLOW (DD Name : Mass Flow Rate)	Measure mass flow. This is the Primary Variable (PV) for this device	RECORD	101	5	D	----	R		R-0247
22	MASS_FLOW_UNITS (DD Name : Mass Flow Units)	Selected unit code for MASS_FLOW, MASS _FLOW_LO_LIMIT and MASS _FLOW_HI_LIMIT	SIMPLE	Unsigned16	2	S	1322	R/W	1318 = g/s 1319 = g/min 1320 = g/hr 1322 = kg/s 1323 = kg/min 1324 = kg/hr 1325 = kg/day 1327 = t/min 1328 = t/h 1329 = t/d 1330 = lb/s 1331 = lb/min 1332 = lb/hr 1333 = lb/day 1335 = Ston/min 1336 = Ston/hr 1337 = Ston/day 1340 = Lton/hr 1341 = Lton/day	R-0039
25	DENSITY (DD Name : Density)	Measure density. This is the Secondary Variable (SV) for this device	RECORD	101	5	D	---	R		R-0003

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
26	DENSITY_UNITS (DD Name : Density Units)	Selected unit code for DENSITY, DENSITY _LO_LIMIT and DENSITY _HI_LIMIT	SIMPLE	Unsigned16	2	S	1103	R/W	0000 = None 1097 = kg/m3 1100 = g/cm3 1103 = kg/L 1104 = g/ml 1105 = g/L 1106 = lb/in3 1107 = lb/ft3 1108 = lb/gal 1109 = Ston/yd3 1113 = DegAPI 1114 = SGU	R-0040
29	TEMPERATURE (DD Name : Temperature)	Measure temperature. This is the Tertiary Variable (TV) for this device	RECORD	101	5	D	----	R		R-251
30	TEMPERATURE_UNITS (DD Name : Temperature Units)	Selected unit code for TEMPERATURE, TEMPERATURE _LO_LIMIT and TEMPERATURE _HI_LIMIT	SIMPLE	Unsigned16	2	S	1000	R/W	0000 = None 1000 = K 1001 = Deg C 1002 = Deg F 1003 = Deg R	R-0041
	Manufacturer Specific Parameters									
33	SNS_DampingFlowRate (DD Name : Flow Damping)	Flow rate (Mass and Volume) internal damping (seconds)	VARIABLE	FLOAT	4	S	0.8	R/W	0.0 to 60.0 sec	R-189 – 190
34	SNS_DampingTemp (DD Name : Temperature Damping)	Temperature internal damping (seconds)	VARIABLE	FLOAT	4	S	4.8	R/W	0.0 to 80.0 sec	R-191 – 192
35	SNS_DampingDensity (DD Name : Density Damping)	Density internal damping (seconds)	VARIABLE	FLOAT	4	S	1.6	R/W	N/A0.0 to 60.0 sec	R 193 – 194
36	SNS_MassMeterFactor (DD Name :Mass Factor)	Mass Rate Factor	VARIABLE	FLOAT	4	S	1.0	R/W	0.8 to 1.2	R-279-0280
37	SNS_DensMeterFactor (DD Name :Density Factor)	Density Factor	VARIABLE	FLOAT	4	S	1.0	R/W	0.8 to 1.2	R-283 – 284
38	SNS_VolMeterFactor (DD Name : Volume Factor)	Volume Rate Factor	VARIABLE	FLOAT	4	S	1.0	R/W	0.8 to 1.2	R-281-282
39	SNS_VolumeFlowCutoff (DD Name : Volume Cutoff)	Volume flow cutoff for internal totalizers	VARIABLE	FLOAT	4	S	0.0	R/W	0 to sensor limit	R-197-198
40	SNS_LowDensityCutoff (DD Name : Density Cutoff)	Density cutoff for internal totalizers	VARIABLE	FLOAT	4	S	0.0	R/W	0.0 to 0.5	R-149-150
41	EMPTY									
42	EMPTY									
43	EMPTY									
44	EMPTY									
45	EMPTY									
46	EMPTY									
47	EMPTY									
48	EMPTY									
	Totalizers									
49	SNS_StartStopTotals (DD Name :Start/Stop All Totalizers)	Start/Stop all Totalizers	METHOD	Unsigned8	1	D	0x01	R/W	0X00 = Stop Totals 0X01 = Start Totals	Coil – 0002
50	SNS_ResetAllTotal (DD Name : Reset All Totals)	Reset all Totals	METHOD	Unsigned8	1	D	-	R/W	0X00 = None 0X01 = Reset	Coil – 0003
51	SNS_ResetAllInventories	Reset all Inventories	METHOD	Unsigned8	1	D	-	R/W	0X00 = None 0X01 = Reset	Coil – 0004
52	SNS_ResetMassTotal (DD Name : Reset Mass Total)	Reset Mass Total	METHOD	Unsigned8	1	D	-	R/W	0X00 = None 0X01 = Reset	Coil – 0056
53	SNS_ResetLineVolTotal (DD Name : Reset Volume Total)	Reset Volume Total	METHOD	Unsigned8	1	D	-	R/W	0X00 = None 0X01 = Reset	Coil – 0057
54	SNS_MassTotal (DD Name :Mass Total)	Mass Total	VARIABLE	101	5	D/20	0	R	N/A	R-0259-0260
55	SNS_VolTotal (DD Name : Volume Total)	Volume Total	VARIABLE	101	5	D/20	0	R	N/A	R-0261-0262
56	SNS_MassInventory (DD Name : Mass Inventory)	Mass Inventory	VARIABLE	101	5	D/20	0	R	N/A	R-0263-0264
57	SNS_VolInventory (DD Name : Volume Inventory)	Volume Inventory	VARIABLE	101	5	D/20	0	R	N/A	R-0265-0266
58	SNS_MassTotalUnits (DD Name: Mass Total/Inv Units)	Standard or special mass total and mass inventory unit	ENUM	Unsigned16	2	S	g/s	R	0000 = None 1088 = Kg 1089 = g 1092 = metric tons 1094 = lbs 1095 = short tons 1096 = long tons	R-0045

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
59	SNS_VolTotalUnits (DD Name: Volume Total/Inv Units)	Standard or special volume total or mass inventory unit	ENUM	Unsigned16	2	S	l/s	R	0000 = None 1034 = m3 1036 = cm3 1038 = l 1043 = ft3 1048 = gal 1049 = ImpGal 1051 = bbl 1641 = Beer bbl	R-0046
60	SNS_ResetMassInv (DD Name: Reset Mass Inventory)	Reset Mass Inventory (“On” = Reset, “Off” = N/A)	METHOD	Unsigned8	1	D	-	R/W	0X00 = None 0X01 = Reset	Coil – 0192
61	SNS_ResetVolInv (DD Name: Reset Volume Inventory)	Reset Volume Inventory (“On” = Reset, “Off” = N/A)	METHOD	Unsigned8	1	D	-	R/W	0x00 = None 0X01 = Reset	Coil – 0193
	Gas Process Variables									
62	SNS_EnableGSV (DD Name: Enable Gas Std Volume Flow And Total)	Enable/Disable Gas Standard Volume Flow and Totals	ENUM	Unsigned8	1	S	0x00	R/W	0x00 = disabled 0x01 = enabled	Coil-0078
63	SNS_GSV_GasDens (DD Name: Gas Std Density)	Gas Density used to calculate Reference Volume Gas Flow and Totals	VARIABLE	FLOAT	4	S	0.0752 lb/ft3	R/W	Density Sensor limits	R-0453-0454
64	SNS_GSV_VolFlow (DD Name: Gas Std Volume Flow Rate)	Reference Volume Gas Flow Rate (not valid when API or ED is enabled)	VARIABLE	101	5	D/20	0	R	N/A	R-0455-0456
65	SNS_GSV_VolTot (DD Name: GSV Total)	Reference Volume Gas Total (not valid when API or ED is enabled)	VARIABLE	101	5	D/20	0	R	N/A	R-0457-0458
66	SNS_GSV_VolInv (DD Name: GSV Inventory)	Reference Volume Gas Invnetory (not valid when API or ED is enabled)	VARIABLE	101	5	D/20	0	R	N/A	R-0459-0460
67	SNS_GSV_FlowUnits (DD Name : GSV Flow Units)	Gas Standard Volume Flow Engineering Units	ENUM	Unsigned16	2	S	SCFM	R/W	1360 = SCFM 1361 = SCFH 1605 = SCFD 1522 = Nm3/s 1523 = Nm3/m 1524 = Nm3/h 1525 = Nm3/d 1527 = Sm3/s 1528 = Sm3/m 1529 = Sm3/h 1530 = Sm3/d 1532 = NL/s 1533 = NL/m 1534 = NL/h 1535 = NL/d 1537 = SL/s 1538 = SL/m 1539 = SL/h 1540 = SL/d 1604 = SCFS	R-2601
68	SNS_GSV_TotalUnits (DD Name: GSV Total/Inv Units)	Gas Standard Volume Total and Inventory Engineering Units	ENUM	Unsigned16	2	S	SCF	R	0000 = None 1053 = SCF 1521 = Nm3 1526 = Sm3 1531 = NL 1536 = SL	R-2602
69	SNS_GSV_FlowCutoff (DD Name: Gas Std Vol Flow Cutoff)	Gas Standard Volume Low Flow Cutoff	VARIABLE	FLOAT	4	S	---	R/W	Must be >=0.0	R-461-462
70	SNS_ResetGSVolTotal (DD Name: Reset Gas Std Volume Total)	Reset Gas Standard Volume Total (“On” = Reset, “Off” = N/A)	Method	Unsigned8	1	S	--	R/W	0x00 = No effect 0x01 = Reset	Coil-0063
71	SNS_ResetAPIGSVInv (DD Name: Reset Gas Std Volume Inventory)	Reset API/GSV Inventory (“On” = Reset, “Off” = N/A)	Method	Unsigned8	1	S	0x00	R/W	0x00 = No Effect 0x01 = Reset	Coil-0194
72	FRF_StartMeterVer DD Name: Start On-Line Meter Verification)	Start On-Line Meter Verification	VARIABLE	Unsigned8	1	D	0x00	R/W	0x00 = No Effect 0x01 = Start On-Line Meter Verification	Coil-0190
73	FRF_MV_Index	FCF Datalog Index	VARIABLE	Unsigned16	2	D	0x00	R/W	(0-19, 0 = most recent run)	R-2984
74	FRF_MV_Counter	FCF Datalog Item 1: Run Number	VARIABLE	Unsigned16	2	N-CP	0x00	R		R-2985
75	FRF_MV_Status	FCF Datalog Item 5: Status Abort States are compressed to fit in 3 bits	VARIABLE	Unsigned16	2	N-CP	0x00	R	Bit7 = FCF pass/fail, Bits6-4 = state, Bits3-0 = Abort code	R-2986
76	FRF_MV_Time	FCF Datalog Item 2: Time Initiated (in running seconds)	VARIABLE	Unsigned32	4	N-CP	0x00	R	N/A	R-2987–2988
77	FRF_MV_LPO_Norm	FCF Datalog Item 3: LPO Normalized Data	VARIABLE	FLOAT	4	N-CP	0x00	R	N/A	R-2989–2990
78	FRF_MV_RPO_Norm	FCF Datalog Item 4: RPO Normalized Data	VARIABLE	FLOAT	4	N-CP	0x00	R	N/A	R-2991–2992
79	FRF_MV_FirstRun_Time	MV Timers: Time Until First Run in Hours	VARIABLE	FLOAT	4	N-CP	0x00	R/W	N/A	R-2993–2994
80	FRF_MV_Elapse_Time	MV Timers: Time between each run after the first run initiated in hours	VARIABLE	FLOAT	4	N-CP	0x00	R/W	N/A	R-2995–2996
81	FRF_MV_Time_Left	MV Timers: Time left until next run in hours	VARIABLE	FLOAT	4	D	0x00	R	N/A	R-2997–2998

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
	CALIBRATION BLOCK									
82	SNS_FlowCalTempCoeff (DD Name: Flow Temp Coeff (FT))	Temperature coefficient for flow	VARIABLE	FLOAT	4	S	5.13	R/W	>=0.0	R-409-410
83	SNS_MaxZeroingTime (DD Name: Zero Time)	Maximum zeroing time	VARIABLE	Unsigned16	2	S	20	R/W	5 to 300	R-0136
84	SNS_AutoZeroStdDev (DD Name: Zero Std Dev)	Standard deviation of auto zero	VARIABLE	FLOAT	4	S	-	R	N/A	R-0231-232
85	SNS_AutoZeroValue (DD Name: Zero Offset)	Present flow signal offset at zero flow in μsec	VARIABLE	FLOAT	4	S	-	R/W	-5.0 to 5.0	R-233-234
86	SNS_FailedCal (DD Name: Zero Failed Value)	Value of the zero if the zero cal failed	VARIABLE	FLOAT	4	S	-	R	N/A	R-0235-0236
87	SNS_K1Cal (DD Name: Low Density Cal)	Perform low-density calibration	METHOD	Unsigned8	1	D	-	R/W	0x00= None 0x01 = Start Cal	Coil-0013
88	SNS_K2Cal (DD Name: High Density Cal)	Perform high-density calibration	METHOD	Unsigned8	1	D	-	R/W	0x00 = None 0x01 = Start Cal	Coil-0014
89	SNS_FdCal (DD Name: Flowing Density Cal)	Perform flowing-density calibration	METHOD	Unsigned8	1	D	-	R/W	0x00 = None 0x01 = Start Cal	Coil-0018
90	SNS_TseriesD3Cal (DD Name: D3 Density Cal)	Perform third point calibration	METHOD	Unsigned8	1	D	-	R/W	0x00 = None 0x01 = Start Cal	Coil-0044
91	SNS_TseriesD4Cal (DD Name: D4 Density Cal)	Perform fourth point calibration	METHOD	Unsigned8	1	D	-	R/W	0x00 = None 0x01 = Start Cal	Coil-0045
92	SNS_K1 (DD Name: K1)	Density calibration constant 1 (μsec)	VARIABLE	FLOAT	4	S	1000.0	R/W	1000 to 50000	R-159-160
93	SNS_K2 (DD Name: K2)	Density calibration constant 2 (μsec)	VARIABLE	FLOAT	4	S	50000.0	R/W	1000 to 50000	R-161-162
94	SNS_FD (DD Name: FD)	Flowing Density calibration constant	VARIABLE	FLOAT	4	S	-	R/W	>= 0.0	R303-304
95	SNS_TseriesK3 (DD Name: K3	Density calibration constant 3 (μsec)	VARIABLE	FLOAT	4	S	-	R/W	0, or 1000 to 50000	R-0503
96	SNS_TseriesK4 (DD Name: K4	Density calibration constant 4 (μsec)	VARIABLE	FLOAT	4	S	-	R/W	0, or 1000 to 50000	R-0519
97	SNS_D1 (DD Name: D1)	Density 1 (g/cc)	VARIABLE	FLOAT	4	S	-	R/W	Density Limits (and <0.05 if T-series)	R-0155-0156
98	SNS_D2 (DD Name: D2)	Density 2 (g/cc)	VARIABLE	FLOAT	4	S	1.0	R/W	Density Limits, and must be 1.0+/-0.1 for T-series	R-0157-0158
99	SNS_CalValForFD (DD Name: FD Value)	Flowing Density (g/cc)	VARIABLE	FLOAT	4	S	-	R/W	>=0	R277-278
100	SNS_TseriesD3 (DD Name: D3)	Density 3 (g/cc)	VARIABLE	FLOAT	4	S	-	R/W	Density Limits, and must be at least +/-0.1 away from D2 and d3 > 0.6 g/cc	R-509
101	SNS_TseriesD4 (DD Name: D4)	Density 4 (g/cc)	VARIABLE	FLOAT	4	S	-	R/W	Density Limits, and must be at least +/-0.1 away from D2 and D3 And d3 <> 0 and d4 > 0.6 g/cc	R-511
102	SNS_DensityTempCoeff (DD Name: Density Temp Coeff (DT))	Density temperature coefficient	VARIABLE	FLOAT	4	S	4.44	R/W	-20.0 to 20.0	R-0163-164
103	SNS_TSeriesFlowTGCO (DD Name: FTG)	T-Series: Flow TG Coefficient (FTG)	VARIABLE	FLOAT	4	S	0.0	R/W	N/A	R-505
104	SNS_TSeriesFlowFQCO (DD Name: FFQ)	T-Ser es : Flow FQ Coefficient (FFQ)	VARIABLE	FLOAT	4	S	0.0	R/W	N/A	R-507
105	SNS_TSeriesDensTGCO (DD Name: DTG)	T-Series: Density TG Coefficient (DTG)	VARIABLE	FLOAT	4	S	0.0	R/W	N/A	R-513
106	SNS_TSeriesDensFQCO1 (DD Name: DFQ1)	T-Series: Density FQ Coefficient #1 (DFQ1)	VARIABLE	FLOAT	4	S	0.0	R/W	N/A	R-515
107	SNS_TSeriesDensFQCO2 (DD Name: DFQ2)	T-Series: Density FQ Coefficient #2 (DFQ2)	VARIABLE	FLOAT	4	S	0.0	R/W	N/A	R-517
108	SNS_TempCalOffset (DD Name: Temperature Offset)	Temperature calibration offset	VARIABLE	FLOAT	4	S	0.0	R/W	N/A	R-0413-414
109	SNS_TempCalSlope (DD Name: Temperature Slope)	Temperature calibration slope	VARIABLE	FLOAT	4	S	1.0	R/W	N/A	R-0411-0412
	Temperature Compensation									
110	SNS_EnableExtTemp (DD Name: Enable Disable Ext Temp)	Enable/Disable External Temp for API/ED (See 449/450)	Method	Unsigned8	1	S	0x00	R/W	0x00 = Disable 0x01 = Enable	Coil-0086
111	SNS_ExternalTempInput (The data base item is same as TEMPERATURE – index 29 parameter) (DD Name: External Temp calibration input)	External temperature calibration input	RECORD	101	5	D	---	R/W	Temp. Sensor Limits	R-0449-0450
	Pressure Compensation									

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
112	SNS_EnablePresComp (DD Name: Pressure Compensation Enable /Disable)	Enable/Disable Pressure Compensation	ENUM	Unsigned 8	1	S	0	R/W	0x00 = disabled 0x01 = enabled	Coil-0082
113	SNS_ExternalPresInput (DD Name : External Pressure calibration input)	Pressure	RECORD	101	5	D	---	R/W	0 to 10,000 bar	R-0451-452
114	SNS_Pressure (The data base item is same as SNS_ExternalPresInput parameter) (DD Name : External Read Pressure)	Pressure	RECORD	101	5	D	----	R		R-0451-452
115	SNS_PressureUnits (DD Name : Pressure Units)	Pressure Unit	ENUM	Unsigned16	2	S	g/cm3	R/W	0000 = None 1148 = inch water @ 68F 1146 = inch water @ 60F 1156 = inch HG @ 0C 1154 = ft water @ 68F 1151 = mm water @ 68F 1158 = mm HG @ 0C 1141 = psi 1137 = bar 1138 = millibar 1144 = g/cm2 1145 = kg/cm2 1130 = pascals 1133 = kilopascals 1139 = torr @ 0C 1140 = atmospheres 1147 = InH2O(4C) 1150 = mmH2O(4C) 1132 = MPA	R-0044
116	SNS_FlowPresComp (DD Name: Flow Factor)	Pressure correction factor for flow	VARIABLE	FLOAT	4	S	0.0	R/W	-0.1 to 0.1	R-267-268
117	SNS_DensPresComp (DD Name: Density factor	Pressure correction factor for density	VARIABLE	FLOAT	4	S	0.0	R/W	-0.1 to 0.1	R-269-270
118	SNS_FlowCalPres (DD Name: Cal Pressure)	Flow calibration pressure	VARIABLE	FLOAT	4	S	0.0	R/W	>=0.0	R-271-272
119	SNS_FlowZeroRestore (DD Name: Restore Factory Zero)	Restore Factory Zero	METHOD	Unsigned8	1	S		R/W	0x00=None0x01 = Restore	Coil-0243
120	DB_SNS_AutoZeroFactory	Factory flow signal offset at zero flow (units of uSec)	VARIABLE	FLOAT	4	S	---	R	N/A	R-2673
121	AO_BLK_COMP	The Pressure / Temp. compensation selector parameter that decides the Temp. / Pressure compensation to be done using AO block or using Modbus or Transducer Block	VARIABLE	U8	1	S	0	R/W	0 – Temp / Pressure Compensation through Modbus / Transducer Block 1 – Temp / Pressure through AO Block	R-2276
122	EMPTY									
123	EMPTY									
124	EMPTY									
125	EMPTY									
126	EMPTY									
127	EMPTY									
128	EMPTY									
129	EMPTY									
	DIAGNOSTIC BLOCK									
	Slug Flow Setup									
130	SNS_SlugDuration (DD Name: Slug Duration)	Slug duration (seconds)	VARIABLE	FLOAT	4	S	1.0	R/W	0 to 60	R-0141-142
131	SNS_SlugLo (DD Name :Slug Low Limit)	Low Density limit (g/cc)	VARIABLE	FLOAT	4	S	0.0	R/W	Density Limits	R-201-202
132	SNS_SlugHi (DD Name :Slug High Limit)	High Density limit (g/cc)	VARIABLE	FLOAT	4	S	5.0	R/W	Density Limits	R-199-200
	Discrete Events									
133	EMPTY									
134	EMPTY									
135	EMPTY									
136	EMPTY									
137	EMPTY									

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
138	EMPTY									
	Alarm Status									
139	PA_StatusWords1 (DD Name: Alarm One Status)	Status Word 1	ENUM	BIT_ENUM ERATED	2	D/20	-	R	0x0001 = Core EEPROM Checksum Error 0x0002 = Core RAM Test Error 0x0004 = Not Used 0x0008 = Sensor Failure 0x0010 = Temp OOR 0x0020 = Cal Failed 0x0040 = Other Failure 0x0080 = Xmitter Init 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	R-419
140	PA_StatusWords2 (DD Name: Alarm Two Status)	Status Word 2	ENUM	BIT_ENUM ERATED	2	D/20	-	R	0x0001 = Not Used 0x0002 = Not Used 0x0004 = Not Used 0x0008 = Not Used 0x0010 = Density OOR 0x0020 = Drive OOR 0x0040 = Not used 0x0080 = Not Used 0x0100 = NV err (CP) 0x0200 = RAM err (CP) 0x0400 = Sensor Failure 0x0800 = Temp OOR 0x1000 = Input OOR 0x2000 = Not Used 0x4000 = Xmitter not Char 0x8000 = Not Used	R-420
141	PA_StatusWords3 (DD Name: Alarm Three Status)	Status Word 3	ENUM	BIT_ENUM ERATED	2	D/20	-	R	0x0001 = Not Used 0x0002 = Power Reset 0x0004 = Xmitter Init 0x0008 = Not Used 0x0010 = Not Used 0x0020 = Not Used 0x0040 = Not Used 0x0080 = Not Used 0x0100 = Cal Failed 0x0200 = Cal Fail: Low 0x0400 = Cal Fail: High 0x0800 = Cal Fail: Noisy 0x1000 = Xmtr Failed 0x2000 = Data Loss 0x4000 = Cal in Progress 0x8000 = Slug Flow	R-421
142	PA_StatusWords4 (DD Name: Alarm Four Status)	Status Word 4	ENUM	BIT_ENUM ERATED	2	D/20	-	R	0x0001 = API: Temp OOR 0x0002 = API: Dens OOR 0x0004 = Line RTD OOR 0x0008 = Meter RTD OOR 0x0010= Reverse Flow 0x0020 = Factory Config. Data Invalid 0x0040 = ED: bad curve 0x0080 = LMV Override Active 0x0100 = ED: Extrap error 0x0200 = Need cal factor 0x0400 = Not Used 0x0800 = Not Used 0x1000= Xmitter not Char 0x2000 = NV err (CP) 0x4000 = NV err (CP) 0x8000 = NV err (CP)	R-422

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
143	PA_StatusWords5 (DD Name: Alarm Five Status)	Status Word 5	ENUM	BIT_ENUM ERATED	2	D/20	-	R	0x0001 = Boot sector (CP) 0x0002 = Not Used 0x0004 = Not Used 0x0008 = Not Used 0x0010 = Not Used 0x0020 = Not Used 0x0040 = D3 in progress 0x0080 = D4 in progress 0x0100 = Not Used 0x0200 = Not Used 0x0400 = Temp slope in progress 0x0800 = Temp offset in progress 0x1000 = FD in progress 0x2000 = D2 in progress 0x4000 = D1 in progress 0x8000 = Zero in progress	R-423
144	PA_StatusWords6 (DD Name: Alarm Six Status)	Status Word 6	ENUM	BIT_ENUM ERATED	2	D/20	-	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 = DE0 active 0x0200 = DE1 active 0x0400 = DE2 active 0x0800 = DE3 active 0x1000 = DE4 active 0x2000 = Not Used 0x4000 = Not Used 0x8000 = Incorrect Board Type (A30)	R-424
145	PA_StatusWords7 (DD Name: Alarm Seven Status)	Status Word 7	ENUM	BIT_ENUM ERATED	2	D/20	---	R	0x0001 = K1/FCF combination Unrecognized. 0x0002 = Warming Up 0x0004 = Low Power (A31) 0x0008 = Tube Not Full (A33) 0x0010 = Meter Verification / Outputs in fault (A32) 0x0020 = Meter Verification / Outputs at last value (A131) 0x0040 = PIC UI EEPROM Error 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	R-433
146	PA_StatusWords8 (DD Name: Alarm Eight Status)	Status Word 8	ENUM	BIT_ENUM ERATED	2	D/20	---	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	R-434
147	SYS_DigCommFaultAction Code (DD Name Digital Comm Fault Action)	Fault Limit Code	ENUM	Unsigned16	2	S	0	R/W	0 = Upscale 1 = Downscale 2 = Zero 3 = NAN 4 = Flow goes to zero 5 = None	R-124
148	DB_SYS_TimeoutValueLMV (DD Name : Last Measured Value Timeout)	Last Measure Value Fault Timeout	VARIABLE	Unsigned16	2	S	0	R/W	0 to 60	R-314

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
149	UNI_Alarm_Index (DD Name: Alarm N Index)	Alarm Index	ENUM	Unsigned8	1	S	0	R/W	0 = Reserved 1 = NVM Failure 2 = RAM error /ROM error 3 = Sensor Fail 4 = Temp. Overrange 5 = Input Overrange 6 = Transmitter not charactized 7 = Reserved 8 = Dens. Overrange 9 = Xmitter Init 10= Cal Failed 11= Cal Fail: Low 12= Cal Fail: High 13= Cal Fail: Noisy 14= Transmitter Fail 15= Reserved 16= Line RTD Over Range 17= Meter RTD Over Range 18= Reserved 19= Reserved 20= Uncofig – K1 21 = Unrecognized / Unentered sensor type 22 = NV Err (CP) 23= NV Err (CP) 24= NV Err (CP) 25= Boot Fail (CP) 26= Reserved 27= Security Breach 28= Reserved 29= Internal Communication Failure 30= Hardware / Software Incompatible 31 = Low power 32 = Meter Verification Fault Alarm 33 = Tube not full 34-41 = Undefined 42= Drive Overrange 43 = Data Loss Possible 44= Cal in Progress 45= Slug Flow 46= Undefined 47= Power Reset 48-55= Reserved 56= API: Temp OOL 57= API:Density OOL 58-59= Reserved 60= CM: Unable to fit curve data 61= CM: Extrapolation alarm 62-70= Reserved 71 = Meter Verification Info Alarm 72 = Simulation Mode. 73- 139 = Undefined	R-1237
150	SYS_AlarmSeverity (DD Name :Alarm Severity)	Alarm Severity	ENUM	Unsigned8	1	S	0	R/W	0 = Ignore 1 = Info 2 = Fault	R-1238
151	SYS_AlarmStatus (DD Name :Alarm Status)	Alarmn Status (write 0 to acknowledge alarm) bit #0 = active (0=no, 1=yes) bit #1 = unacknowledged (0=no, 1=yes)	Unsigned8	BIT_ENUM ERATED	1	D/20	--	R/W	Between 0 to 3	R-1239
152	SYS_AlarmCount (DD Name : Alarm N Count)	Alarm n count(inactive to active transition)	VARIABLE	Unsigned16	2	S	---	R	N/A	R-1240
153	SYS_AlarmPosted(DD Name : Alarm N Last Posted)	Alarmn Last Posted (seconds since January 1, 1996)	VARIABLE	Unsigned32	4	S	---	R	N/A	R1241-1242
154	SYS_AlarmCleared (DD Name : Alarm N Last Cleared)	Alarmn Last clearded (seconds since January 1, 1996)	VARIABLE	Unsigned32	4	S	----	R	N/A	R1243-1244
155	SYS_AckAlarm (DD Name : Acknowledge)	Acknowledge alarm (write alarm index to acknowledge the alarm) 1=A1,…, 39=A39, 40=A100, …, 70=A130)	VARIABLE	Unsigned16	2	S	----	R/W	Enum list is same as Alarm Index – R1237	R-2623
156	SYS_AckAllAlarms (DD Name : Acknowlege All)	Acknowledge All Alarms	Method	Unsigned8	1	S	-----	R/W	0x00 = Not used 0x01 = Acknowledge	Coil-0241
157	SYS_ClearAlarmHistory (DD Name: Reset Alarm History)	Reset Alarm History (“On” = reset, “Off” = N/A)	Method	Unsigned8	1	S	----	R/W	0x00 = Not used 0x01 = Reset	Coil-0053
158	EMPTY									
159	EMPTY									

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
	Diagnostics									
160	SNS_DriveGain (DD Name :Drive Gain)	Drive Gain	RECORD	101	5	D	----	R		R-291-292
161	SNS_RawTubeFreq (DD Name: Tube Frequency)	Raw Tube Period	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-285-286
162	SNS_LiveZeroFlow (DD Name : Live Zero Flow)	Live Zero (MassFlow)	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-293-294
163	SNS_LPOamplitude (DD Name : LPO Amplitude)	Left Pickoff Voltage	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-287-288
164	SNS_RPOamplitude (DD Name : RPO Amplitude)	Right Pickoff Voltage	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-289-290
165	SNS_BoardTemp (DD Name : Board Temperature)	Board Temperature (degC)	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-383-384
166	SNS_MaxBoardTemp (DD Name: Maximum electronic temperature)	Maximum electronics temperature	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-463
167	SNS_MinBoardTemp (DD Name: Minimum electronic temperature)	Minimum electronics temperature	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-465
168	SNS_AveBoardTemp (DD Name: Average board temperature)	Average electronics temperature	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-467
169	SNS_MaxSensorTemp (DD Name: Maximum Sensor temperature)	Maximum sensor temperature	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-435-436
170	SNS_MinSensorTemp (DD Name: Minimum Sensor temperature)	Minimum sensor temperature	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-437-438
171	SNS_AveSensorTemp (DD Name: Average Sensor temperature)	Average sensor temperature	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-439-440
172	SNS_WireRTDRes (DD Name: 9 wire cable RTD)	9-wire cable RTD Resistance (ohms)	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-469
173	SNS_LineRTDRes (DD Name: Meter RTD Resistance)	Meter RTD Resistance (ohms)	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-475
174	SYS_PowerCycleCount (DD Name: Power Cycle Count)	Number of core processor power cycles	VARIABLE	Unsigned16	2	D	0	R	N/A	R-497
175	SYS_PowerOnTimeSec (DD Name: Power On Time)	Power on time(Seconds since last reset)	VARIABLE	Unsigned32	4	S	---	R	N/A	R-2625-2626
176	SNS_InputVoltage (DD Name: Input_Voltage)	Input Voltage(Volts)	VARIABLE	FLOAT	4	S	---	R	N/A	R0385-0386
177	SNS_TargetAmplitude (DD Name: Target Amplitude)	Actual Target Amplitude (mV/Hz) (Pre 700 2.1, Actual & Override)	VARIABLE	FLOAT	4	S	---	R	N/A	R-395-396
178	SNS_CaseRTDRes (DD Name: Case RTD Resistance)	Case RTD Resistance (ohms)	VARIABLE	FLOAT	4	S	---	R	N/A	R-473-474
179	SYS_RestoreFactoryConfig (DD Name: Restore Factory Configuration)	Restore Factory Configuration ("On"=restore, "Off"=N/A)	Method	Unsigned8	1	S	----	R/W	0x00 = no action 0x01 = Restore	Coil-0247
180	SYS_ResetPowerOnTime (DD Name: Reset Power On Time)	Reset power-on time	Method	Unsigned8	1	S	----	R/W	0x00 = no action 0x01 = Reset	Coil-242
181	FRF_EnableFCFValidation (DD Name: FCF Varification)	Enable FCF Verification (0=disable, 1=normal enable, 2=Factory Verification of Air, 3=Factory Verification of Water, 4=debug)	ENUM	Unsigned16	2	S	----	R/W	0x0000 = Disable 0x0001 = Normal Enable 0x0002 = Factory Verification of Air 0x0003 = Factory Verification of Water 0x0004 = Debug	R-3000
182	FRF_FaultAlarm (DD Name: FCF Varification Alarm)	Output state during FCF Verification (0=Last Value, 1=Fault)	VARIABLE	Unsigned8 (Bool)	1	D	--	R/W	N/A	R-3093
183	DB_FRF_StiffnessLimit (DD Name: Stifness limit Set point)	Stiffness Limit Set point	VARIABLE	FLOAT	4	S	0.04	R/W	0< Stiffness limit <=1	R-3147
184	FRF_AlgoState (DD Name: Algorithm State)	Algorithm State (1 through 18)	VARIABLE	Unsigned16	2	S	----	R	N/A	R-3001

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
185	FRF_AbortCode (DD Name: Abort Code)	Abort Code	ENUM	Unsigned16	2	S	---	R	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	R-3002
186	FRF_StateAtAbort (DD Name: StateAt Abort)	State at Abort	VARIABLE	Unsigned16	2	S	---	R	N/A	R-3003
187	DB_FRF_StiffOutLimLpo (DD Name: LPO Stiffness out of limit)	Stiffness out of limits LPO (0=No, 1=Yes)	VARIABLE	Unsigned16	2	D	---	R	N/A	R-3004
188	DB_FRF_StiffOutLimRpo (DD Name: RPO Stiffness out of limit)	Stiffness out of limits RPO (0=No, 1=Yes)	VARIABLE	Unsigned16	2	D	---	R	N/A	R-3005
189	FRF_Progress (DD Name: Progress)	Progress (% Complete)	VARIABLE	Unsigned16	2	S	--	R	N/A	R-3020
190	DB_FRF_StiffnessLpo _Mean (DD Name: Stiffness LPO)	Stiffness LPO – current data means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3101, R-3100
191	DB_FRF_StiffnessRpo_Mean (DD Name: Stiffness RPO)	Stiffness RPO – current data means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3103, R-3100
192	DB_FRF_Damping_Mean (DD Name: Mean Damping)	Damping – current data means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3105, R-3100
193	DB_FRF_MassLpo_Mean (DD Name: Mean Mass LPO)	Mass LPO – current data means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3107, R-3100
194	DB_FRF_MassRpo_Mean (DD Name: Mean Mass RPO)	Mass RPO – current data means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3109, R-3100
195	DB_FRF_StiffnessLpo_StdDev (DD Name: Stiffness LPO)	Stiffness LPO – current data std dev	VARIABLE	FLOAT	4	S	---	R	N/A	R-3101, R-3100
196	DB_FRF_StiffnessRpo_StdDev (DD Name: Stiffness RPO)	Stiffness RPO – current data std dev	VARIABLE	FLOAT	4	S	---	R	N/A	R-3103, R-3100
197	DB_FRF_Damping_StdDev (DD Name: Std Deviation Damping)	Damping – current data std dev	VARIABLE	FLOAT	4	S	---	R	N/A	R-3105, R-3100
198	DB_FRF_MassLpo_StdDev (DD Name: Std Deviation Mass LPO)	Mass LPO – current data std dev	VARIABLE	FLOAT	4	S	---	R	N/A	R-3107, R-3100
199	DB_FRF_MassRpo_StdDev (DD Name: Std Deviation Mass RPO)	Mass RPO – current data std dev	VARIABLE	FLOAT	4	S	---	R	N/A	R-3109, R-3100
200	DB_FRF_StiffnessLpo_AirCal (DD Name: Factory Cal Stiffness LPO)	Stiffness LPO – factory cal air means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3101, R-3100
201	DB_FRF_StiffnessRpo_AirCal (DD Name: Factory Cal Stiffness RPO)	Stiffness RPO – factory cal air means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3103, R-3100
202	DB_FRF_Damping_AirCal (DD Name: Damping Factory Cal Air)	Damping – factory cal air means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3105, R-3100
203	DB_FRF_MassLpo_AirCal (DD Name: Mass LPO Air Cal)	Mass LPO – factory cal air means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3107, R-3100
204	DB_FRF_MassRpo_AirCal (DD Name: Mass RPO Air Cal)	Mass RPO – factory cal air means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3109, R-3100
205	DB_FRF_StiffnessLpo_WaterCal (DD Name: Stiffness LPO Water Cal)	Stiffness LPO – cal water means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3101, R-3100
206	DB_FRF_StiffnessRpo_WaterCal (DD Name: Stiffness RPO Water Cal)	Stiffness RPO – cal water means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3103, R-3100
207	DB_FRF_Damping_WaterCal (DD Name: Damping Water Cal)	Damping – factory cal water means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3105, R-3100
208	DB_FRF_MassLpo_WaterCal (DD Name: Mass LPO Water Cal)	Mass LPO – factory cal water means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3107, R-3100
209	DB_FRF_MassRpo_WaterCal (DD Name: Mass RPO Water Cal)	Mass RPO – factory cal air means	VARIABLE	FLOAT	4	S	---	R	N/A	R-3109, R-3100
210	SNS_DriveCurrent (DD Name: Drive Current)	Drive Current (mA)	VARIABLE	FLOAT	4	D/20	----	R	N/A	R-0401
211	SNS_SensorFailureTimeoutTime (DD Name: Sensor Failure Time Out)	Sensor Failure Time out(1/16sec units)	VARIABLE	Unsigned16	2	S	---	R/W	NA	R-0399

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
212	EMPTY									
213	EMPTY									
214	EMPTY									
215	EMPTY									
216	EMPTY									
217	EMPTY									
218	EMPTY									
219	EMPTY									
	LDO									
220	UI_EnableLdoTotalizerReset(DD Name: Totalizer Reset)	Enable/Disable LDO Totalizer Reset	ENUM	Unsigned8	1	S	0x01	R/W	0x00 = disabled 0x01 = enabled	Coil-0094
221	UI_EnableLdoTotalizerStartStop(DD Name: Start/ Stop Totals)	Enable/Disable LDO Totalizer Start/Stop option	ENUM	Unsigned8	1	S	0x01	R/W	0x00 = disabled 0x01 = enabled	Coil-0091
222	UI_EnableLdoAutoScrol(DD Name: Auto Scroll)	Enable/Disable LDO Auto Scroll Feature	ENUM	Unsigned8	1	S	0x00	R/W	0x00 = disabled 0x01 = enabled	Coil-0095
223	UI_EnableLdoOfflineMenu(DD Name: Offline Menu)	Enable/Disable LDO Offline Menu Feature	ENUM	Unsigned8	1	S	0x01	R/W	0x00 = disabled 0x01 = enabled	C-0096
224	UI_EnableSecurity (DD Name: Offline Password)	Enable/Disable LDO Offline Password	ENUM	Unsigned8	1	S	0x00	R/W	0x00 = disabled 0x01 = enabled	C-0097
225	UI_EnableLdoAlarmMenu(DD Name: Alarm Menu)	Enable/Disable LDO Alarm Menu	ENUM	Unsigned8	1	S	0x01	R/W	0x00= disabled 0x01 = enabled	C-0098
226	UI_EnableLdoAckAllAlarms (DD Name: ACK All Alarms)	Enable/Disable LDO Acknowledge All #larms Feautre	ENUM	Unsigned8	1	S	0x01	R/W	0x00 = disabled 0x01 = enabled	C-0099
227	UI_OfflinePassword (DD Name: Enter Offline Password)	LDO offline password	VARIABLE	Unsigned16	2	S	1234	R/W	0 – 9999	R-1115
228	UI_AutoScrollRate (DD Name: ScrollPeriod)	LDO Scroll rate	VARIABLE	Unsigned16	2	S	10	R/W	Between 1 to 30	R-1116
229	UI_BacklightOn	LDO Backlight Control	ENUM	Unsigned8	1	S	0x01	R/W	0x00 = off 0x01 = on	Coil-0050
230	UNI_UI_ProcVarIndex	Process Variable Code (n = 0…94)	ENUM	Unsigned8	1	S	---	R/W	0 = Mass Flow Rate 1 = Temperature 2 = Mass Total 3= Density 4= Mass Inventory 5= Line (Gross) Volume Flow Rate 6= Line (Gross) Volume Total 7= Line (Gross) Volume Invento 8 = Not used 9= Not used 10= Not used 11= Not used 12= Not used 13= Not used 14= Not used 15= API: Temp Corrected Density 16= API: Temp Corrected (Standard) Volume Flow 17= API: Temp Corrected (Standard) Volume Total 18= API: Temp Corrected ((Standard) Volume Inventory 19= API: Batch Weighted Average Density 20= API: Batch Weighted Average Temperature 21= CM: Density At Reference	R-1367

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
									22= CM: Density (Fixed SG Units) 23= CM: Standard Volume Flow Rate 24= CM: Standard Volume Total 25= CM: Standard Volume Inventory 26= CM: Net Mass Flow Rate 27= CM: Net Mass Total 28= CM: Net Mass Inventory 29= CM: Net Volume Flow Rate 30= CM: Net Volume Total 31= CM: Net Volume Inventory 32= CM: Concentration 33= API: CTL 34= Not used 35= Not used 36= Not used 37= Not used 38= Not used 39= Not used 40= Not used 41= Not used 42= Not used 43= Not used 44= Not used 45= Not used 46=Raw Tube Frequency 47= Drive Gain 48= Case Temperature (T-Series) 49= LPO Amplitude 50= RPO Amplitude 51= Board Temperature 52= Input Voltage 53= Externally read Pressure 54= Not used 55= Externally read Temperature 56= CM: Density (Fixed Baume Units)/ Enhanced 57= Not used 58= Not used 59= Not used 60= Not used 61= Not used 62= Gas Standard Volume Flow Rate 63= Gas Standard Volume Total 64= Gas Standard Volume Inventory 65= Not used 66= Not used 67= Not used 68= Not used 69= Live Zero 70= Not used 71= Not used 72= Not used 73= Not used 74= Not used 75= Not used 76= Not used 77= Not used	

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
									78= Not used 79= Not used 80= Not used 81= Not used 82= Not used 83= Not used 84= Not used 85= Not used 86= Not used 87= Not used 88= Not used 89= Not used 90= Not used 91= Not used 92= Not used 93= Not used 94= Not used 95= Not used 96= Not used 97= Not used 98= Not used 99= Not used 100= Not used 101= Not used 102= Not used 103= Not used 104= Not used 105-252 = Not used 253= Not used 254= Not used 255= Not used	
231	UI_NumDecimals	For Totals, the number of digits to the right of the decimal point to display on LDO	VARIABLE	Unsigned8	1	S	-	R/W	0 to 5	R-1368
232	UI_ProcessVariables (LDO_VAR_1_CODE) (DD Name: Display Variable 1)	Display the Variable #1associated with the code on the LDO	ENUM	Unsigned16	2	S	0	R/W	0 = Mass Flow Rate 1 = Temperature 2 = Mass Total 3 = Density 4 = Mass Inventory 5 = Volume Flow Rate 6 = Volume Total 7 = Volume Inventory 8 – 11 = Not used 12= Not used 13= Not used 14= Not used 15 = API: Corr Density 16 = API: Corr Vol Flow 17 = API: Corr Vol Total 18 = API: Corr Vol Inv 19 = API: Avg Density 20 = API: Avg Temp 21 = CM: Density At Ref 22 = CM: Density (SGU) 23 = CM: Std Vol Flow Rate 24 = CM: Std Vol Total 25 = CM: Std Vol Inventory 26 = CM: Net Mass Flow 27 = CM: Net Mass Total 28 = CM: Net Mass Inv 29 = CM: Net Vol Flow Rate 30 = CM: Net Vol Total 31 = CM: Net Vol Inventory 32 = CM: Concentration 33 = API: CTL 34-45 = Not used 46 = Raw Tube Frequency 47 = Drive Gain 48 = Case Temperature 49 = LPO Amplitude 50 = RPO Amplitude	R-1117

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
									51 = Board Temperature 52 = Input Voltage 53 = Ext. Input Pressure 54 = Not used 55 = Ext. Input Temp 56 = CM: Density (Baume) 57 = Not used 58 = Not used 59 = Not used 60 = Not used 61 = Not used 62 = Gas Std Vol Flow 63 = Gas Std Vol Total 64 = Gat Std Vol Inventory 65 = Not used 66 = Not used 67 = Not used 68 = Not used 69 = Live Zero 70 – 101 = Not used 102 = Not used 103 = Not used 104 = Not used 105 – 250 = Not used 251 – 255 = Not used	

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
233	UI_ProcessVariables (LDO_VAR_2_CODE) (DD Name: Display Variable 2)	Display the Variable#2 associated with the code on the LDO	ENUM	Unsigned16	2	S	2	R/W	0 = Mass Flow Rate 1 = Temperature 2 = Mass Total 3 = Density 4 = Mass Inventory 5 = Volume Flow Rate 6 = Volume Total 7 = Volume Inventory 8 – 11 = Not used 12= Not used 13= Not used 14= Not used 15 = API: Corr Density 16 = API: Corr Vol Flow 17 = API: Corr Vol Total 18 = API: Corr Vol Inv 19 = API: Avg Density 20 = API: Avg Temp 21 = ED: Density At Ref 22 = ED: Density (SGU) 23 = ED: Std Vol Flow Rate 24 = ED: Std Vol Total 25 = ED: Std Vol Inventory 26 = ED: Net Mass Flow 27 = ED: Net Mass Total 28 = ED: Net Mass Inv 29 = ED: Net Vol Flow Rate 30 = ED: Net Vol Total 31 = ED: Net Vol Inventory 32 = ED: Concentration 33 = API: CTL 34-45 = Not used 46 = Raw Tube Frequency 47 = Drive Gain 48 = Case Temperature 49 = LPO Amplitude 50 = RPO Amplitude 51 = Board Temperature 52 = Input Voltage 53 = Ext. Input Pressure 54 = Not used 55 = Ext. Input Temp 56 = ED: Density (Baume) 57 = Not used 58 = Not used 59 = Not used 60 = Not used 61 = Not used 62 = Gas Std Vol Flow 63 = Gas Std Vol Total 64 = Gat Std Vol Inventory 65 = Not used 66 = Not used 67 = Not used 68 = Not used 69 = Live Zero 70 – 101 = Not used 102 = Not used 103 = Not used 104 = Not used 105 – 250 = Not used 251 = None 252 – 255 = Not used	R-1118
234	UI_ProcessVariables (LDO_VAR_3_CODE) (DD Name: Display Variable 3)	Display the Variable #3 associated with the code on the LDO	ENUM	Unsigned16	2	S	5	R/W	Same as LDO_VAR_2_CODE	R-1119
235	UI_ProcessVariables (LDO_VAR_4_CODE) (DD Name: Display Variable 4)	Display the Variable#4 associated with the code on the LDO	ENUM	Unsigned16	2	S	6	R/W	Same as LDO_VAR_2_CODE	R-1120
236	UI_ProcessVariables (LDO_VAR_5_CODE) (DD Name: Display Variable 5)	Display the Variable#5 associated with the code on the LDO	ENUM	Unsigned16	2	S	3	R/W	Same as LDO_VAR_2_CODE	R-1121
237	UI_ProcessVariables (LDO_VAR_6_CODE) (DD Name: Display Variable 6)	Display the Variable#6 associated with the code on the LDO	ENUM	Unsigned16	2	S	1	R/W	Same as LDO_VAR_2_CODE	R-1122

Table F-5 Transducer block 1 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
238	UI_ProcessVariables (LDO_VAR_7_CODE) (DD Name: Display Variable 7)	Display the Variable#7 associated with the code on the LDO	ENUM	Unsigned16	2	S	251	R/W	Same as LDO_VAR_2_CODE	R-1123
239	UI_ProcessVariables (LDO_VAR_8_CODE) (DD Name: Display Variable 8)	Display the Variable#8 associated with the code on the LDO	ENUM	Unsigned16	2	S	251	R/W	Same as LDO_VAR_2_CODE	R-1124
240	UI_ProcessVariables (LDO_VAR_9_CODE) (DD Name: Display Variable 9)	Display the Variable#9 associated with the code on the LDO	ENUM	Unsigned16	2	S	251	R/W	Same as LDO_VAR_2_CODE	R-1125
241	UI_ProcessVariables (LDO_VAR_10_CODE) (DD Name: Display Variable 10)	Display the Variable#10 associated with the code on the LDO	ENUM	Unsigned16	2	S	251	R/W	Same as LDO_VAR_2_CODE	R-1126
242	UI_ProcessVariables (LDO_VAR_11_CODE) (DD Name: Display Variable 11)	Display the Variable#11 associated with the code on the LDO	ENUM	Unsigned16	2	S	251	R/W	Same as LDO_VAR_2_CODE	R-1127
243	UI_ProcessVariables (LDO_VAR_12_CODE) (DD Name: Display Variable 12)	Display the Variable#12 associated with the code on the LDO	ENUM	Unsigned16	2	S	251	R/W	Same as LDO_VAR_2_CODE	R-1128
244	UI_ProcessVariables (LDO_VAR_13_CODE) (DD Name: Display Variable 13)	Display the Variable#13 associated with the code on the LDO	ENUM	Unsigned16	2	S	251	R/W	Same as LDO_VAR_2_CODE	R-1129
245	UI_ProcessVariables (LDO_VAR_14_CODE) (DD Name: Display Variable 14)	Display the Variable#14 associated with the code on the LDO	ENUM	Unsigned16	2	S	251	R/W	Same as LDO_VAR_2_CODE	R-1130
246	UI_ProcessVariables (LDO_VAR_15_CODE) (DD Name: Display Variable 15)	Display the Variable#15 associated with the code on the LDO	ENUM	Unsigned16	2	S	251	R/W	Same as LDO_VAR_2_CODE	R-1131
247	UI_UpdatePeriodmsec	Display update period (milliseconds)	VARIABLE	Unsigned16	2	S	200ms	R/W	Between 100 to 10,000	R-2621
248	EMPTY									
249	UI_Language	Display language selection	ENUM	Unsigned16	2	S	English	R/W	0 = English 1 = German 2 = French 3 = Not used 4 = Spanish	R-1359
250	STATUS_LED_TEST	Simulate the Status LED	ENUM	Unsigned 16	2	S	0x0000	R/W	0=off, 1=green, 2=red, 3=yellow, 4=flashing, add 4 to flash	R 5006
251	EMPTY									
252	EMPTY									
253	EMPTY									
254	Transducer Block1 VIEW1									

F.4.1 Transducer block 1 object

Table F-6 shows the transducer block 1 object.

Table F-6 Transducer block 1 object

Slot/Index	Element name	Data type	Size in bytes	Value
Slot 11/Index 0	Reserved	Unsigned 8	1	250 (default)
	Block_Object	Unsigned 8	1	03
	Parent_Class	Unsigned 8	1	03
	Class	Unsigned 8	1	03
	DD_Refrence	Unsigned 32	4	00 ,00, 00, 00 (reserved)
	DD_Revision	Unsigned 16	2	00 ,00 (reserved)
	Profile	Octet String	2	64 02 (compact class B)
	Profile_Revision	Unsigned 16	2	03 01 (3.01)
	Execution_Time	Unsigned 8	1	00 (for future use)
	Number_Of_Parameters	Unsigned 16	2	00 254(max number of TB1 parameters)
	Address_of_View_1	Unsigned 16	2	11 254 (slot, index)
	Number_of_Views	Unsigned 8	1	01 (1 view)

F.4.2 Transducer block 1 (measurement, calibration, and diagnosis) views

Table F-7 shows the views for transducer block 1.

Table F-7 Transducer block 1 views

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
0	BLOCK_OBJECT				
1	ST_REV	2			
2	TAG_DESC				
3	STRATEGY				
4	ALERT_KEY				
5	TARGET_MODE				
6	MODE_BLK	3			
7	ALARM_SUM	8			
	Overall sum of bytes in View Object	13			

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
21	MASS_FLOW	5			
25	DENSITY	5			
29	TEMPERATURE	5			
254	Overall sum of bytes in View Object (+ 13 Standard parameters bytes)	15+13			

F.4.3 Transducer block 2 (device information, API, CM) parameters

Table F-8 shows the parameters for transducer block 2.

Table F-8 Transducer block 2 parameters

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
	Standard PA parameters									
0	BLOCK_OBJECT	This object contains the characteristics of the block	RECORD	DS-32	20	S	----	R	NA	NA
1	ST_REV	A block has static block parameters, that are not changed by the process. Values are assigned to this parameter during the configuration of optimization. The value of ST_REV increases by 1 after every change of a static block parameter.	SIMPLE	Unsigned16	2	N	0	R	NA	NA
2	TAG_DESC	Every block can be assigned a textual TAG description. The TAG_DESC must be unambiguous and unique in the field bus system.	SIMPLE	OCTET STRING	32	S	‘ ’	R/W	NA	NA
3	STRATEGY	Grouping of function block. The STRATEGY field can be used to group blocks.	SIMPLE	Unsigned16	2	S	0	R/W	NA	NA
4	ALERT_KEY	This parameter contains the identification number of the plant unit.	SIMPLE	Unsigned8	1	S	0	R/W	NA	NA
5	TARGET_MODE	This parameter contains desired mode normally set by a control application of an operator. The modes are valid alternatively only, i.e. only one mode can be set at one time. A write access to this parameter with more than one mode is out of the range of the parameter and has to be rejected.	SIMPLE	Unsigned8	1	S	AUTO (0x08)	R/W	AUTO (0x08)	NA
6	MODE_BLK	This parameter contains the current mode and the permitted and normal mode of the block.	RECORD	DS-37	3	D	---	R	NA	NA
7	ALARM_SUM	This parameter contains the current states of the block alarms.	RECORD	DS-42	8	D	0,0,0,0	R	NA	NA
	DEVICE INFORMATION BLOCK									
	Transmitter Data									
8	SYS_FeatureKey (DD Name: Enabled Features)	Enabled Features	STRING	BIT_ENUM ERATED	2	S	-	R	0x0000 = standard 0x0800 = Meter Verification 0x0008 = Enh. Density 0x0010 = API	R-5000
9	SYS_CEQ_Number (DD Name: CP ETO)	Model 2700 Transmitter CEQ Number	VARIABLE	Unsigned16	2	S	S/W Rev	R/W	N/A	R-5005
	Sensor Data									
10	SNS_SensorSerialNum (DD Name : Sensor Serial Number)	Sensor serial number	VARIABLE	Unsigned32	4	S	0	R/W	>=0 and <=16777215.0f	R-0127-128
11	SNS_SensorType (DD Name: Sensor Model Number)	Sensor type (i.e. F200, CMF025)	STRING	OCTET STRING	16	S	“”	R/W	N/A	R-0425
12	SNS_SensorTypeCode (DD Name: Sensor Type Code)	Sensor type code	ENUM	Unsigned16	2	S	0	R/W	0 = Curve Tube 1 = Straight Tube	R-1139
13	SNS_SensorMaterial (DD Name : Sensor Material)	Sensor Material	ENUM	Unsigned16	2	S	0	R/W	0 = None 3 = Hastelloy C-22 4 = Monel 5 = Tantalum 6 = Titanium 19 = 316L stainless steel 23 = Inconel 252 = Unknown 253 = Special	R-0130
14	SNS_LinerMaterial (DD Name : Sensor Liner)	Liner Material	ENUM	Unsigned16	2	S	0	R/W	0 = None 10 = PTFE (2larms) 11 = Halar 16 = Tefzel 251 = None 252 = Unknown 253 = Special	R-0131

Table F-8 Transducer block 2 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Acce ss	Enumerated List of Values / Range	Modbus Register / Coil
15	SNS_FlangeType (DD Name : Sensor Flange)	Flange Type	ENUM	Unsigned16	2	S	0	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	R-0129
16	SNS_MassFlowLoSpan (DD Name: Mass Minimum Span)	Mass flow minimum range	VARIABLE	FLOAT	4	S	Calc	R	N/A	R-181-182
17	SNS_TempFlowLoSpan (DD Name: Temp Minimum Span)	Temperature minimum range	VARIABLE	FLOAT	4	S	Calc	R	N/A	R-183-184
18	SNS_DensityLoSpan (DD Name: Density Minimum Span)	Density minimum range (g/cc)	VARIABLE	FLOAT	4	S	Calc	R	N/A	R-185-186
19	SNS_VolumeFlowLoSpan (DD Name: Volume Minimum Span)	Volume flow minimum range	VARIABLE	FLOAT	4	S	Calc	R	N/A	R-187-188
20	SYS_BoardRevision	Board Revision	VARIABLE	Unsigned8	1	S		R	N/A	R-1163
21	SNS_HartDeviceID(0) (DD Name: Hart Device ID - 0)	Hart device ID. Mapped with R122 of core	VARIABLE	Unsigned32	4	D		R	N/A	R-1187
22	SNS_HartDeviceID(1) (DD Name: Hart Device ID - 1)	Hart device ID. Mapped with R122 of core	VARIABLE	Unsigned32	4	D		R	N/A	R-1188
23	EMPTY									
24	EMPTY									
25	EMPTY									
26	EMPTY									
27	EMPTY									
28	EMPTY									
	Petroleum Measurement									
	API Process Variables									
29	SNS_API_CorrDensity (DD Name : PMI TC Density)	Temp Corrected Density	RECORD	101	5	D	----	R		R-0325-326
30	SNS_API_CorrVolFlow (DD Name : PMI TC Volume Flow)	Temp Corrected (Standard) Volume Flow	RECORD	101	5	D	----	R		R-0331-332
31	SNS_API_AveCorrDensity (DD Name : PM Batch Weighted Average Density)	Batch Weighted Average Density	RECORD	101	5	D	----	R		R-0337-338
32	SNS_API_AveCorrTemp (DD Name : PM Batch Weighted Average Temperature)	Batch Weighted Average Temperature	RECORD	101	5	D	----	R		R-339-340
33	SNS_API_CTL (DD Name :PM CTL)	CTL	RECORD	101	5	D	----	R		R-0329-330
34	SNS_API_CorrVolTotal (DD Name : PM TC Volume Total)	Temp Corrected (Standard) Volume Total	VARIABLE	101	5	D/20	0	R	N/A	R-0333-0334
35	SNS_API_CorrVolInv (DD Name : PM TC Volume Inventory)	Temp Corrected (Standard) Volume Inventory	VARIABLE	101	5	D/20	0	R	N/A	R-0335-336
36	SNS_ResetApiRefVolTotal (DD Name : Reset PM TC Volume Total)	Reset API Reference Volume Total	METHOD	Unsigned8	1	S	-	R/W	0x00 = None 0x01 = Reset	Coil-0058
37	SNS_ResetAPIGSVInv (DD Name: Rest PM Volume Inventory)	Reset API/GSV Inventory (“On” = Reset, “Off” = N/A)	Method	Unsigned8	1	S	0x00	R/W	0x00 = No Effect 0x01 = Reset	Coil-0194
	API Setup Data									
38	SNS_APIRefTemp (DD Name:PM Reference Temp)	API Reference Temp	VARIABLE	FLOAT	4	S	15	R/W	0 to 100	R-0319-0320
39	SNS_APITEC (DD Name: PM Thermal Expansion Coeff)	API Thermal Expansion Coeff	VARIABLE	FLOAT	4	S	0	R/W	>= 0.000485	R-0323-0324

Table F-8 Transducer block 2 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
40	SNS_API2540TableType (DD Name: PM2540 CTL Table Type)	API 2540 CTLTable Type	ENUM	Unsigned16	2	S	API_ TABLE _53A	R/W	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	R-0351
41	EMPTY									
42	EMPTY									
43	EMPTY									
44	EMPTY									
45	EMPTY									
46	EMPTY									
	Concentration Measurement									
	CM Process Variables									
47	SNS_ED_RefDens (DD Name : CM Density at Reference)	Density At Reference	RECORD	101	5	D	----	R	RECORD	R-0963
48	SNS_ED_SpecGrav (DD Name : CM Specific Gravity)	Density (Fixed SG Units)	RECORD	101	5	D	----	R	RECORD	R-0965
49	SNS_ED_StdVolFlow (DD Name : CM TC Volume Flow)	Standard Volume Flow Rate	RECORD	101	5	D	----	R	RECORD	R-0967
50	SNS_ED_NetMassFlow (DD Name : CM Net Mass Flow)	Net Mass Flow Rate	RECORD	101	5	D	----	R	RECORD	R-0973
51	SNS_ED_NetVolFlow (DD Name : CM Net Volume Flow)	Net Volume Flow Rate	RECORD	101	5	D	----	R	RECORD	R-0979
52	SNS_ED_Conc (DD Name : Concentration)	Concentration	RECORD	101	5	D	----	R	RECORD	R-0985
53	SNS_ED_SpecDens (DD Name : CM Density (Baume))	Density (Fixed Baume Units)	RECORD	101	5	D	----	R	RECORD	R-0987
	CM Totals									
54	SNS_ED_StdVolTotal (DD Name : CM TC Volume Total)	Standard Volume Total	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-0969
55	SNS_ED_StdVolInv (DD Name : CM TC Volume Inventory)	Standard Volume Inventory	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-0971
56	SNS_ED_NetMassTotal (DD Name : CM Net Mass Total)	Net Mass Total	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-0975
57	SNS_ED_NetMassInv (DD Name : CM Net Mass Inventory)	Net Mass Inventory	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-0977
58	SNS_ED_NetVolTotal (DD Name : CM Net Volume Total)	Net Volume Total	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-0981
59	SNS_ED_NetVolInv (DD Name : CM Net Volume Inventory)	Net Volume Inventory	VARIABLE	FLOAT	4	D/20	0	R	N/A	R-0983
60	SNS_ResetEDRefVolTotal (DD Name : Reset CM TC Volume Total)	Reset ED Standard Volume Total	METHOD	Unsigned8	1	S	-	R/W	0x00 = None 0x01 = Reset	Coil-0059
61	SNS_ResetEDNetMassTotal (DD Name : Reset CM Net Mass Total)	Reset ED Net Mass Total	METHOD	Unsigned8	1	S	-	R/W	0x00 = None 0x01 = Reset	Coil-0060
62	SNS_ResetEDNetVolTotal (DD Name : Reset CM Net Volume Total)	Reset ED Net Volume Total	METHOD	Unsigned8	1	S	-	R/W	0x00 = None 0x01 = Reset	Coil-0061
63	SNS_ResetEDVolInv (DD Name: Reset Volume Inventory At Reference Temp)	Reset ED Volume Inventory (“On” = Reset, “Off” = N/A)	Method	Unsigned8	1	S		R/W	0x00 = No Effect 0x01 = Reset	Coil-0195
64	SNS_ResetEDNetMassInv (DD Name: Reset Net Mass Inventory)	Reset ED Net Mass Inventory (“On” = Reset, “Off” = N/A)	Method	Unsigned8	1	S		R/W	0x00 = No Effect 0x01 = Reset	Coil-0196
65	SNS_ResetEDNetVolInv (DD Name: Reset Net Volume Inventory)	Reset ED Net Volume Inventory (“On” = Reset, “Off” = N/A)	Method	Unsigned8	1	S		R/W	0x00 = No Effect 0x01 = Reset	Coil-0197
	CM Setup Data									

Table F-8 Transducer block 2 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Acce ss	Enumerated List of Values / Range	Modbus Register / Coil
66	SNS_ED_CurveLock (DD Name: Lock/Unlock ED Curves)	Lock Enhanced Density Tables	ENUM	Unsigned8	1	S	1	R/W	0x00 = not locked 0x01 = locked	Coil-0085
67	SNS_ED_Mode (DD Name: Derived Variable)	Enhanced Density Mode	ENUM	Unsigned16	2	S	Mass Conc. (Dens)	R/W	0 = None 1= Dens @ Ref Temp 2= Specific Gravity 3= Mass Conc (Dens) 4=Mass Conc (SG) 5= Volume Conc (Dens) 6= Volume Conc (SG) 7= Concentration (Dens) 8 = Concentration (SG)	R-0524
68	SNS_ED_ActiveCurve (DD Name: Active Calculation Curve)	Active Calculation Curve	VARIABLE	Unsigned16	2	S	0	R/W	0 through 5	R-0523
69	UNI_ED_CurveIndex (DD Name: Curve Configured)	Curve Configuration Index (n)	VARIABLE	Unsigned8	1	S	---	R/W	0 through 5	R-0527
70	UNI_ED_TempIndex (DD Name: Curve Temperature Isotherm Index (X-Axis))	Curven Temperature Isotherm Index (x-axis)	VARIABLE	Unsigned8	1	S	---	R/W	0 through 5	R-0528
71	UNI_ED_ConcIndex (DD Name: Curve Concentration Index (Y-Axis))	Curven Concentration Index (y-axis)	VARIABLE	Unsigned8	1	S	---	R/W	0 through 5	R-0529
72	SNS_ED_TempISO (DD Name: Curve N (6*5) Temp Isotherm X Value (X-Axis))	Curven (6x5) Temperature Isothermx Value (x-axis)	VARIABLE	FLOAT	4	S	---	R/W	N/A	R-0531
73	SNS_ED_DensAtTempISO (DD Name: Curve N (6*5) Density @ Temp Isotherm X, Concentration Y)	Curven (6x5) Density @ Temperature IsothermX, ConcentrationY	VARIABLE	FLOAT	4	S	----	R/W	N/A	R-0533
74	SNS_ED_DensAtTempCoeff (DD Name: Curve N (6*5) Coeff @ Temp Isotherm X, Concentration Y)	Curven (6x5) Coeff @ Temperature IsothermX, ConcentrationY	VARIABLE	FLOAT	4	S	-----	R	N/A	R-0535
75	SNS_ED_ConcLabel55 (DD Name: Curve N (6*5) Concentration Y Value (Label For Y-Axis))	Curven (6x5) ConcentrationY Value (Label for y-axis)	VARIABLE	FLOAT	4	S	----	R/W	N/A	R-0537
76	SNS_ED_DensAtConc (DD Name: Curve N (5*1) Density @ Concentration Y (At Ref Temp))	Curven (5x1) Density at ConcentrationY (at Ref Temp)	VARIABLE	FLOAT	4	S	-----	R/W	N/A	R-0539
77	SNS_ED_DensAtConcCoeff (DD Name: Curve N (5*1) Coeff @ Concentration Y (At Ref Temp))	Curven (5x1) Coeff at ConcentrationY (at Ref Temp)	VARIABLE	FLOAT	4	S	-----	R	N/A	R-0541
78	SNS_ED_ConcLabel51 (DD Name: Curve N (5*1) Concentration Y Value (Y-Axis))	Curven (5x1) ConcentrationY Value (y-axis)	VARIABLE	FLOAT	4	S	----	R/W	N/A	R-0543
79	SNS_ED_RefTemp (DD Name: Curve N Reference Temperature)	Curven Reference Temperature	VARIABLE	FLOAT	4	S	----	R/W	Temp. sensor Limits	R-0545
80	SNS_ED_SGWaterRefTemp (DD Name: Curve N Water Reference Temperature)	Curven SG Water Reference Temperature	VARIABLE	FLOAT	4	S	----	R/W	Temp. sensor limits	R-0547
81	SNS_ED_SGWaterRefDens (DD Name: Curve N Water Reference Density)	Curven SG Water Reference Density	VARIABLE	FLOAT	4	S	-----	R/W	Density Limits	R-0549
82	SNS_ED_SlopeTrim (DD Name: Curve N Trim Slope)	Curven Slope Trim	VARIABLE	FLOAT	4	S	----	R/W	0.8 to 1.2	R-0551
83	SNS_ED_OffsetTrim (DD Name: Curve N Trim Offset)	Curven Offset Trim	VARIABLE	FLOAT	4	S	----	R/W	None	R-0553
84	SNS_ED_ExtrapAlarmLimit (DD Name: Curve N Alarm Limit (%))	Curven Extrapolation Alarm Limit: %	VARIABLE	FLOAT	4	S	----	R/W	0 to 270	R-0555
85	SNS_ED_CurveName (DD Name: Curve N Curve Name)	Curven ASCII String – Name of Curve – 12 chars supported	VARIABLE	OCTET STRING	12	S	----	R/W	N/A	R-2771- 2776
86	SNS_ED_MaxFitOrder (DD Name: Curve Fit Max Order)	Maximum Fit Order for 5x5 curve	VARIABLE	Unsigned16	2	S	----	R/W	2, 3, 4, 5	R-0564
87	SNS_ED_FitResults (DD Name: Curve N Fit Results)	Curven Curve Fit Results	ENUM	Unsigned16	2	S	----	R	0 = Good 1 = Poor 2 = Failed 3 = Empty	R-0569

Table F-8 Transducer block 2 parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
88	SNS_ED_ConcUnitCode (DD Name: Curve N Concentration Units)	Curven Concentration Units Code	ENUM	Unsigned16	2	S	----	R/W	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 Per Volume 1429 = Proof Per mass 1346 = Percent Plato	R-0570
89	SNS_ED_ExpectedAcc (DD Name: Curve N Curve Fit Expected Accuracy)	Curven Curve Fit Expected Accuracy	VARIABLE	FLOAT	4	S	------	R		R-0571
90	SNS_ED_ResetFlag (DD Name: Reset All Curve Information)	Reset All Enhanced Density Curve Information	Method	Unsigned8	1	S	1	W	0x00 = Not used 0x01 = Reset	Coil-249
91	SNS_ED_EnableDensLowExtrap (DD Name: Enable Density Low)	Enable Dens Low Extrap (Enhanced Denisty Extrap Alarm)	Method	Unsigned8	1	S	1	R/W	0x00 = Disable 0x01 = Enable	Coil-250
92	SNS_ED_EnableDensHighExtrap (DD Name: Enable Density High)	Enable Dens High Extrap (Enhanced Denisty Extrap Alarm)	Method	Unsigned8	1	S	1	R/W	0x00 = Disable 0x01 = Enable	Coil-251
93	SNS_ED_EnableTempLowExtrap (DD Name: Enable Temperature Low)	Enable Temp Low Extrap (Enhanced Denisty Extrap Alarm)	Method	Unsigned8	1	S	1	R/W	0x00 = Disable 0x01 = Enable	Coil-252
94	SNS_ED_EnableTempHighExtrap (DD Name: Enable Temperature High)	Enable Temp High Extrap (Enhanced Denisty Extrap Alarm)	Method	Unsigned8	1	S	1	R/W	0x00 = Disable 0x01 = Enable	Coil-253
95	DB_SNS_PuckDeviceTypeCode	Device Type Code for attached Core	Variable	Unsigned16	2	D/20		R	40 = 700 CP 50 = 80 CP	R-1162
96	EMPTY									
97	EMPTY									
98	Transducer Block 2 VIEW 1									

F.4.4 Transducer block 2 object

Table F-9 shows the transducer block 2 object.

Table F-9 Transducer block 2 object

Slot/Index	Element name	Data type	Size in bytes	Value
Slot 11/Index 0	Reserved	Unsigned 8	1	250 (default)
	Block_Object	Unsigned 8	1	03
	Parent_Class	Unsigned 8	1	03
	Class	Unsigned 8	1	128 (manufacturer-specific class)
	DD_Refrence	Unsigned 32	4	00 ,00, 00, 00 (reserved)
	DD_Revision	Unsigned 16	2	00 ,00 (reserved)
	Profile	Octet String	2	64 02 (compact class B)
	Profile_Revision	Unsigned 16	2	03 01 (3.01)
	Execution_Time	Unsigned 8	1	00 (for future use)
	Number_Of_Parameters	Unsigned 16	2	00 98 (max number of TB2 parameters)
	Address_of_View_1	Unsigned 16	2	12 98 (slot, index)
	Number_of_Views	Unsigned 8	1	01 (1 view)

F.4.5 Transducer block 2 (device information, API, CM) views

Table F-10 shows the views for transducer block 2.

Table F-10 Transducer block 2 views

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
0	BLOCK_OBJECT				
1	ST_REV	2			
2	TAG_DESC				
3	STRATEGY				
4	ALERT_KEY				
5	TARGET_MODE				
6	MODE_BLK	3			
7	ALARM_SUM	8			
	Overall sum of bytes in View Object	13			

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
98	Overall sum of bytes in View Object (+ 13 Standard parameters bytes)	13			

F.4.6 I & M functions

Table F-11 shows the parameters for I & M functions.

Table F-11 I & M parameters

Index	Sub-Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store/ Rate (HZ)	Default Value	Access	Enumerated List of Values	Modbus Register / Coil
255	65000	IM_DEFAULT	I&M0(Mandatory)	VARIABLE	Octet String	64	S	---	R	--	--
			HEADER –Reserved	STRING	Octet String	10	S	0x00	R	---	Hard coded
			MANUFACTURER_ID – Identification code of the Manufacturer of the PA Device	VARIABLE	Unsigned16	2	S	0x00	R	---	Physical Block Index 26 DEVICE_MAN_ID
			ORDER_ID –Order No. of the Device	STRING	Visible String	20	S	2700S Profibus PA	R	---	R 2545 – 2554
			SERIAL_NO –Production Serial No. of the device	STRING	Visible String	16	S	----	R	---	Physical Block Index 28 – DEVICE_SER_NUM
			HARDWARE_REVISION –Revision No. of the Hardware	VARIABLE	Unsigned 16	2	S	0xFFFF	R	---	0xFFFF
			SOFTWARE_REVISION –Software or Firmware revision of the device or module	VARIABLE	1Char 3 Unsigned8	4	S	---	R	--	V 0xFF 0xFF 0xFF
			REV_COUNTER – According to /I&M/. The REV_COUNTER is incremented if a parameter content with static attribute in the according slot has Changed. Slot 0 carries a REV_COUNTER that counts all changes of static parameters of The whole device.	VARIABLE	Unsigned16	2	S	0	R	---	Sum of ST_REV of all Blocks i.e. TB1 + TB2+AI1+AI2+ AI3+AI4+TOT1 +TOT2+TOT3 +TOT4 + AO1+AO2

Table F-11 I & M parameters (continued)

Index	Sub-Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store/ Rate (HZ)	Default Value	Access	Enumerated List of Values	Modbus Register / Coil
			PROFILE_ID –Profile type of supporting Profile	VARIABLE	Unsigned16	2	S	0x9700	R	--	Hard Coded
			PROFILE_SPECIFIC_TYPE –Specific Profile Type	VARIABLE	Octet String	2	S	0x01 0x01	R	--	Byte 0: BLOCK_OBJECT.BlockObject Byte 1: BLOCK_OBJECT.ParentClass
			IM_VERSION –Implemented version of I & M function	VARIABLE	2 – Unsigned8	2	S	0x01,0x01	R	--	Hard Coded
			IM_SUPPORTED –Indicated Availability of I & M Records	VARIABLE	Octet String	2	S	0x00 0x07	R	--	Hard Coded
	65001	IM_1	I&M1(Mandatory)								
			HEADER –Manufacturer Specific	STRING	Octet String	10	S	0x00	R	---	Hard Coded
			TAG_FUNCTION –Device Identification Tag	STRING	Visible String	32	S	Blank 0x20	R	--	Physical block Index 18 TAG_DESC
			TAG_LOCATION –Device Location Identification Tag	STRING	Visible String	22	S	Blank 0x20	R	--	Hard Coded
	65002	IM_2	I&M2(Mandatory)								
			Header – Manufacture Specific	STRING	Octet String	10	S	0x00	R	---	Hard Coded
			Date – Date of installation of PA Device	STRING	Visible String	16	S	Blank 0x20	R	---	Physical Block Index – 38 DEVICE_INSTALL_DATE
			Reserved	STRING	Octect String	38	S	0x00	R	----	---
	65016	PA_IM_0	Header – Reserved	STRING	Octet String	10	S	0x00	R	--	Hard Coded
			PA_IM_VERSION – Version of the process device profile specific extensions of I&M Octet 1 (MSB) = major version number, e.g. 1 of version 1.0 Octet 2 (LSB) = minor version number, e.g. 0 of version 1.0	VARIABLE	Unsigned 8	2	S	0x01 0x00	R	--	Hard Coded
			HARDWARE_REVISION – Hardware Revision according to Physical Component	STRING	Visible String	16	S	Blank	R	---	Physical Block – Index25
			SOFTWARE_REVISON – Firmware Revision of the according Physical component	STRING	Visible String	16	S	Blank	R	S	Physical Block – Index-24
			Reserved			18					
			PA_IM_SUPPORTED	STRING	Octet String	2	S	0x00 0x00	R	S	Hard Coded

F.4.7 AI function block parameters

Table F-12 shows the parameters for the AI function blocks.

Table F-12 AI function block parameters

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
	Standard PA parameters									
16	BLOCK_OBJECT	This object contains the characteristics of the block	RECORD	DS-32	20	S	----	R	NA	NA
17	ST_REV	A block has static block parameters that are not changed by the process. Values are assigned to this parameter during the configuration of optimization. The value of ST_REV increases by 1 after every change of a static block parameter.	SIMPLE	Unsigned16	2	N	0	R	NA	NA
18	TAG_DESC	Every block can be assigned a textual TAG description. The TAG_DESC must be unambiguous and unique in the field bus system.	SIMPLE	OCTET STRING	32	S	' '	R/W	NA	NA
19	STRATEGY	Grouping of function block. The STRATEGY field can be used to group blocks.	SIMPLE	Unsigned16	2	S	0	R/W	NA	NA
20	ALERT_KEY	This parameter contains the identification number of the plant unit.	SIMPLE	Unsigned8	1	S	0	R/W	NA	NA
21	TARGET_MODE	This parameter contains desired mode normally set by a control application of an operator. The modes are valid alternatively only, i.e. only one mode can be set at one time. A write access to this parameter with more than one mode is out of the range of the parameter and has to be rejected.	SIMPLE	Unsigned8	1	S	Auto (0x08)	R/W	0x08 – Auto 0x10 – Manual 0x80 – Out of Service	R-1506
22	MODE_BLK	This parameter contains the current mode and the permitted and normal mode of the block.	RECORD	DS-37	3	D	----	R	NA	R-1507
23	ALARM_SUM	This parameter contains the current states of the block alarms.	RECORD	DS-42	8	D	0,0,0,0	R	NA	NA
24	BATCH	This parameter is intended to be used in Batch applications in line with IEC 61512 Part1. Only Function Blocks carry this parameter. There is no algorithm necessary Within a Function Block.	RECORD	DS-67	10	S	0,0,0,0	RW	NA	NA
25	RESERVED									
	AI Function Block Standard Parameters									
26	OUT (DD Name: AI Out)	The Function Block parameter OUT contains the current measurement value in a vendor specific or configuration adjusted engineering unit and the belonging state in AUTO MODE. The Function Block parameter OUT contains the value and status set by an operator in MAN MODE.	RECORD	101	5	D	----	R/W (Can be written only in Manual Mode)	NA	NA
27	PV_SCALE (DD Name: AI PV Scale)	Conversion of the Process Variable into percent using the high and low scale values.	ARRAY	FLOAT	8	S	100.00	R/W	NA	NA
28	OUT_SCALE (DD Name: AI Out Scale)	Scale of the Process Variable.	RECORD	DS-36	11	S	100.00	R/W	NA	R-1509 (Only units)
29	LIN_TYPE (DD Name: AI Linearization Type)	Type linearizationion.	SIMPLE	Unsigned8	1	S	1	R/W	NA	R-1510
30	CHANNEL (DD Name: AI Channel)	Reference to the active Transducer Block which provides the measurement value to the Function Block.	SIMPLE	Unsigned16	2	S	---	R/W	NA	R-1508
31	RESERVED									
32	PV_FTIME (DD Name: AI PV Filter Time)	Filter time of the Process Variable.	SIMPLE	FLOAT	4	S	0	R/W	NA	NA
33	RESERVED									
34	RESERVED									

Table F-12 AI function block parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
35	ALARM_HYS (DD Name: AI Alarm Hys)	Hysteresis	SIMPLE	FLOAT	4	S	0.5% of the range	R/W	NA	NA
36	RESERVED									
37	HI_HI_LIM (DD Name: AI Hi Hi Lim)	Value for upper limit of alarms	SIMPLE	FLOAT	4	S	Max Value	R/W	NA	NA
38	RESERVED									
39	HI_LIM (DD Name: AI Hi Lim)	Value for upper limit of warnings	SIMPLE	FLOAT	4	S	Max Value	R/W	NA	NA
40	RESERVED									
41	LO_LIM (DD Name: AI Lo Lim)	Value for lower limit of warnings	SIMPLE	FLOAT	4	S	MinVal ue	R/W	NA	NA
42	RESERVED									
43	LO_LO_LIM (DD Name: AI Lo Lo Lim)	Value for the lower limit of alarms	SIMPLE	FLOAT	4	S	MinVal ue	R/W	NA	NA
44	RESERVED									
45	RESERVED									
46	RESERVED									
47	RESERVED									
48	RESERVED									
49	RESERVED									
50	SIMULATE (DD Name: AI Simulate)	For commissioning and test purposes the input value from the Transducer Block in the Analog Input Function Block AI-FB can be modified.	RECORD	DS-50	6	S	Disabl e	R/W	NA	NA
51	RESERVED									
52	RESERVED									
53	RESERVED									
54	RESERVED									
55	RESERVED									
56	RESERVED									
57	RESERVED									
58	RESERVED									
59	RESERVED									
60	RESERVED									
61	AI BLOCK VIEW1									

F.4.8 Analog input block objects

Table F-13 shows the analog input block objects.

Table F-13 Analog input block objects

Slot/Index	Element name	Data type	Size in bytes	Value	
Slot 11/Index 0	Reserved	Unsigned 8	1	250 (default)	
	Block_Object	Unsigned 8	1	02 (function block)	
	Parent_Class	Unsigned 8	1	01 (input)	
	Class	Unsigned 8	1	01 (AI)	
	DD_Refrence	Unsigned 32	4	00 ,00, 00, 00 (reserved)	
	DD_Revision	Unsigned 16	2	00 ,00 (reserved)	
	Profile	Octet String	2	64 02 (compact class B)	
	Profile_Revision	Unsigned 16	2	03 01 (3.01)	
	Execution_Time	Unsigned 8	1	00 (for future use)	
	Number_Of_Parameters	Unsigned 16	2	00 45 (max number of AI block parameters)	
	Address_of_View_1	Unsigned 16	2	AI1	01 61 (slot, index)
				AI2	02 61 (slot, index)
				AI3	03 61 (slot, index)
				AI4	05 61 (slot, index)
	Number_of_Views	Unsigned 8	1		01 (1 view)

F.4.9 AI function block views

Table F-14 shows the views for the AI function blocks.

Table F-14 AI function block views

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
16	BLOCK_OBJECT				
17	ST_REV	2			
18	TAG_DESC				
19	STRATEGY				
20	ALERT_KEY				
21	TARGET_MODE				
22	MODE_BLK	3			
23	ALARM_SUM	8			
	Overall sum of bytes in View Object	13			

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
26	Out	5			
61	Overall sum of bytes in View Object (+ 13 Standard parameters bytes)	5+13			

F.4.10 AO function block parameters

Table F-15 lists the parameters for the AO function blocks.

Table F-15 AO function block parameters

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
	Standard PA parameters									
16	BLOCK_OBJECT	This object contains the characteristics of the block	RECORD	DS-32	20	S	----	R	NA	NA
17	ST_REV	A block has static block parameters that are not changed by the process. Values are assigned to this parameter during the configuration of optimization. The value of ST_REV increases by 1 after every change of a static block parameter.	SIMPLE	Unsigned16	2	N	0	R	NA	NA
18	TAG_DESC	Every block can be assigned a textual TAG description. The TAG_DESC must be unambiguous and unique in the field bus system.	SIMPLE	OCTET STRING	32	S	' '	R/W	NA	NA
19	STRATEGY	Grouping of function block. The STRATEGY field can be used to group blocks.	SIMPLE	Unsigned16	2	S	0	R/W	NA	NA
20	ALERT_KEY	This parameter contains the identification number of the plant unit.	SIMPLE	Unsigned8	1	S	0	R/W	NA	NA
21	TARGET_MODE	This parameter contains desired mode normally set by a control application of an operator. The modes are valid alternatively only, i.e. only one mode can be set at one time. A write access to this parameter with more than one mode is out of the range of the parameter and has to be rejected.	SIMPLE	Unsigned8	1	S	Auto (0x08)	R/W	0x08 – Auto 0x10 – Manual 0x80 – OOS	R-2295
22	MODE_BLK	This parameter contains the current mode and the permitted and normal mode of the block.	RECORD	DS-37	3	D	---	R	NA	R-2296
23	ALARM_SUM	This parameter contains the current states of the block alarms.	RECORD	DS-42	8	D	0,0,0, 0	R	NA	NA
24	BATCH	This parameter is intended to be used in Batch applications in line with IEC 61512 Part1. Only Function Blocks carry this parameter. There is no algorithm necessary within a Function Block.	RECORD	DS-67	10	S	0,0,0, 0	RW	NA	NA
	AO Function Block Standard Parameters									
25	SP (DD Name: AO Set Point)	Set point.	RECORD	101	5	D	----	R/W	NA	NA
26	RESERVED									
27	PV_SCALE (DD Name: AO PV Scale)	Conversion of the PV in engineering units to PV in percent as the input value of the Function Block.	RECORD	DS-36	11	S	100,0 %	R/W	NA	R-2298 (only units)
28	READBACK (DD Name: AO ReadBack Value)	The actual position of the final control element within the travel span (between OPEN and CLOSE position) in units of PV_SCALE.	RECORD	101	5	D	----	R	NA	NA
29	RESERVED									
30	RESERVED									
31	RESERVED									
32	RESERVED									
33	RESERVED									
34	RESERVED									
35	RESERVED									
36	RESERVED									

Table F-15 AO function block parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
37	IN_CHANNEL (DD Name: AO IN Channel)	Reference to the active Transducer Block and its parameter that provides the actual position of the final control element.	SIMPLE	Unsigned16	2	S	---	R/W	NA	R-2297
38	OUT_CHANNEL (DD Name: AO OUT Channel)	Reference to the active Transducer Block and its parameter that provides the position value for the final control element.	SIMPLE	Unsigned16	2	S	----	R/W	NA	R-2299 (only units)
39	FSAFE_TIME (DD Name: AO Fail Safe Time)	Time in seconds from detection of failure of the actual used set point (SP = BAD or RCAS_IN <> GOOD) to the action of the block if the condition still exists.	SIMPLE	Float	4	S	0	R/W	NA	NA
40	FSAFE_TYPE (DD Name: AO Fail Safe Type)	Defines reaction of the device, if a failure of the actual used set point is still detected after FSAFE_TIME or if the status of actual used set point is Initiate Fail Safe.	SIMPLE	Unsigned8	1	S	2	R/W	0: value FSAFE_VALUE is used as set point status of OUT = UNCERTA–N – Substitute Value 1: use last valid set point status of OUT = UNCERTA–N – Last usable Value or B–D – No communication, no LUV 2: actuator goes to fail-safe position defined by ACTUATOR_ACTION (only useful for actuators with spring return) status of OUT = B–D – non specific	NA
41	FSAFE_VALUE (DD Name: AO Fail Safe Value)	Set point used if FSAFE_TYPE = 1 and FSAFE is activated.	SIMPLE	Float	4	S	0	R/W	NA	NA
42	RESERVED									
43	RESERVED									
44	RESERVED									
45	RESERVED									
46	RESERVED									
47	POS_D (DD Name: AO POS_D)	The current position of the valve	RECORD	102	2	D	---	R	0: not initialized 1: closed 2: opened 3: intermediate	NA
48	RESERVED									
49	CHECK_BACK (DD Name: AO Check Back)	Detailed information of the device, bitwise coded. More than one message possible at once.	SIMPLE	Octet String	3	D	-----	R	NA	NA
50	CHECK_BACK_MASK (DD Name: AO Check Back Mask)	Definition of supported CHECK_BACK information bits.	SIMPLE	OctetString	3	Cst	---	R	0: not supported 1: supported	NA
51	SIMULATE (DD Name: AO Simulate)	For commissioning and maintenance reasons, it is possible to simulate the READBACK by defining the value and the status.	RECORD	DS-50	6	S	Disabled	R/W	NA	NA
52	INCREASE_CLOSE (DD Name: AO Increase Close)	Direction of positioner in mode Rcas and Auto	SIMPLE	Unsigned8	1	S	0	R/W	0: rising (increasing of set point input results in OPENING of the valve) 1: falling (increasing of set point input results in CLOSING of the valve)	NA
53	OUT (DD Name: AO Out)	This parameter is the process variable of the AO Block in engineering units in AUTO mode and is the value specified by the operator in Manual mode.	RECORD	101	5	D	----	R/W (Can be written only in Manual Mode)	NA	NA
54	OUT_SCALE (DD Name: AO Out Scale)	Scale of the Process Variable.	RECORD	DS-36	11	S	---	R/W	NA	NA
55	RESERVED									
56	RESERVED									
57	RESERVED									
58	RESERVED									
59	RESERVED									
60	RESERVED									

Table F-15 AO function block parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
61	RESERVED									
62	RESERVED									
63	RESERVED									
64	RESERVED									
65	AO BLOCK VIEW 1									

F.4.11 Analog output block objects

Table F-16 shows the analog output block objects.

Table F-16 Analog output block objects

Slot/Index	Element name	Data type	Size in bytes	Value	
Slot 11/Index 0	Reserved	Unsigned 8	1	250 (default)	
	Block_Object	Unsigned 8	1	02 (function block)	
	Parent_Class	Unsigned 8	1	02 (output)	
	Class	Unsigned 8	1	01 (A0)	
	DD_Refrence	Unsigned 32	4	00 ,00, 00, 00 (reserved)	
	DD_Revision	Unsigned 16	2	00 ,00 (reserved)	
	Profile	Octet String	2	64 02 (compact class B)	
	Profile_Revision	Unsigned 16	2	03 01 (3.01)	
	Execution_Time	Unsigned 8	1	00 (for future use)	
	Number_Of_Parameters	Unsigned 16	2	00 49 (max number of AO block parameters)	
	Address_of_View_1	Unsigned 16	2	AO1	09 65 (slot, index)
				AO2	10 65 (slot, index)
	Number_of_Views	Unsigned 8	1		01 (1 view)

F.4.12 AO function block views

Table F-17 shows the views for the AO function blocks.

Table F-17 AO function block views

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
16	BLOCK_OBJECT				

Table F-17 AO function block views

17	ST_REV	2			
18	TAG_DESC				
19	STRATEGY				
20	ALERT_KEY				
21	TARGET_MODE				
22	MODE_BLK	3			
23	ALARM_SUM	8			
	Overall sum of bytes in View Object	13			

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
28	READBACK	5			
47	POS_D	2			
49	CHECK_BACK	3			
61	Overall sum of bytes in View Object (+ 13 Standard parameters bytes)	10+13			

F.4.13 Totalizer block parameters

Table F-18 lists the parameters for the totalizer blocks.

Table F-18 Totalizer block parameters

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
	Standard PA parameters									
16	BLOCK_OBJECT	This object contains the characteristics of the block	RECORD	DS-32	20	S	----	R	NA	NA
17	ST_REV	A block has static block parameters that are not changed by the process. Values are assigned to this parameter during the configuration of optimization. The value of ST_REV increases by 1 after every change of a static block parameter.	SIMPLE	Unsigned16	2	N	0	R	NA	NA
18	TAG_DESC	Every block can be assigned a textual TAG description. The TAG_DESC must be unambiguous and unique in the field bus system.	SIMPLE	OCTET STRING	32	S	‘ ’	R/W	NA	NA
19	STRATEGY	Grouping of function block. The STRATEGY field can be used to group blocks.	SIMPLE	Unsigned16	2	S	0	R/W	NA	NA
20	ALERT_KEY	This parameter contains the identification number of the plant unit.	SIMPLE	Unsigned8	1	S	0	R/W	NA	NA
21	TARGET_MODE	This parameter contains desired mode normally set by a control application of an operator. The modes are valid alternatively only, i.e. only one mode can be set at one time. A write access to this parameter with more than one mode is out of the range of the parameter and has to be rejected.	SIMPLE	Unsigned8	1	S	Auto (0x08)	R/W	0x08 – Auto 0x10 – Manual 0x80 – OOS	R-2287
22	MODE_BLK	This parameter contains the current mode and the permitted and normal mode of the block.	RECORD	DS-37	3	D	---	R	NA	R-2288
23	ALARM_SUM	This parameter contains the current states of the block alarms.	RECORD	DS-42	8	D	0,0,0, 0	R	NA	NA
24	BATCH	This parameter is intended to be used in Batch applications in line with IEC 61512 Part 1. Only Function Blocks carry this parameter. There is no algorithm necessary within a Function Block.	RECORD	DS-67	10	S	0,0,0, 0	RW	NA	NA

Table F-18 Totalizer block parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
25	RESERVED									
	Totalizer Function Block Standard Parameters									
26	TOTAL (DD Name: TOT Total)	The Function Block parameter TOTAL contains the integrated quantity of the rate parameter provided by CHANNEL and the associated status.	RECORD	101	5	N	0	R/W (Can be written only in Manual mode)	NA	NA
27	UNIT_TOT (DD Name: TOT Total Units)	Unit of the totalized quantity.	SIMPLE	Unsigned16	2	S	direct integral of the channel value unit	R/W	NA	R-2290
28	CHANNEL (DD Name: TOT Channel)	Reference to the active Transducer Block, which provides the measurement value to the Function Block.	SIMPLE	Unsigned16	2	S	---	R/W	NA	R-2289
29	SET_TOT (DD Name: TOT Set Total)	Reset of the internal value of the FB algorithm to 0 or set this value to PRESET_TOT.	SIMPLE	Unsigned8	1	N	0 – Totalize	R/W	0: TOTALIZE 1: RESET 2: PRESET	R-2292
30	MODE_TOT (DD Name: TOT Mode Total)	This Function Block parameter governs the behavior of the totalization.	SIMPLE	Unsigned8	1	N	0: BALANCED	R/W	0: BALANCED 1: POS_ONLY 2: NEG_ONLY 3: HOLD	R-2293
31	FAIL_TOT (DD Name: TOT Fail Total)	Fail-safe mode of the Totalizer Function Block. This parameter governs the behavior of the Function Block during the occurrence of input values with BAD status.	SIMPLE	Unsigned8	1	S	0 – Run	R/W	0: RUN 1: HOLD 2: MEMORY	NA
32	PRESET_TOT (DD Name: TOT Preset Total)	This value is used as a preset for the internal value of the FB algorithm. The value get effective if using the SET_TOT function.	SIMPLE	Float	4	S	0	R/W	NA	NA
33	ALARM_HYS (DD Name: TOT Alarm Hys)	Hysteresis	SIMPLE	Float	4	S	0	R/W	NA	NA
34	HI_HI_LIM (DD Name: TOT Hi Hi Lim)	Value for upper limit of alarms	SIMPLE	Float	4	S	Max Value	R/W	NA	NA
35	HI_LIM (DD Name: TOT Hi Lim)	Value for upper limit of warnings	SIMPLE	Float	4	S	Max Value	R/W	NA	NA
36	LO_LIM (DD Name: TOT Lo Lim)	Value for lower limit of warnings	SIMPLE	Float	4	S	Min Value	R/W	NA	NA
37	LO_LO_LIM (DD Name: TOT Lo Lo Lim)	Value for the lower limit of alarms	SIMPLE	Float	4	S	Min Value	R/W	NA	NA
38	RESERVED									
39	RESERVED									
40	RESERVED									
41	RESERVED									
42	RESERVED									
43	RESERVED									
44	RESERVED									
45	RESERVED									
46	RESERVED									
47	RESERVED									
48	RESERVED									
49	RESERVED									
50	RESERVED									

Table F-18 Totalizer block parameters (continued)

Index	Parameter Mnemonic	Definition	Message Type	Data Type/ Structure	Size	Store /Rate (HZ)	Default Value	Access	Enumerated List of Values / Range	Modbus Register / Coil
51	RESERVED									
52	Totalizer Selection (DD Name: TOT Selection)	Selection of Totalizer operation mode	SIMPLE	Unsigned8	1	S	0	RW	0 – Standard (Profile Specific) 1 – Internal Mass Total 2 – Internal Volume Total 3 – Internal Mass Inventory 4 – Internal volume Inventory 5 – Internal GSV Total 6 – Internal GSV Inventory 7 – Internal API CorrVol Total 8 – Internal API CorrVol Inventory 9 – Internal ED_StdVolTotal 10 – Internal ED_StdVolInv 11 – Internal ED_NetMassTotal 12 – Internal ED_NetMassInv 13 – Internal ED_NetVolTotal 14 – Internal ED_NetVolInv	R-2291
53	TOTALIZER BLOCK VIEW1									

F.4.14 Totalizer block objects

Table F-19 shows the totalizer block objects.

Table F-19 Totalizer block objects

Slot/Index	Element name	Data type	Size in bytes	Value	
Slot 11/Index 0	Reserved	Unsigned 8	1	250 (default)	
	Block_Object	Unsigned 8	1	02 (function block)	
	Parent_Class	Unsigned 8	1	05 (calculation class)	
	Class	Unsigned 8	1	08 (TOT)	
	DD_Refrence	Unsigned 32	4	00 ,00, 00, 00 (reserved)	
	DD_Revision	Unsigned 16	2	00 ,00 (reserved)	
	Profile	Octet String	2	64 02 (compact class B)	
	Profile_Revision	Unsigned 16	2	03 01 (3.01)	
	Execution_Time	Unsigned 8	1	00 (for future use)	
	Number_Of_Parameters	Unsigned 16	2	00 37 (max number of totalizer block parameters)	
	Address_of_View_1	Unsigned 16	2	TOT1	04 53 (slot, index)
				TOT2	06 53 (slot, index)
				TOT3	07 53 (slot, index)
				TOT4	08 53 (slot, index)
	Number_of_Views	Unsigned 8	1		01 (1 view)

F.4.15 Totalizer function block views

Table F-20 shows the views for the totalizer function blocks.

Table F-20 Totalizer function block views

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
16	BLOCK_OBJECT				
17	ST_REV	2			
18	TAG_DESC				
19	STRATEGY				
20	ALERT_KEY				
21	TARGET_MODE				
22	MODE_BLK	3			
23	ALARM_SUM	8			
	Overall sum of bytes in View Object	13			

OD Index	Parameter Mnemonic	View 1	View 2	View 3	View 4
	Standard Parameters				
26	TOTAL	5			
53	Overall sum of bytes in View Object (+ 13 Standard parameters bytes)	5+13			

Appendix G
NE53 History

G.1 Overview

This appendix documents the change history of the Model 2700 transmitter with PROFIBUS-PA software.

G.2 Software change history

Table G-1 describes the change history of the transmitter software. Operating instructions are English versions. Instructions in other languages have different part numbers but matching revision letters.

Table G-1 Transmitter software change history

Date	Software version	Changes to software	Operating instructions
09/2000	1.0	Initial release	20000327 Rev. A 20000327 Rev. B
08/2001	1.1	*Software improvements*	
		Expanded the ability to control totalizers through multiple communication protocols.	
02/2002	2.0	*Software improvements*	20000327 Rev. C 20000327 Rev. D 20000327 Rev. E
		Improved the handling of RS-485 communication via the service port.	
		Improved the user experience with the display.	
		Expanded the ability to control totalizers through multiple communication protocols.	
		Tightened data synchronization when accessing data via different communication tools.	
		Enhanced volume flow functionality.	
		Feature additions	
		Added protections against low-power conditions.	
08/2008	2.2	*Software improvements*	20000327 Rev. F
		Improved the user experience with the display.	
		Increased immunity to line noise.	
		Feature additions	
		Added drive gain as an Analog Input channel.	
		Added the ability to configure blocks without putting them in Out of Service mode.	
		Added improved diagnostic reporting.	
		Added density cutoffs.	

Table G-1 Transmitter software change history (continued)

Date	Software version	Changes to software	Operating instructions
10/2009	3.0	*Software improvements*	20000327 Rev. FA
		Improved EDD more closely matches ProLink II.	
		Added petroleum measurement application.	
		Added enhanced density application.	
		Improved consistency with other Micro Motion 2700 transmitters.	
		Feature additions	
		Added compatibility with enhanced core processor.	
		Added gas standard volume measurement.	
		Added configurable alarm severity.	
		Added meter verification.	
		Expanded LDO capability.	
10/2010	3.1	*Feature additions*	20000327 Rev. FB
		Added support for Smart Meter Verification.	
		Expanded LDO capability.	
04/2011	3.2	*Software improvements*	20000327 Rev. FB
		Maintenance release	

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