Configuration and Use Manual
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Micro Motion™ 2700 Transmitters with FOUNDATION™ Fieldbus

Configuration and Use Manual

MICRO MOTION™

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Safety messages

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

Safety and approval information

This Micro Motion product complies with all applicable European directives when properly installed in accordance with the instructions in this manual. Refer to the EU declaration of conformity for directives that apply to this product. The following are available: the EU Declaration of Conformity, with all applicable European directives, and the complete ATEX installation drawings and instructions. In addition, the IECEx installation instructions for installations outside of the European Union and the CSA installation instructions for installations in North America are available at Emerson.com or through your local Micro Motion support center.

Information affixed to equipment that complies with the Pressure Equipment Directive, can be found at Emerson.com. For hazardous installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

Other information

Troubleshooting information can be found in the Configuration Manual. Product data sheets and manuals are available from the Micro Motion web site at Emerson.com.

Return policy

Follow Micro Motion procedures when returning equipment. These procedures ensure legal compliance with government transportation agencies and help provide a safe working environment for Micro Motion employees. Micro Motion will not accept your returned equipment if you fail to follow Micro Motion procedures.

Return procedures and forms are available on our web support site at Emerson.com, or by calling the Micro Motion Customer Service department.

Contents

1 Before you begin

1.1 About this manual

This manual helps you configure, commission, use, maintain, and troubleshoot Micro Motion 2700 transmitters with FOUNDATION Fieldbus.

Important

This manual assumes that:

- The transmitter has been installed correctly and completely according to the instructions in the transmitter installation manual.
- Users understand basic transmitter and sensor installation, configuration, and maintenance concepts and procedures.

1.2 Fieldbus instrument data sheet

Transmitter operating conditions

Type	Electronic microprocessor based
Input signal	FOUNDATION fieldbus H1 ISA.50.02 IEC-61158
Baud rate	31.25 Kbps
Physical media	Twisted pair wires, (H1) compliant
Power supply	9–32 VDC, bus powered, 4 wires
Power connections on FF bus	11.5 milliamps maximum
Input voltage	Model 2700: 18–100 VDC or 85–265 VAC
Device class	Link master; ITK 4.60 minimum
Minimum VCRs	20
Electrical class	FISCO; Other

Function blocks

Device function block fixed type	FOUNDATION fieldbus FF-891/FF-892 compliant
Analog Input Block (AI)	Executable time: 18 ms
Analog Output Block (AO)	Executable time: 18 ms
Discrete Input Block	Executable time: 16 ms
Discrete Output Block	Executable time: 16 ms
PID Block	Executable time: 20 ms
Integrator Block (INT)	Executable time: 18 ms
Instantiable Function Blocks	Model 2700: DO/DI

Transducer Block Type	Measurement TB; Calibration TB Local Display TB; Device Information TB Enhanced Density TB; API TB

Diagnostics

Diagnostic TB

1.3 Communication methods

You can use several different communications methods to interface with the transmitter. You may use different methods in different locations or for different tasks.

Interface	Tool
Display	Infrared-sensitive buttons
Universal Service Port	ProLink™ III
FOUNDATION Fieldbus channel	• Field communicator • FOUNDATION Fieldbus (FF) host — On an *enhanced FF host*, the transmitter parameters are displayed either in the form of a menu tree (for example, the 475 Field Communicator) or in the form of UIRD (for example, the AMS Intelligent Device Manager with DeltaV™ System). Both the menu tree and UIRD are provided as part of the Device Description. — A *basic FF host* displays the transmitter parameters in the form of a list under the Resource block and transducer blocks. — The configuration sections contain information for both types of host.

For information about how to use the communication tools, see the appendices in this manual.

Tip
You may be able to use other communications tools, such as AMS™ Suite: Intelligent Device Manager.

1.4 Related documentation

You can find all product documentation on the product documentation DVD shipped with the product or at Emerson.com.

See any of the following documents for more information:

- *Micro Motion Series 1000 and Series 2000 Transmitters with MVD Technology Product Data Sheet*
- *Micro Motion 1700 and 2700 Installation Manual*
- *Micro Motion Enhanced Density Application Manual*
- *Modbus Interface Tool*
- Sensor installation manual

2 Quick start

2.1 Power up the transmitter

The transmitter must be powered up for all configuration and commissioning tasks or for process measurement.

Procedure

1. **WARNING**
   If the transmitter is in a hazardous area, do not remove the housing cover while the transmitter is powered up. Failure to follow these instructions can cause an explosion resulting in injury or death.

   Ensure that all transmitter and sensor covers and seals are closed.
2. Turn on the electrical power at the power supply.
   The transmitter will automatically perform diagnostic routines. The transmitter is self-switching and will automatically detect the supply voltage. When using DC power, a minimum of 1.5 amps of startup current is required. During this period, Alert 009 is active. The diagnostic routines should complete in approximately 30 seconds. The status LED will turn green and begin to flash when the startup diagnostics are complete. If the status LED exhibits different behavior, an alert is active.

Postrequisites

Although the sensor is ready to receive process fluid shortly after power-up, the electronics can take up to ten minutes to reach thermal equilibrium. Therefore, if this is the initial startup, or if power has been off long enough to allow components to reach ambient temperature, allow the electronics to warm up for approximately ten minutes before relying on process measurements. During this warm-up period, you may observe minor measurement instability or inaccuracy.

2.2 Check meter status

Check the meter for any error conditions that require user action or that affect measurement accuracy.

Procedure

1. Wait approximately 10 seconds for the power-up sequence to complete.

   Immediately after power-up, the transmitter runs through diagnostic routines and checks for error conditions. During the power-up sequence, Alert A009 is active. This alert should clear automatically when the power-up sequence is complete.
2. Check the status LED on the transmitter.

Related information

View and acknowledge status alerts
Status alerts, causes, and recommendations

2.2.1 Transmitter status reported by LED

LED state	Description	Recommendation
Solid green	No alerts are active.	Continue with configuration or process measurement.
Flashing green (if enabled)	Unacknowledged corrected condition (no alert)	Continue with configuration or process measurement. Acknowledge the alert if you choose.
Solid yellow	One or more low-severity alerts are active. A low severity alarm can mean one or more process variables is at a set output level (i.e. simulation or two phase timeout).	A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement, but Micro Motion still recommends identifying and resolving the alert condition.
Flashing yellow (if enabled)	Calibration in progress. One or more low-severity alerts are active and have not been acknowledged.	A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement, but Micro Motion still recommends identifying and resolving the alert condition.
Solid red	One or more high-severity alerts are active.	A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing.
Flashing red (if enabled)	One or more high-severity alerts are active and have not been acknowledged.	A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing. Acknowledge the alert if you choose.

If **Status LED Blinking** is disabled, all LEDs will show a solid color rather than flashing.

2.3 Determine the FOUNDATION Fieldbus unique device ID

The transmitter is shipped with a sticker that displays a unique 32-digit number that the fieldbus segment uses for identification. If the sticker is missing, use this procedure to determine your device ID.

Procedure

From ProLink III, navigate to **Device Tools** → **Device Information** → **Transmitter Electronics** → **Fieldbus Device ID**.

2.4 Make a startup connection to the transmitter

For all configuration tools except the display, you must have an active connection to the transmitter to configure the transmitter.

Procedure

Identify the communications tool to use (ProLink III or the Field Communicator), and follow the instructions for that tool in the appropriate appendix.

2.5 Verify mass flow measurement

Check to see that the mass flow rate reported by the transmitter is accurate. You can use any available method.

Procedure

- Connect to the transmitter with ProLink III and read the value for **Mass Flow Rate** in the *Process Variables* panel.

Postrequisites

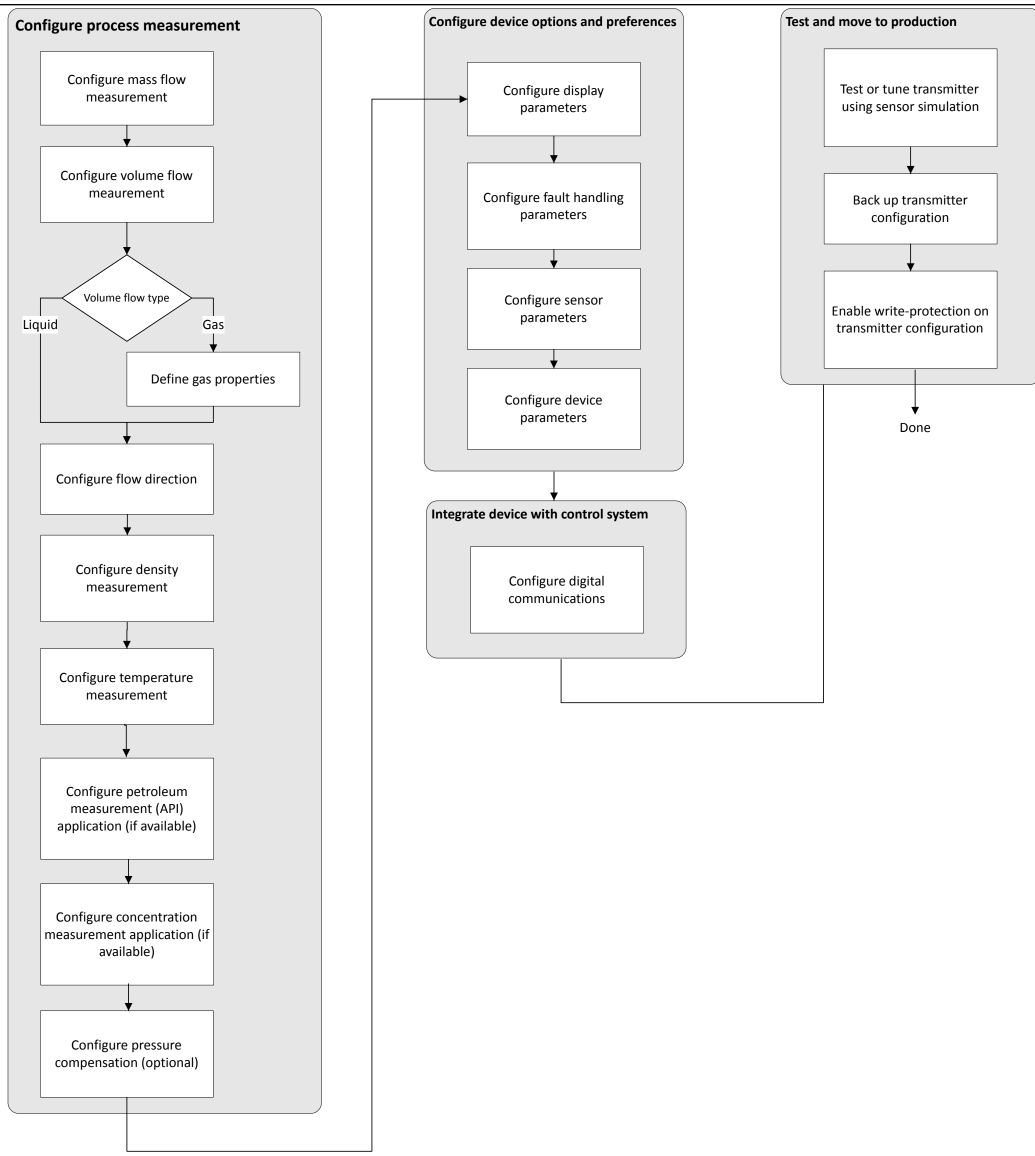
If the reported mass flow rate is not accurate, check the characterization parameters.

3 Introduction to configuration and commissioning

3.1 Configuration flowchart

Use the following flowchart as a general guide to the configuration and commissioning process.

Some options may not apply to your installation. Detailed information is provided in the remainder of this manual.



3.2 Default values and ranges

See Default values and ranges to view the default values and ranges for the most commonly used parameters.

3.3 Enable access to the off-line menu of the display

Display	**OFF-LINE MAINT → OFF-LINE CONFG**
ProLink III	**Device Tools → Configuration → Transmitter Display → Display Security**
Field Communicator	**Configure → Manual Setup → Display → Display Menu → Offline Menu**
Fieldbus host	**LDO TB → EN_LDO_OFFLINE_MENU (OD Index 17)**

By default, access to the off-line menu of the display is enabled. If it is disabled, you must enable it if you want to use the display to configure the transmitter.

Restriction
You cannot use the display to enable access to the off-line menu. You must make a connection from another tool.

3.4 Disable write-protection on the transmitter configuration

ProLink III	**Device Tools → Configuration → Write-Protection**
Fieldbus Communicator	**Service Tools → Maintenance → Security and Simulation → Write Lock Setup**

If the transmitter is write-protected, the configuration is locked and you must unlock it before you can change any configuration parameters. By default, the transmitter is not write-protected.

Tip
Write-protecting the transmitter prevents accidental changes to configuration. It does not prevent normal operational use. You can always disable write-protection, perform any required configuration changes, then re-enable write-protection.

3.5 Place function, transducer, and resource blocks in OOS mode

Prerequisites

Before you modify parameters on the fieldbus function blocks, you must place the function blocks in OOS mode.

Procedure

Option	Description
Display	Not available

Option	Description
ProLink III	**Device Tools → Configuration → Communications → Fieldbus**
Field Communicator	**Overview → Mode**
Fieldbus host	**(block name) → MODE_BLOCK (OD Index Number 005)**

Postrequisites

Before you return the device to operation, you must place them back in service (Auto mode).

3.6 Lockout FOUNDATION Fieldbus hosts

If you plan to use a fieldbus connection to configure the device, you can lock out fieldbus hosts. If you do this, the fieldbus hosts will be able to read data from the device, but you will not be able to write data to the device.

Restriction
This feature is available only if you are using the Field Communicator or AMS.

Procedure

Choose **Service Tools → Maintenance → Security and Simulation → Write Lock Setup**.

3.7 Restore the factory configuration

Display	Not available
ProLink III	**Device Tools → Configuration Transfer → Restore Factory Configuration**
Field communicator	**Service Tools → Maintenance → Reset/Restore → Master Reset**
Fieldbus host	**Diagnostic TB → Restore Factory Config (OD Index 056)**

Restoring the factory configuration returns the transmitter to the same configuration it had when it left the factory. This may be useful if you experience problems during configuration.

Important
You cannot restore factory configurations with a 700 core.

Tip
Restoring the factory configuration is not a common action. You may want to contact customer support to see if there is a preferred method to resolve any issues.

3.8 Enable or disable fieldbus write lock

When locked, the fieldbus write lock prevents any configuration changes being written from the fieldbus segment.

Procedure

Set the **Write Lock** parameter (OD index 34) of the Resource block to **Locked** (1) or **Unlocked** (0).

4 Configure process measurement

4.1 Configure mass flow measurement

The mass flow measurement parameters control how mass flow is measured and reported.

4.1.1 Configure Mass Flow Measurement Unit

Display	**OFF-LINE MAINT → OFF-LINE CONFG → UNITS → MASS**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow**
Field Communicator	**Configure → Manual Setup → Measurements → Flow → Mass Flow Unit**
Fieldbus host	**Measurement TB → MFLOW_UNITS (OD Index 15)**

Mass Flow Measurement Unit specifies the unit of measure that will be used for the mass flow rate. The unit used for mass total and mass inventory is derived from this unit.

Procedure

Set **Mass Flow Measurement Unit** to the unit you want to use.

The default setting for **Mass Flow Measurement Unit** is g/sec (grams per second).

Tip
If the measurement unit you want to use is not available, you can define a special measurement unit.

Options for Mass Flow Measurement Unit

The transmitter provides a standard set of measurement units for **Mass Flow Measurement Unit**, plus one user-defined special measurement unit. Different communications tools may use different labels for the units.

	Label		
Unit description	**Display**	**ProLink III**	**Field Communicator**
Grams per second	G/S	g/sec	g/s
Grams per minute	G/MIN	g/min	g/min
Grams per hour	G/H	g/hr	g/h
Kilograms per second	KG/S	kg/sec	kg/s
Kilograms per minute	KG/MIN	kg/min	kg/min
Kilograms per hour	KG/H	kg/hr	kg/h
Kilograms per day	KG/D	kg/day	kg/d
Metric tons per minute	T/MIN	mTon/min	t/min
Metric tons per hour	T/H	mTon/hr	t/h
Metric tons per day	T/D	mTon/day	t/d
Pounds per second	LB/S	lbs/sec	lb/s

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

Define a special measurement unit for mass flow

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Special Units**
Field Communicator	**Configure → Manual Setup → Measurements → Special Units → Mass Special Units**
Fieldbus host	**Measurement TB → MFLOW_SPECIAL_UNIT_BASE (OD Index 16)** **Measurement TB → MFLOW_SPECIAL_UNIT_TIME (OD Index 17)** **Measurement TB → MFLOW_SPECIAL_UNIT_CONV (OD Index 18)** **Measurement TB → MFLOW_SPECIAL_UNIT_STR (OD Index 19)**

A special measurement unit is a user-defined unit of measure that allows you to report process data, totalizer data, and inventory data in a unit that is not available in the transmitter. A special measurement unit is calculated from an existing measurement unit using a conversion factor.

Note

Although you cannot define a special measurement unit using the display, you can use the display to select an existing special measurement unit, and to view process data using the special measurement unit.

The special unit label displays only on the local display. The AI block uses and displays the actual engineering unit (i.e. lb/min).

Procedure

1. Specify **Base Mass Unit**.

   Base Mass Unit is the existing mass unit that the special unit will be based on.

2. Specify **Base Time Unit**.

   Base Time Unit is the existing time unit that the special unit will be based on.

3. Calculate **Mass Flow Conversion Factor** as follows:

   a) x base units = y special units

   b) **Mass Flow Conversion Factor** = x ÷ y

The original mass flow rate value is divided by this value.

4. Enter **Mass Flow Conversion Factor**.
5. Set **Mass Flow Label** to the name you want to use for the mass flow unit.
6. Set **Mass Total Label** to the name you want to use for the mass total and mass inventory unit.

The special measurement unit is stored in the transmitter. You can configure the transmitter to use the special measurement unit at any time.

Example: Defining a special measurement unit for mass flow

You want to measure mass flow in ounces per second (oz/sec).

1. Set **Base Mass Unit** to Pounds (lb).
2. Set **Base Time Unit** to Seconds (sec).
3. Calculate **Mass Flow Conversion Factor**:
   a. 1 lb/sec = 16 oz/sec
   b. **Mass Flow Conversion Factor** = 1 ÷ 16 = 0.0625
4. Set **Mass Flow Conversion Factor** to `0.0625`.
5. Set **Mass Flow Label** to `oz/sec`.
6. Set **Mass Total Label** to `oz`.

4.1.2 Configure Flow Damping

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Flow**
Field Communicator	**Configure → Manual Setup → Measurements → Flow → Flow Damping**
Fieldbus host	**Measurement TB → FLOW_DAMPING → OD Index**

Damping is used to smooth out small, rapid fluctuations in process measurement. **Damping Value** specifies the time period (in seconds) over which the transmitter will spread changes in the process variable. At the end of the interval, the internal value will reflect 63% of the change in the actual measured value.

Procedure

Set **Flow Damping** to the value you want to use.

- Default: 0.8 seconds
- Range: 0 seconds to 51.2 seconds
- Valid damping values: 0.0, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8, 25.6, 51.2

Tip

- A high damping value makes the process variable appear smoother because the reported value changes slowly.
- A low damping value makes the process variable appear more erratic because the reported value changes more quickly.

- The combination of a high damping value and rapid, large changes in flow rate can result in increased measurement error.
- Whenever the damping value is non-zero, the reported measurement will lag the actual measurement because the reported value is being averaged over time.
- In general, lower damping values are preferable because there is less chance of data loss, and less lag time between the actual measurement and the reported value.

The value you enter is automatically rounded off to the nearest valid value. For example, if the damping is currently set to 0.8 seconds, any value entered up to 1.2 seconds will be rounded down to 0.8 seconds, and any value entered from 1.21 to 1.59 seconds will be rounded up to 1.6 seconds.

Effect of flow damping on volume measurement

Flow damping affects volume measurement for liquid volume data. Flow damping also affects volume measurement for gas standard volume data. The transmitter calculates volume data from the damped mass flow data.

4.1.3 Configure Mass Flow Cutoff

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Flow**
Field Communicator	**Configure → Manual Setup → Measurements → Flow → Mass Flow Cutoff**
Fieldbus host	**Measurement TB → MASS_LOW_CUT (OD Index 38)**

Mass Flow Cutoff specifies the lowest mass flow rate that will be reported as measured. All mass flow rates below this cutoff will be reported as 0.

Procedure

Set **Mass Flow Cutoff** to the value you want to use.

The default value for **Mass Flow Cutoff** is 0.0 g/sec or a sensor-specific value set at the factory. The recommended value is 0.5% of the nominal flow rate of the attached sensor. See the sensor specifications. Do not leave **Mass Flow Cutoff** at 0.0 g/sec.

Effect of Mass Flow Cutoff on volume measurement

Mass Flow Cutoff does not affect volume measurement. Volume data is calculated from the actual mass data rather than the reported value.

Volume flow has a separate Volume Flow Cutoff that is not affected by the Mass Flow Cutoff value.

4.2 Configure volume flow measurement for liquid applications

The volume flow measurement parameters control how liquid volume flow is measured and reported.

Restriction

You cannot implement both liquid volume flow and gas standard volume flow at the same time. Choose one or the other.

4.2.1 Configure Volume Flow Type for liquid applications

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Flow**
Field Communicator	**Configure → Manual Setup → Measurements → GSV → Volume Flow Type → Liquid**
Fieldbus host	**Measurement TB → SNS_EnableGSV (OD Index 66)**

Volume Flow Type controls whether liquid or gas standard volume flow measurement will be used.

Restriction

Gas standard volume measurement is incompatible with some applications. Set **Volume Flow Type** to Liquid if you are using any of the following applications:

- Petroleum measurement
- Concentration measurement

Procedure

Set **Volume Flow Type** to Liquid.

4.2.2 Configure Volume Flow Measurement Unit for liquid applications

Display	**OFF-LINE MAINT → OFF-LINE CONFG → UNITS → VOL**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow**
Field Communicator	**Configure → Manual Setup → Measurements → Flow → Volume Flow Unit**
Fieldbus host	**Measurement TB → VOLUME_FLOW_UNITS (OD Index 25)**

Volume Flow Measurement Unit specifies the unit of measurement that will be displayed for the volume flow rate. The unit used for the volume total and volume inventory is based on this unit.

Prerequisites

Before you configure **Volume Flow Measurement Unit**, be sure that **Volume Flow Type** is set to Liquid.

Procedure

Set **Volume Flow Measurement Unit** to the unit you want to use.

To read US gallons, select that unit from this menu. G/MIN stands for grams per minute (USGPM), not gallons per minute. The default setting for **Volume Flow Measurement Unit** is l/sec (liters per second).

Tip
If the measurement unit you want to use is not available, you can define a special measurement unit.

Options for Volume Flow Measurement Unit for liquid applications

The transmitter provides a standard set of measurement units for **Volume Flow Measurement Unit**, plus one user-defined measurement unit. Different communications tools may use different labels for the units.

	Label		
Unit description	**Display**	**ProLink III**	**Field Communicator**
Cubic feet per second	CUFT/S	ft3/sec	CFS
Cubic feet per minute	CUF/MN	ft3/min	CFM
Cubic feet per hour	CUFT/H	ft3/hr	CFH
Cubic feet per day	CUFT/D	ft3/day	ft3/d
Cubic meters per second	M3/S	m3/sec	m3/s
Cubic meters per minute	M3/MIN	m3/min	m3/min
Cubic meters per hour	M3/H	m3/hr	m3/h
Cubic meters per day	M3/D	m3/day	m3/d
U.S. gallons per second	USGPS	US gal/sec	gal/s
U.S. gallons per minute	USGPM	US gal/min	GPM
U.S. gallons per hour	USGPH	US gal/hr	gal/h
U.S. gallons per day	USGPD	US gal/day	gal/d
Million U.S. gallons per day	MILG/D	mil US gal/day	Mgal/d
Liters per second	L/S	l/sec	L/s
Liters per minute	L/MIN	l/min	L/min
Liters per hour	L/H	l/hr	L/h
Million liters per day	MILL/D	mil l/day	ML/d
Imperial gallons per second	UKGPS	Imp gal/sec	Impgal/s
Imperial gallons per minute	UKGPM	Imp gal/min	Impgal/min
Imperial gallons per hour	UKGPH	Imp gal/hr	Impgal/h
Imperial gallons per day	UKGPD	Imp gal/day	Impgal/d
Barrels per second(1)	BBL/S	barrels/sec	barrel(US Beer)/s
Barrels per minute	BBL/MN	barrels/min	barrel(US Beer)/min
Barrels per hour	BBL/H	barrels/hr	barrel(US Beer)/h
Barrels per day	BBL/D	barrels/day	barrel(US Beer)/d
Beer barrels per second(2)	BBBL/S	Beer barrels/sec	bbbl/s

Unit description	Label		
	Display	ProLink III	Field Communicator
Beer barrels per minute	BBBL/MN	Beer barrels/min	bbbl/min
Beer barrels per hour	BBBL/H	Beer barrels/hr	bbbl/h
Beer barrels per day	BBBL/D	Beer barrels/day	bbbl/d

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

Define a special measurement unit for volume flow

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Special Units**
Field Communicator	**Configure → Manual Setup → Measurements → Special Units → Volume Special Units**
Fieldbus host	**Measurement TB → VOL_SPECIAL_UNIT_BASE (OD Index 26)** **Measurement TB → VOL _SPECIAL_UNIT_TIME (OD Index 27)** **Measurement TB → VOL _SPECIAL_UNIT_CONV (OD Index 28)** **Measurement TB → VOL _SPECIAL_UNIT_STR (OD Index 29)**

A special measurement unit is a user-defined unit of measure that allows you to report process data, totalizer data, and inventory data in a unit that is not available in the transmitter. A special measurement unit is calculated from an existing measurement unit using a conversion factor.

Note

Although you cannot define a special measurement unit using the display, you can use the display to select an existing special measurement unit, and to view process data using the special measurement unit.

The special unit label displays only on the local display. The AI block uses and displays the actual engineering unit (i.e. L/min).

Procedure

1. Specify **Base Volume Unit**.

   Base Volume Unit is the existing volume unit that the special unit will be based on.

2. Specify **Base Time Unit**.

   Base Time Unit is the existing time unit that the special unit will be based on.

3. Calculate **Volume Flow Conversion Factor** as follows:

   a) x base units = y special units

   b) **Volume Flow Conversion Factor** = x ÷ y

4. Enter **Volume Flow Conversion Factor**.

   The original volume flow rate value is divided by this conversion factor.

5. Set **Volume Flow Label** to the name you want to use for the volume flow unit.
6. Set **Volume Total Label** to the name you want to use for the volume total and volume inventory unit.

The special measurement unit is stored in the transmitter. You can configure the transmitter to use the special measurement unit at any time.

Defining a special measurement unit for volume flow

You want to measure volume flow in pints per second (pints/sec).

1. Set **Base Volume Unit** to Gallons (gal).
2. Set **Base Time Unit** to Seconds (sec).
3. Calculate the conversion factor:
   a. 1 gal/sec = 8 pints/sec
   b. **Volume Flow Conversion Factor** = 1 ÷ 8 = 0.1250
4. Set **Volume Flow Conversion Factor** to `0.1250`.
5. Set **Volume Flow Label** to `pints/sec`.
6. Set **Volume Total Label** to `pints`.

4.2.3 Configure Volume Flow Cutoff

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Flow**
Field Communicator	**Configure → Manual Setup → Measurements → Flow → Volume Flow Cutoff**
Fieldbus host	**Measurement TB → VOLUME_FLOW_LOW_CUTOFF (OD Index 39)**

Volume Flow Cutoff specifies the lowest volume flow rate that will be reported as measured. All volume flow rates below this cutoff are reported as 0.

Procedure

Set **Volume Flow Cutoff** to the value you want to use.

The default value for **Volume Flow Cutoff** is 0.0 l/sec (liters per second). The lower limit is 0. Leaving the volume flow cutoff at 0 is not recommended.

4.3 Configure GSV flow measurement

The gas standard volume (GSV) flow measurement parameters control how volume flow is measured and reported in a gas application.

Restriction
You cannot implement both liquid volume flow and gas standard volume flow at the same time. Choose one or the other.

4.3.1 Configure Volume Flow Type for gas applications

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Flow**

Field Communicator	**Configure → Manual Setup → Measurements → GSV → Volume Flow Type → Standard Gas Volume**
Fieldbus host	**Measurement TB → GSV_Gas_Dens (OD Index 62)** **Measurement TB → SNS_GSV_FlowUnits (OD Index 67)** **Measurement TB → SNS_GSVflowFactor (OD Index 71)** **Measurement TB → SNS_GSV_FlowCutoff (OD Index 74)**

Volume Flow Type controls whether liquid or gas standard volume flow measurement is used.

Restriction
Gas standard volume measurement is incompatible with some applications. Set **Volume Flow Type** to Liquid if you are using any of the following applications:

- Petroleum measurement
- Concentration measurement

Procedure

Set **Volume Flow Type** to Gas Standard Volume.

4.3.2 Configure Standard Density of Gas

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Flow**
Field Communicator	**Configure → Manual Setup → Measurements → GSV → Gas Ref Density**
Fieldbus host	**Measurement TB → GSV_Gas_Dens (OD Index 62)**

The **Standard Density of Gas** value is the gas density at standard reference conditions. Use it to convert the measured mass flow data to volume flow at reference conditions.

Prerequisites

Ensure that **Density Measurement Unit** is set to the measurement unit you want to use for **Standard Density of Gas**.

Procedure

Set **Standard Density of Gas** to standard reference conditions.

4.3.3 Configure Gas Standard Volume Flow Unit

Display	**OFF-LINE MAINT → OFF-LINE CONFG → UNITS → GSV**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow**
Field Communicator	**Configure → Manual Setup → Measurements → GSV → GSV Flow Unit**
Fieldbus host	**Measurement TB → SNS_GSV_FlowUnits (OD Index 67)**

Gas Standard Volume Flow Unit specifies the unit of measure that will be displayed for the gas standard volume flow. The measurement unit used for the gas volume total and the gas volume inventory is derived from this unit.

Prerequisites

Before you configure **Gas Standard Volume Flow Unit**, be sure that **Volume Flow Type** is set to Gas Standard Volume.

Procedure

Set **Gas Standard Volume Flow Unit** to the unit you want to use.

The default setting for **Gas Standard Volume Flow Unit** is SCFM (Standard Cubic Feet per Minute).

Tip
If the measurement unit you want to use is not available, you can define a special measurement unit.

Options for Gas Standard Volume Flow Unit

The transmitter provides a standard set of measurement units for **Gas Standard Volume Flow Unit**, plus one user-defined special measurement unit. Different communications tools may use different labels for the units.

Unit description	Label		
	Display	**ProLink III**	**Field Communicator**
Normal cubic meters per second	NM3/S	Nm3/sec	Nm3/s
Normal cubic meters per minute	NM3/MN	Nm3/sec	Nm3/min
Normal cubic meters per hour	NM3/H	Nm3/hr	Nm3/h
Normal cubic meters per day	NM3/D	Nm3/day	Nm3/d
Normal liters per second	NLPS	NLPS	NL/s
Normal liters per minute	NLPM	NLPM	NL/min
Normal liters per hour	NLPH	NLPH	NL/h
Normal liters per day	NLPD	NLPD	NL/d
Standard cubic feet per second	SCFS	SCFS	SCFS
Standard cubic feet per minute	SCFM	SCFM	SCFM
Standard cubic feet per hour	SCFH	SCFH	SCFH
Standard cubic feet per day	SCFD	SCFD	SCFD
Standard cubic meters per second	SM3/S	Sm3/sec	Sm3/s
Standard cubic meters per minute	SM3/MN	Sm3/min	Sm3/min
Standard cubic meters per hour	SM3/H	Sm3/hr	Sm3/h
Standard cubic meters per day	SM3/D	Sm3/day	Sm3/d
Standard liters per second	SLPS	SLPS	SL/s
Standard liters per minute	SLPM	SLPM	SL/min
Standard liters per hour	SLPH	SLPH	SL/h

Unit description	Label		
	Display	**ProLink III**	**Field Communicator**
Standard liters per day	SLPD	SLPD	SL/d
Special measurement unit	SPECL	special	Special

Define a special measurement unit for gas standard volume flow

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Flow → Special Units**
Field Communicator	**Configure → Manual Setup → Measurements → Special Units → Special GSV Units**
Fieldbus host	**Measurement TB → SNS_GSVflowBaseUnit (OD Index 69)** **Measurement TB → SNS_GSVflowBaseTime (OD Index 70)** **Measurement TB → SNS_GSVflowFactor (OD Index 71)** **Measurement TB → SNS_GSVflowText (OD Index 72)**

A special measurement unit is a user-defined unit of measure that allows you to report process data, totalizer data, and inventory data in a unit that is not available in the transmitter. A special measurement unit is calculated from an existing measurement unit using a conversion factor.

Note

Although you cannot define a special measurement unit using the display, you can use the display to select an existing special measurement unit, and to view process data using the special measurement unit.
The special unit label displays only on the local display. The AI block uses and displays the actual engineering unit (i.e. SCFM).

Procedure

1. Specify **Base Gas Standard Volume Unit**.

   Base Gas Standard Volume Unit is the existing gas standard volume unit that the special unit will be based on.

2. Specify **Base Time Unit**.

   Base Time Unit is the existing time unit that the special unit will be based on.

3. Calculate **Gas Standard Volume Flow Conversion Factor** as follows:
   a) x base units = y special units
   b) **Gas Standard Volume Flow Conversion Factor** = x ÷ y

4. Enter the **Gas Standard Volume Flow Conversion Factor**.

   The original gas standard volume flow value is divided by this conversion factor.

5. Set **Gas Standard Volume Flow Label** to the name you want to use for the gas standard volume flow unit.
6. Set **Gas Standard Volume Total Label** to the name you want to use for the gas standard volume total and gas standard volume inventory unit.

The special measurement unit is stored in the transmitter. You can configure the transmitter to use the special measurement unit at any time.

Example: Defining a special measurement unit for gas standard volume flow

You want to measure gas standard volume flow in thousands of standard cubic feet per minute.

1. Set **Base Gas Standard Volume Unit** to SCF.
2. Set **Base Time Unit** to minutes (min).
3. Calculate the conversion factor:
   a. 1 thousands of standard cubic feet per minute = 1000 cubic feet per minute
   b. **Gas Standard Volume Flow Conversion Factor** = 1 ÷ 1000 = 0.001 standard
4. Set **Gas Standard Volume Flow Conversion Factor** to `0.001`.
5. Set **Gas Standard Volume Flow Label** to `MSCFM`.
6. Set **Gas Standard Volume Total Label** to `MSCF`.

4.3.4 Configure Gas Standard Volume Flow Cutoff

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Flow**
Field Communicator	**Configure → Manual Setup → Measurements → GSV → GSV Cutoff**
Fieldbus host	**Measurement TB → SNS_GSV_FlowCutoff (OD Index 74)**

Gas Standard Volume Flow Cutoff specifies the lowest gas standard volume flow rate that will reported as measured. All gas standard volume flow rates below this cutoff will be reported as 0.

Procedure

Set **Gas Standard Volume Flow Cutoff** to the value you want to use.

The default value for **Gas Standard Volume Flow Cutoff** is 0.0. The lower limit is 0.0. There is no upper limit. The recommended value is 0.5% of the nominal flow rate of the attached sensor. See the sensor specifications.

4.4 Configure Flow Direction

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Flow**
Field Communicator	**Configure → Manual Setup → Measurements → Flow → Flow Direction**
Fieldbus host	**Measurement TB → FLOW_DIRECTION (OD Index 41)**

Flow Direction controls how forward flow and reverse flow affect flow measurement and reporting.

Flow Direction is defined with respect to the flow arrow on the sensor:

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

Tip
Micro Motion sensors are bidirectional. Measurement accuracy is not affected by actual flow direction or the setting of the **Flow Direction** parameter.

Procedure

Set **Flow Direction** to the value you want to use.

4.4.1 Options for Flow Direction

Flow Direction setting		
ProLink III	**Field Communicator**	**Relationship to Flow Direction arrow on sensor**
Forward	Forward	Appropriate when the Flow Direction arrow is in the same direction as the majority of flow.
Reverse	Reverse	Appropriate when the Flow Direction arrow is in the opposite direction from the majority of flow.
Absolute Value	Absolute Value	Flow Direction arrow is not relevant.
Bidirectional	Bi directional	Appropriate when both forward and reverse flow are expected, and forward flow will dominate, but the amount of reverse flow will be significant.
Negate Forward	Negate/Forward Only	Appropriate when the Flow Direction arrow is in the opposite direction from the majority of flow.
Negate Bidirectional	Negate/Bi-directional	Appropriate when both forward and reverse flow are expected, and reverse flow will dominate, but the amount of forward flow will be significant.

Effect of flow direction on digital communications

Flow direction affects how flow values are reported via digital communications. The following table describes the effect of the flow direction parameter and actual flow direction on flow values reported via digital communications.

Table 4-1: Effect of the flow direction on flow values

	Actual flow direction		
Flow Direction setting	**Forward**	**Zero flow**	**Reverse**
Forward	Positive	0	Negative
Reverse	Positive	0	Negative
Bidirectional	Positive	0	Negative
Absolute Value	Positive(1)	0	Positive(1)
Negate Forward	Negative	0	Positive
Negate Bidirectional	Negative	0	Positive

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

Effect of flow direction on flow totals

Flow direction affects how flow totals and inventories are calculated.

Flow Direction setting	Actual flow direction		
	Forward	**Zero flow**	**Reverse**
Forward	Totals increase	Totals do not change	Totals do not change
Bidirectional	Totals increase	Totals do not change	Totals decrease
Negate Forward	Totals do not change	Totals do not change	Totals increase
Negate Bidirectional	Totals decrease	Totals do not change	Totals increase

4.5 Configure density measurement

The density measurement parameters control how density is measured and reported.

4.5.1 Configure Density Measurement Unit

Display	**OFF-LINE MAINT → OFF-LINE CONFG → UNITS → DENS**
ProLink III	**Device Tools → Configuration → Process Measurement → Density**
Field Communicator	**Configure → Manual Setup → Measurements → Density → Density Unit**
Fieldbus host	**Measurement TB → DENSITY_UNITS (OD Index 23)**

Density Measurement Unit controls the measurement units that will be used in density calculations and reporting.

Procedure

Set **Density Measurement Unit** to the option you want to use.

The default setting for **Density Measurement Unit** is g/cm3 (grams per cubic centimeter).

Options for Density Measurement Unit

The transmitter provides a standard set of measurement units for **Density Measurement Unit**. Different communications tools may use different labels.

Unit description	Label		
	Display	**ProLink III**	**Field Communicator**
Specific gravity(1)	SGU	SGU	SGU
Grams per cubic centimeter	G/CM3	g/cm3	g/cm3
Grams per liter	G/L	g/l	g/L
Grams per milliliter	G/mL	g/ml	g/ml
Kilograms per liter	KG/L	kg/l	kg/L
Kilograms per cubic meter	KG/M3	kg/m3	kg/m3
Pounds per U.S. gallon	LB/GAL	lbs/Usgal	lb/gal

Unit description	Label		
	Display	ProLink III	Field Communicator
Pounds per cubic foot	LB/CUF	lbs/ft3	lb/ft3
Pounds per cubic inch	LB/CUI	lbs/in3	lb/in3
Short ton per cubic yard	ST/CUY	sT/yd3	STon/yd3
Degrees API	D API	degAPI	degAPI

(1) Non-standard calculation. This value represents line density divided by the density of water at 4 °C.

4.5.2 Configure two-phase flow parameters

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Density**
Field Communicator	**Configure → Manual Setup → Measurements → Density → Slug Low Limit** **Configure → Manual Setup → Measurements → Density → Slug High Limit** **Configure → Manual Setup → Measurements → Density → Slug Duration**
Fieldbus host	**Diag TB → SLUG_LOW_LIMIT (OD Index 15)** **Diag TB → SLUG_HIGH_LIMIT (OD Index 16)** **Diag TB → SLUG_TIME (OD Index 14)**

The two-phase flow parameters control how the transmitter detects and reports two-phase flow (gas in a liquid process or liquid in a gas process).

Note
Two-phase flow is also referred to as *slug flow*.

Procedure

1. Set **Two-Phase Flow Low Limit** to the lowest density value that is considered normal in your process.

   Values below this will cause the transmitter to post Alert A105 (Two-Phase Flow).

   Tip
   Gas entrainment can cause your process density to drop temporarily. To reduce the occurrence of two-phase flow alerts that are not significant to your process, set **Two-Phase Flow Low Limit** slightly below your expected lowest process density.

   You must enter **Two-Phase Flow Low Limit** in g/cm^3, even if you configured another unit for density measurement.

2. Set **Two-Phase Flow High Limit** to the highest density value that is considered normal in your process.

   Micro Motion recommends leaving **Two-Phase Flow High Limit** at the default value.

   Values above this will cause the transmitter to post Alert A105 (Two-Phase Flow).

   You must enter **Two-Phase Flow High Limit** in g/cm^3, even if you configured another unit for density measurement.

3. Set **Two-Phase Flow Timeout** to the number of seconds that the transmitter will wait for a two-phase flow condition to clear before posting the alert.

The default value for **Two-Phase Flow Timeout** is 0.0 seconds, meaning that the alert will be posted immediately. The range is 0.0 to 60.0 seconds.

The Two-Phase Flow alert is set immediately. The flow rate will hold the last measured value for the Timeout time. Then the flow rate will report zero flow. If the density goes back in range, the error clears immediately.

Detecting and reporting two-phase flow

Two-phase flow (gas in a liquid process or liquid in a gas process) can cause a variety of process control issues. By configuring the two-phase flow parameters appropriately for your application, you can detect process conditions that require correction.

Micro Motion recommends leaving **Two-Phase Flow High Limit** at the default value.

A two-phase flow condition occurs whenever the measured density goes below **Two-Phase Flow Low Limit** or above **Two-Phase Flow High Limit**. If this occurs:

- A two-phase flow alert is posted to the active alert log.
- All outputs that are configured to represent flow rate hold their last *pre-alert* value for the number of seconds configured in **Two-Phase Flow Timeout**.

If the two-phase flow condition clears before **Two-Phase Flow Timeout** expires:

- Outputs that represent flow rate revert to reporting actual flow.
- The two-phase flow alert is deactivated, but remains in the active alert log until it is acknowledged.

If the two-phase flow condition does not clear before **Two-Phase Flow Timeout** expires, the outputs that represent flow rate report a flow rate of 0.

If **Two-Phase Flow Timeout** is set to 0.0 seconds, the outputs that represent flow rate will report a flow rate of 0 as soon as two-phase flow is detected.

4.5.3 Configure Density Damping

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Density**
Field Communicator	**Configure → Manual Setup → Measurements → Density → Density Damping**
Fieldbus host	**Measurement TB → DENSITY_DAMPING (OD Index 34)**

Density Damping controls the amount of damping that will be applied to the line density value.

Damping is used to smooth out small, rapid fluctuations in process measurement. **Damping Value** specifies the time period (in seconds) over which the transmitter will spread changes in the process variable. At the end of the interval, the internal value will reflect 63% of the change in the actual measured value.

Tip
Density damping affects all process variables that are calculated from line density.

Procedure

Set **Density Damping** to the desired value.

- Default: 1.6 seconds
- Range: 0 to 51.2 seconds
- Valid damping values: 0.0, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8, 25.6, 51.2

The default value is 1.6 seconds. The range depends on the core processor type and the setting of **Update Rate**, as shown in the following table:

Tip

- A high damping value makes the process variable appear smoother because the reported value changes slowly.
- A low damping value makes the process variable appear more erratic because the reported value changes more quickly.
- The combination of a high damping value and rapid, large changes in flow rate can result in increased measurement error.
- Whenever the damping value is non-zero, the reported measurement will lag the actual measurement because the reported value is being averaged over time.
- In general, lower damping values are preferable because there is less chance of data loss, and less lag time between the actual measurement and the reported value.

Effect of Density Damping on volume measurement

Density Damping affects liquid volume measurement. Liquid volume values are calculated from the damped density value rather than the measured density value. **Density Damping** does not affect gas standard volume measurement.

4.5.4 Configure Density Cutoff

Display	Not available
ProLink III	**Device Tools → Configuration → Process Measurement → Density**
Field Communicator	**Configure → Manual Setup → Measurements → Density → Density Cutoff**
Fieldbus host	**Measurement TB → DENSITY_LOW_CUTOFF (OD Index 38)**

Density Cutoff specifies the lowest density value that will be reported as measured. All density values below this cutoff will be reported as 0.

Procedure

Set **Density Cutoff** to the value you want to use.

For most applications, the default setting (0.2 g/cm^3) is sufficient. The range is 0.0 g/cm^3 to 0.5 g/cm^3.

Effect of Density Cutoff on volume measurement

Density Cutoff affects liquid volume measurement. If the density value goes below **Density Cutoff**, the volume flow rate is reported as 0.

4.6 Configure temperature measurement

The temperature measurement parameters control how temperature data from the sensor is reported.

4.6.1 Configure Temperature Measurement Unit

Display	**OFF-LINE MAINT → OFF-LINE CONFG → UNITS → TEMP**
ProLink III	**Device Tools → Configuration → Process Measurement → Temperature**
Field Communicator	**Configure → Manual Setup → Measurements → Temperature → Temperature Unit**
Fieldbus host	**Measurement TB → TEMPERATURE_UNITS (OD Index 21)**

Temperature Measurement Unit specifies the unit that will be used for temperature measurement.

Procedure

Set **Temperature Measurement Unit** to the option you want to use.

The default setting is Degrees Celsius.

Options for Temperature Measurement Unit

The transmitter provides a standard set of units for **Temperature Measurement Unit**. Different communications tools may use different labels for the units.

Unit description	Label		
	Display	**ProLink III**	**Field Communicator**
Degrees Celsius	°C	°C	degC
Degrees Fahrenheit	°F	°F	degF
Degrees Rankine	°R	°R	degR
Kelvin	°K	°K	K

4.6.2 Configure Temperature Damping

Display	Not available
ProLink III	**Device Tools → Configuration → Temperature**
Field Communicator	**Configure → Manual Setup → Measurements → Temperature → Temp Damping**
Fieldbus host	**Measurement TB → TEMPERATURE_DAMPING (OD Index 33)**

Temperature Damping controls the amount of damping that will be applied to the line temperature value, when the on-board temperature data is used (RTD).

Damping is used to smooth out small, rapid fluctuations in process measurement. **Damping Value** specifies the time period (in seconds) over which the transmitter will spread changes in the process variable. At the end of the interval, the internal value will reflect 63% of the change in the actual measured value.

Tip

Temperature Damping affects all process variables, compensations, and corrections that use temperature data from the sensor.

Procedure

Enter the value you want to use for **Temperature Damping**.

The default value is 4.8 seconds. For most applications, the default temperature damping setting is sufficient. The range is 0.0 to 38.4 seconds.

Tip

- A high damping value makes the process variable appear smoother because the reported value changes slowly.
- A low damping value makes the process variable appear more erratic because the reported value changes more quickly.
- Whenever the damping value is non-zero, the reported measurement will lag the actual measurement because the reported value is being averaged over time.
- In general, lower damping values are preferable because there is less chance of data loss, and less lag time between the actual measurement and the reported value.

The value you enter is automatically rounded off to the nearest valid value. Valid values for **Temperature Damping** are 0, 0.6, 1.2, 2.4, 4.8, 9.6, 19.2, and 38.4.

4.6.3 Effect of Temperature Damping on process measurement

Temperature Damping affects all processes and algorithms that use temperature data from the internal sensor RTD.

Temperature compensation

Temperature compensation adjusts process measurement to compensate for the effect of temperature on the sensor tubes.

Petroleum measurement

Temperature Damping affects petroleum measurement process variables only if the transmitter is configured to use temperature data from the sensor. If an external temperature value is used for petroleum measurement, **Temperature Damping** does not affect petroleum measurement process variables.

Concentration measurement

Temperature Damping affects concentration measurement process variables only if the transmitter is configured to use temperature data from the sensor. If an external temperature value is used for concentration measurement, **Temperature Damping** does not affect concentration measurement process variables.

4.7 Configure the petroleum measurement application

The petroleum measurement application corrects line density to reference temperature according to American Petroleum Institute (API) standards. The resulting process variable is *referred density*.

4.7.1 Configure petroleum measurement using ProLink III

The petroleum measurement parameters specify the API table, measurement units, and reference values to be used in referred density calculations.

Prerequisites

You will need API documentation for the API table that you select.

Depending on your API table, you may need to know the thermal expansion coefficient (TEC) for your process fluid.

You must know the reference temperature that you want to use.

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Petroleum Measurement**.
2. Specify the API table to use to calculate referred density.

   Each API table is associated with a specific set of equations.

   a) Set **Process Fluid** to the API table group that your process fluid belongs to.

API table group	Process fluids
A tables	Generalized crude and JP4
B tables	Generalized products: Gasoline, jet fuel, aviation fuel, kerosene, heating oils, fuel oils, diesel, gas oil
C tables	Liquids with a constant base density or known thermal expansion coefficient (TEC). You will be required to enter the TEC for your process fluid.
D tables	Lubricating oils

   b) Set **Referred Density Measurement Unit** to the measurement units that you want to use for referred density.

   c) Click **Apply**.

   These parameters uniquely identify the API table to be used to calculate referred density. The selected API table is displayed, and the meter automatically changes the density unit, temperature unit, pressure unit, and reference pressure to match the API table.

   Your choice also determines the API table that will be used to calculate the correction factor for volume (CTL).

   Restriction
   Not all combinations are supported by the petroleum measurement application. See the list of API tables in this manual.

3. Refer to the API documentation and confirm your table selection.

   a) Verify that your process fluid falls within range for line density, line temperature, and line pressure.
   b) Verify that the referred density range of the selected table is adequate for your application.

4. If you chose a C table, enter **Thermal Expansion Coefficient (TEC)** for your process fluid.
5. Set **Reference Temperature** to the temperature to which density will be corrected in referred density calculations. If you choose Other, select the temperature measurement unit and enter the reference temperature.

4.7.2 Configure petroleum measurement using the Field Communicator

Procedure

1. Choose **Online** → **Configure** → **Manual Setup** → **Measurements** → **Petroleum Measurement**.
2. Specify the API table to use.
   a) Open the ***Petroleum Measurement Source*** menu and select the API table number.
   Depending on your choice, you may be prompted to enter a reference temperature or a thermal expansion coefficient.
   b) Enter the API table letter.

   These two parameters uniquely specify the API table.
3. Determine how the transmitter will obtain temperature data for the petroleum measurement calculations, and perform the required setup.

Option	Setup
Temperature data from the sensor	a. Choose **Online** → **Configure** → **Manual Setup** → **Measurements** → **External Inputs** b. Set **External Temperature** to Disabled
A user-configured static temperature value	a. Choose **Online** → **Configure** → **Manual Setup** → **Measurements** → **External Inputs** b. Set **External Temperature** to Enabled c. Set **Correction Temperature** to the value to be used.
A value written by digital communications	a. Choose **Online** → **Configure** → **Manual Setup** → **Measurements** → **External Inputs** b. Set **External Temperature** to Enabled c. Hook up the AO Function block of the transmitter to the input of the external device to write the external temperature to the transmitter.

4.7.3 API tables supported by the petroleum measurement application

The API tables listed here are supported by the petroleum measurement application.

Table name	Process fluid	CTL source data	Reference temperature	Density unit
5A	Generalized crude and JP4	Observed density and observed temperature	60 °F (configurable)	Degrees API Range: 0 to 100
5B	Generalized products	Observed density and observed temperature	60 °F (configurable)	Degrees API Range: 0 to 85
5D	Lubricating oils	Observed density and observed temperature	60 °F (configurable)	Degrees API Range: −10 to +45
6C	Liquids with a constant density base or known thermal expansion coefficient	User-supplied reference density (or thermal expansion coefficient) and observed temperature	60 °F (configurable)	Degrees API
23A	Generalized crude and JP4	Observed density and observed temperature	60 °F (configurable)	Relative density Range: 0.6110 to 1.0760
23B	Generalized products	Observed density and observed temperature	60 °F (configurable)	Relative density Range: 0.6535 to 1.0760
23D	Lubricating oils	Observed density and observed temperature	60 °F (configurable)	Relative density Range: 0.8520 to 1.1640
24C	Liquids with a constant density base or known thermal expansion coefficient	User-supplied reference density (or thermal expansion coefficient) and observed temperature	60 °F (configurable)	Relative density
53A	Generalized crude and JP4	Observed density and observed temperature	15 °C (configurable)	Base density Range: 610 to 1075 kg/m^3
53B	Generalized products	Observed density and observed temperature	15 °C (configurable)	Base density Range: 653 to 1075 kg/m^3
53D	Lubricating oils	Observed density and observed temperature	15 °C (configurable)	Base density Range: 825 to 1164 kg/m^3
54C	Liquids with a constant density base or known thermal expansion coefficient	User-supplied reference density (or thermal expansion coefficient) and observed temperature	15 °C (configurable)	Base density in kg/m^3

Restriction
These tables are not appropriate for the following process fluids: propane and propane mixes, butane and butane mixes, butadiene and butadiene mixes, isopentane, LNG, LPG, NGL, ethylene, propylene, cyclohexane, aeromatics, asphalts, and road tars.

4.8 Set up concentration measurement

This section guides you through loading and setting up a concentration matrix used for measurement. It does not cover building a concentration matrix.

The concentration measurement application calculates concentration data from process temperature and density. Micro Motion provides a set of concentration matrices that provide the reference data for several standard industry applications and process fluids. If desired, you can build a custom matrix for your process fluid, or purchase a custom matrix from Micro Motion.

Note
Concentration matrices can be made available on your transmitter either by loading an existing matrix from a file or by building a new matrix. Up to 6 matrices can be available on your transmitter, but only 1 can be used for measurement at any given time. For detailed information on building a matrix, see the *Micro Motion Enhanced Density Application Manual*.

Prerequisites

Before you can configure concentration measurement:

- The concentration measurement application must be purchased on your transmitter.
- The concentration matrix you want to use must be available on your transmitter, or it must be available as a file on your computer.
- You must know the derived variable that your matrix is designed for.
- You must know the density unit used by your matrix.
- You must know the temperature unit used by your matrix.
- The concentration measurement application must be unlocked.

4.8.1 Configure concentration measurement using ProLink III

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Density** and set **Density Unit** to the density unit used by your matrix.
2. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Temperature** and set **Temperature Unit** to the temperature unit used by your matrix.
3. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Concentration Measurement**.
4. Set **Derived Variable** to the derived variable that your matrix is designed for, and click **Apply**.

   Important
   - All concentration matrices on your transmitter must use the same derived variable. If you are using one of the standard matrices from Micro Motion, set **Derived Variable** to Mass Concentration (Density). If you are using a custom matrix, see the reference information for your matrix.

- If you change the setting of **Derived Variable**, all existing concentration matrices will be deleted from transmitter memory. Set **Derived Variable** before loading concentration matrices.

---

5. Load one or more matrices.
   a) Set **Matrix Being Configured** to the location to which the matrix will be loaded.
   b) Click **Load Matrix from a File**, navigate to the matrix file on your computer, and load it.
   c) Repeat until all required matrices are loaded.
6. Configure or review matrix data.
   a) If necessary, set **Matrix Being Configured** to the matrix you want to configure or review, and click **Change Matrix**.
   b) Set **Concentration Unit** to the label that will be used for the concentration unit.
   c) If you set **Concentration Unit** to Special, enter the custom label.
   d) If desired, change the matrix name.
   e) Review the data points for this matrix.
   f) Do not change **Reference Temperature** or **Curve Fit Maximum Order**.
   g) If you changed any matrix data, click **Apply**.
7. Set up extrapolation alarms.

   Each concentration matrix is built for a specific density range and a specific temperature range. If process density or process temperature goes outside the range, the transmitter will extrapolate concentration values. However, extrapolation may affect accuracy. Extrapolation alarms are used to notify the operator that extrapolation is occurring.
   a) If necessary, set **Matrix Being Configured** to the matrix you want to view, and select **Change Matrix**.
   b) Set **Extrapolation Alarm Limit** to the point, in percent, at which an extrapolation alarm will be posted.
   c) Enable or disable the high and low limit alarms for temperature and density, as desired, and select **Apply**.

   #### Example

   If **Extrapolation Alarm Limit** is set to 5%, **High Extrapolation Limit (Temperature)** is enabled, and the matrix is built for a temperature range of 40 °F (4.4 °C) to 80 °F (26.7 °C), an extrapolation alarm will be posted if process temperature goes above 82 °F (27.8 °C).

Concentration process variables are now available on the transmitter. You can view and report them in the same way that you view and report other process variables.

4.8.2 Configure concentration measurement using the Field Communicator

Procedure

1. Choose **Online** → **Configure** → **Manual Setup** → **Measurements** → **External Outputs**.
2. Set **Pressure Compensation** to Enabled.
3. Enter **Flow Cal Pressure**for your sensor.

   The calibration pressure is the pressure at which your sensor was calibrated, and defines the pressure at which there is no pressure effect. If the data is unavailable, enter 20 PSI.

4. Enter **Dens Press Factor** for your sensor.

   The density factor is the change in fluid density, in g/cm3/PSI. When entering the value, reverse the sign.

   #### Example

   If the density factor is 0.000006 g/com3/PSI, enter -0.000006 g/cm3/PSI.

5. Determine how the transmitter will obtain pressure data, and perform the required setup.

Option	Setup
A user-configured static pressure value	a. Set **Pressure Unit** to the desired unit. b. Set **Compensation Pressure** to the desired value.
A value written by digital communications	a. Choose **Pressure Unit** to the desired unit. b. Perform the necessary host programming and communications setup to write pressure data to the transmitter at appropriate intervals .

Postrequisites

If you are using an external pressure value, verify the setup by choosing **Service Tools** → **Variables** → **External Variables** and checking the value displayed for **External Pressure**.

4.8.3 Standard matrices for the concentration measurement application

The standard concentration matrices available from Micro Motion are applicable for a variety of process fluids. These matrices are included in the ProLink III installation folder.

Tip
If the standard matrices are not appropriate for your application, you can build a custom matrix or purchase a custom matrix from Micro Motion.

Matrix name	Description	Density unit	Temperature unit	Derived variable
Deg Balling	Matrix 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	Mass Concentration (Density)
Deg Brix	Matrix 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	Mass Concentration (Density)
Deg Plato	Matrix 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	Mass Concentration (Density)
HFCS 42	Matrix 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	Mass Concentration (Density)
HFCS 55	Matrix 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	Mass Concentration (Density)
HFCS 90	Matrix 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	Mass Concentration (Density)

4.8.4 Derived variables and calculated process variables

The concentration measurement application calculates a different set of process variables from each derived variable. The process variables are then available for viewing or reporting.

Derived variable	Description	Calculated process variables					
		Density at reference temp	Standard volume flow rate	Specific gravity	Concentration	Net mass flow rate	Net volume flow rate
Density at Reference	Mass/unit volume, corrected to a given reference temperature	✓	✓				

Derived variable	Description	Calculated process variables					
		Density at reference temp	Standard volume flow rate	Specific gravity	Concentration	Net mass flow rate	Net volume flow rate
Specific Gravity	The ratio of the density of a process fluid at a given temperature to the density of water at a given temperature **Note** The two given temperature conditions do not need to be the same.	✓	✓	✓			
Mass Concentration (Density)	The percent mass of solute or of material in suspension in the total solution, derived from reference density	✓	✓		✓	✓	
Mass Concentration (Specific Gravity)	The percent mass of solute or of material in suspension in the total solution, derived from specific gravity	✓	✓	✓	✓	✓	
Volume Concentration (Density)	The percent volume of solute or of material in suspension in the total solution, derived from reference density	✓	✓		✓		✓
Volume Concentration (Specific Gravity)	The percent volume of solute or of material in suspension in the total solution, derived from specific gravity	✓	✓	✓	✓		✓
Concentration (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	✓	✓		✓		
Concentration (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	✓	✓	✓	✓		

4.9 Set up concentration measurement using a basic FF host

This section guides you through most of the tasks related to setting up and implementing the concentration measurement application.

Restriction

This section does not cover building a concentration matrix. See *Micro Motion Enhanced Density Application Manual* for detailed information on building a matrix.

4.9.1 Set reference temperature values for specific gravity using a basic FF host

When **Derived Variable** is set to any option based on specific gravity, you must set the reference temperature for water, then verify the density of water at the configured reference temperature. These values affect specific gravity measurement.

To check the setting of **Derived Variable**, read the value of the **Derived Variable** parameter in the Concentration Measuremnt TB.

Table 4-2: Fieldbus codes for derived variable options (Derived Variable parameter)

Fieldbus code	Derived variable
1	Density at reference temperature
2	Specific gravity
3	Mass concentration (density)
4	Mass concentration (specific gravity)
5	Volume concentration (density)
6	Volume concentration (specific gravity)
7	Concentration (density)
8	Concentration (specific gravity)

Important

Do not change the setting of **Derived Variable**. If you change the setting of **Derived Variable**, all existing concentration matrices will be deleted from transmitter memory.

Procedure

Write the desired values into the appropriate parameters in the Concentration Measuremnt TB for **Reference Temperature**, **Water Reference Temperature**, and **Water Reference Density**.

The transmitter automatically calculates the density of water at the specified temperature. The new value will be displayed the next time that transmitter memory is read. You can enter a different value if you want to.

4.9.2 Modify matrix names and labels using a basic FF host

For convenience, you can change the name of a concentration matrix and the label used for its measurement unit. This does not affect measurement.

Procedure

1. Choose the matrix you want to modify by writing to the **Matrix Being Configured** parameter in the Concentration Measuremnt TB. Each saved matrix has a unique value of 0 through 5.
2. Write the desired values into the **Matrix Name** and **Concentration Unit** parameters in the Concentration Measuremnt TB.

Table 4-3: Concentration unit codes

Fieldbus code	Unit
1110	degTwad
1426	degBrix
1111	degBaum hv
1112	degBaum lt
1343	% sol/wt
1344	% sol/vol
1427	degBall
1428	proof/vol
1429	proof/mass
1346	% plato
253	special

3. Write a value into the **Special Concentration Unit Label** parameter if **Concentration Unit** is set to code 253 (special).

4.9.3 Modify extrapolation alerts for concentration measurement using a basic FF host

You can enable and disable extrapolation alerts, and set extrapolation alert limits. These parameters control the behavior of the concentration measurement application but do not affect measurement directly.

Each concentration matrix is built for a specific density range and a specific temperature range. If line density or line temperature goes outside the range, the transmitter will extrapolate concentration values. However, extrapolation may affect accuracy. Extrapolation alerts are used to notify the operator that extrapolation is occurring.

Each concentration matrix has its own extrapolation alert limits.

Procedure

1. Choose the matrix you want to configure using the **Active Matrix** parameter in the Concentration Measuremnt TB. Each saved matrix has a unique value of 0 through 5.
2. Write the desired values into the appropriate parameters in the Concentration Measuremnt TB.

Parameter name	Description
Extrapolation Limit	*Extrapolation Alert Limit* The point, in percent, at which an extrapolation alert will be posted.
Density Low	Enable low density extrapolation alarm (write `1` to enable; `0` to disable).
Density High	Enable high density extrapolation alarm (write `1` to enable; `0` to disable).
Temperature Low	Enable low temperature extrapolation alarm (write `1` to enable; `0` to disable).
Temperature High	Enable high temperature extrapolation alarm (write `1` to enable; `0` to disable).

Extrapolation alert in action

If the following conditions exist, the high temperature extrapolation alert will be posted when the line temperature exceeds 82 °F (27.8 °C):

- The Extrapolation Alert Limit is set to 5%
- The high temperature alarm is enabled
- The active matrix is built for a temperature range of 40 °F (4.4 °C) to 80 °F (26.7 °C)

4.9.4 Select the active concentration matrix using a basic FF host

You must select the concentration matrix to be used for measurement. Although the transmitter can store up to six concentration matrices, only one matrix can be used for measurement at any one time.

Procedure

Choose the matrix you want to use by writing to the **Active Matrix** parameter in the Concentration Measuremnt TB. Each saved matrix has a unique value of 0 through 5.

4.10 Configure pressure compensation

Pressure compensation adjusts process measurement to compensate for the pressure effect on the sensor. The pressure effect is the change in the sensor's sensitivity to flow and density caused by the difference between the calibration pressure and the process pressure.

Tip
Not all sensors or applications require pressure compensation. The pressure effect for a specific sensor model can be found in the product data sheet located at Emerson.com. If you are uncertain about implementing pressure compensation, contact customer service.

Prerequisites

You will need the flow factor, density factor, and calibration pressure values for your sensor.

- For the flow factor and density factor, see the product data sheet for your sensor.
- For the calibration pressure, see the calibration sheet for your sensor. If the data is unavailable, use 20 PSI.

4.10.1 Configure pressure compensation using ProLink III

Procedure

1. Choose **Device Tools** → **Configuration** → **Process Measurement** → **Pressure Compensation**.
2. Set **Pressure Unit** to the appropriate unit.

   If you will use an external pressure value, set **Pressure Unit** to match the pressure unit used by the external pressure device.

3. Enter **Flow Calibration Pressure** for your sensor.

   The calibration pressure is the pressure at which your sensor was calibrated, and defines the pressure at which there is no pressure effect. If the data is unavailable, enter `20` PSI.

4. Enter **Flow Factor** for your sensor.

   The flow factor is the percent change in the flow rate per PSI. When entering the value, reverse the sign.

   Example

   If the flow factor is 0.000004 % per PSI, enter `-0.000004 % per PSI`.
5. Enter **Density Factor** for your sensor.

   The density factor is the change in fluid density, in g/cm^3/PSI. When entering the value, reverse the sign.

   Example

   If the density factor is −0.000006 g/cm^3/PSI, enter `+0.000006` g/cm^3/PSI.

Postrequisites

If you are using an external pressure value, verify the setup by checking the **External Pressure** value displayed in the ***Inputs*** area of the main window.

4.10.2 Configure pressure compensation using the Field Communicator

Procedure

1. Choose **Online** → **Configure** → **Manual Setup** → **Measurements** → **External Inputs**.
2. Set **Pressure Compensation** to Enabled.
3. Enter **Flow Cal Pressure** for your sensor.

   The calibration pressure is the pressure at which your sensor was calibrated, and defines the pressure at which there is no pressure effect. If the data is unavailable, enter `20` PSI.

4. Enter **Flow Press Factor** for your sensor.

   The flow factor is the percent change in the flow rate per PSI. When entering the value, reverse the sign.

Example

If the flow factor is −0.0002 % per PSI, enter `+0.0002` % per PSI.

5. Enter **Dens Press Factor** for your sensor.

   The density factor is the change in fluid density, in g/cm^3/PSI. When entering the value, reverse the sign.

   ### Example

   If the density factor is −0.000006 g/cm^3/PSI, enter `+0.000006` g/cm^3/PSI.

6. Determine how the transmitter will obtain pressure data, and perform the required setup.

Option	Setup
A user-configured static pressure value	a. Set **Pressure Unit** to the desired unit. b. Set **Compensation Pressure** to the desired value.
A value written by digital communications	a. Set **Pressure Unit** to the desired unit. b. Perform the necessary host programming and communications setup to write pressure data to the transmitter at appropriate intervals.

Postrequisites

If you are using an external pressure value, verify the setup by choosing **Service Tools** → **Variables** → **External Variables** and checking the value displayed for **External Pressure**.

4.10.3 Options for Pressure Measurement Unit

The transmitter provides a standard set of measurement units for **Pressure Measurement Unit**. Different communications tools may use different labels for the units. In most applications, **Pressure Measurement Unit** should be set to match the pressure measurement unit used by the remote device.

	Label		
Unit description	**Display**	**ProLink III**	**Field Communicator**
Feet water @ 68 °F	FTH$_2$O	Ft Water @ 68 °F	ftH$_2$O (68°F)
Inches water @ 4 °C	INW4C	In Water @ 4 °C	inH$_2$O (4°C)
Inches water @ 60 °F	INW60	In Water @ 60 °F	inH$_2$O@60°F
Inches water @ 68 °F	INH$_2$O	In Water @ 68 °F	inH$_2$O (68°F)
Millimeters water @ 4 °C	mmW4C	mm Water @ 4 °C	mmH$_2$O (4°C)
Millimeters water @ 68 °F	mmH$_2$O	mm Water @ 68°F	mmH$_2$O (68°F)
Millimeters mercury @ 0 °C	mmHG	mm Mercury @ 0 °C	mmHg (0°C)
Inches mercury @ 0 °C	INHG	In Mercury @ 0°C	inHg (0°C)
Pounds per square inch	PSI	PSI	psi

Unit description	Label		
	Display	ProLink III	Field Communicator
Bar	BAR	bar	bar
Millibar	mBAR	millibar	mbar
Grams per square centimeter	G/SCM	g/cm2	g/cm2
Kilograms per square centimeter	KG/SCM	kg/cm2	kg/cm2
Pascals	PA	pascals	Pa
Kilopascals	KPA	Kilopascals	kPa
Megapascals	MPA	Megapascals	MPa
Torr @ 0 °C	TORR	Torr @ 0°C	torr
Atmospheres	ATM	atms	atm

5 Configure device options and preferences

5.1 Configure the transmitter display

You can control the process variables shown on the display and a variety of display behaviors.

5.1.1 Configure the language used for the display

Display	**OFF-LINE MAINT → OFF-LINE CONFG → DISPLAY → LANG**
ProLink III	**Device Tools → Configuration → Transmitter Display → General**
Field Communicator	**Configure → Manual Setup → Display → Language**
Fieldbus host	**LDO TB → UI_Language (OD Index 24)**

Display Language controls the language used for process data and menus on the display.

Procedure

Select the language you want to use.
The languages available depend on your transmitter model and version.

5.1.2 Configure the process variables and diagnostic variables shown on the display

Display	Not available
ProLink III	**Device Tools → Configuration → Transmitter Display → Display Variables**
Field Communicator	**Configure → Manual Setup → Display → Display Variables**
Fieldbus host	**LDO TB → LDO_VAR_1_CODE (OD Index 25)** to **LDO TB → LDO_VAR_15_CODE (OD Index 39)**

You can control the process variables and diagnostic variables shown on the display, and the order in which they appear. The display can scroll through up to 15 variables in any order you choose. In addition, you can repeat variables or leave slots unassigned.

Restriction

Display Variable 1 must be set to a process variable.

Note

If you configure a display variable as a volume process variable and then change **Volume Flow Type**, the display variable is automatically changed to the equivalent process variable. For example, Volume Flow Rate would be changed to Gas Standard Volume Flow Rate.

Procedure

For each display variable you want to change, assign the process variable you want to use.

Default display variable configuration

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

5.1.3 Configure the number of decimal places (precision) shown on the display

Display	Not available
ProLink III	**Device Tools → Configuration → Transmitter Display → Display Variables**
Field Communicator	**Configure → Manual Setup → Display → Decimal Places**
Fieldbus host	**LDO TB → FBUS_UI_ProcVarIndex (OD Index 40)** **LDO TB → UI_NumDecimals (OD Index 41)**

You can specify the number of decimal places (precision) that are shown on the display for each process variable or diagnostic variable. You can set the precision independently for each variable.

The display precision does not affect the actual value of the variable or the value used in calculations.

Procedure

1. Select a variable.
2. Set **Number of Decimal Places** to the number of decimal places you want shown when the process variable or diagnostic variable appears on the display.

   For temperature and density process variables, the default value is 2 decimal places. For all other variables, the default value is 4 decimal places. The range is 0 to 5.

Tip
The lower the precision, the greater the change must be for it to be reflected on the display. Do not set the precision too low or too high to be useful.

5.1.4 Configure the refresh rate of data shown on the display

Display	**OFF-LINE MAINT → OFF-LINE CONFG → DISPLAY → RATE**
ProLink III	**Device Tools → Configuration → Transmitter Display → Display Variables**
Field Communicator	**Configure → Manual Setup → Display → Display Variable Menu Features → Refresh Rate**
Fieldbus host	**LDO TB → UI_UpdatePeriodmsec (OD Index 42)**

You can set **Refresh Rate** to control how frequently data is refreshed on the display.

Procedure

Set **Refresh Rate** to the desired value.

The default value is 200 milliseconds. The range is 100 milliseconds to 10,000 milliseconds (10 seconds).

5.1.5 Enable or disable automatic scrolling through the display variables

Display	**OFF-LINE MAINT → OFF-LINE CONFG → DISPLAY → AUTO SCRLL**
ProLink III	**Device Tools → Configuration → Transmitter Display → General**
Field Communicator	**Configure → Manual Setup → Display → Display Variable Menu Features → Auto Scroll**
Fieldbus host	**LDO TB → EN_LDO_AUTO_SCROLL (OD Index 16)**

You can configure the display to automatically scroll through the configured display variables or to show a single display variable until the operator activates **Scroll**. When you set automatic scrolling, you can also configure the length of time each display variable is displayed.

Procedure

1. Enable or disable **Auto Scroll** as desired.

Option	Description
Enabled	The display automatically scrolls through each display variable as specified by **Scroll Rate**. The operator can move to the next display variable at any time using **Scroll**.
Disabled (default)	The display shows **Display Variable 1** and does not scroll automatically. The operator can move to the next display variable at any time using **Scroll**.

2. If you enabled **Auto Scroll**, set **Scroll Rate** as desired.

   The default value is 10 seconds.

Tip
Scroll Rate may not be available until you apply **Auto Scroll**.

5.1.6 Enable or disable the display backlight

Display	**OFF-LINE MAINT → OFF-LINE CONFG → DISPLAY → BKLT**
ProLink III	**Device Tools → Configuration → Transmitter Display → General**
Field Communicator	**Configure → Manual Setup → Display → Backlight**
Fieldbus host	**LDO TB → LDO_BACKLIGHT_ON (OD Index 23)**

You can enable or disable the display backlight.

Procedure

Enable or disable **Backlight**.

The default setting is Enabled.

5.1.7 Enable or disable Status LED Blinking

Display	Not available
ProLink III	**Device Tools → Configuration → Transmitter Display → General**
Field Communicator	**Configure → Manual Setup → Display → Display Variable Menu Features → Status LED Blinking**
Fieldbus host	**LDO TB → UI_EnableStatusLedBlinking (OD Index 43)**

By default, the status LED blinks (flashes) to indicate unacknowledged alerts. If you disable **Status LED Blinking**, the status LED does not blink, whether alerts are acknowledged or not. It still changes color to indicate active alerts.

Procedure

Enable or disable **Status LED Blinking**.

The default setting is Enabled.

5.2 Enable or disable operator actions from the display

You can configure the transmitter to let the operator perform specific actions using the display.

5.2.1 Enable or disable Totalizer Start/Stop from the display

Display	**OFF-LINE MAINT → OFF-LINE CONFG → DISPLAY → TOTALS STOP**
ProLink III	**Device Tools → Configuration → Totalizer Control Methods**
Field Communicator	**Configure → Manual Setup → Display → Display Variable Menu Features → Start/Stop Totalizers**
Fieldbus host	**LDO TB → EN_LDO_TOT_START_STOP (OD Index 15)**

You can control whether or not the operator is able to start and stop totalizers and inventories from the display.

Restriction

- You cannot start and stop totalizers individually from the display. All totalizers are started or stopped together.
- You cannot start or stop inventories separately from totalizers. When a totalizer is started or stopped, the associated inventory is also started or stopped.
- If the petroleum measurement application is installed, the operator must enter the off-line password to perform this function, even if the off-line password is not enabled.

Procedure

1. Ensure that at least one totalizer is configured as a display variable.
2. Enable or disable **Totalizer Reset** as desired.

Option	Description
Enabled	Operators can start and stop totalizers and inventories from the display, if at least one totalizer is configured as a display variable.
Disabled (default)	Operators cannot start and stop totalizers and inventories from the display.

5.2.2 Enable or disable Totalizer Reset from the display

Display	**OFF-LINE MAINT → OFF-LINE CONFG → DISPLAY → TOTALS RESET**
ProLink III	**Device Tools → Configuration → Totalizer Control Methods**
Field Communicator	**Configure → Manual Setup → Display → Display Variable Menu Features → Totalizer Reset**
Fieldbus host	**LDO TB → EN_LDO_TOT_RESET (OD Index 14)**

You can configure whether or not the operator is able to reset totalizers from the display.

Restriction

- This parameter does not apply to inventories. You cannot reset inventories from the display.
- You cannot use the display to reset all totalizers as a group. You must reset totalizers individually.
- If the petroleum measurement application is installed, the operator must enter the off-line password to perform this function, even if the off-line password is not enabled.

Procedure

1. Ensure that the totalizers you want to reset have been configured as display variables.

   If the totalizer is not configured as a display variable, the operator will not be able to reset it.
2. Enable or disable resetting the totalizer as desired.

Option	Description
Enabled	Operators can reset a totalizer from the display, if the totalizer is configured as a display variable.
Disabled (default)	Operators cannot reset totalizers from the display.

5.2.3 Enable or disable the Acknowledge All Alerts display command

Display	**OFF-LINE MAINT → OFF-LINE CONFG → DISPLAY → ALERT**
ProLink III	**Device Tools → Configuration → Transmitter Display → Ack All**
Field Communicator	**Configure → Manual Setup → Display → Offline Variable Menu Features → Acknowledge All**
Fieldbus host	**LDO TB → EN_LDO_ACK_ALL_ALARMS (OD Index 20)**

You can configure whether or not the operator can use a single command to acknowledge all alerts from the display.

Procedure

1. Ensure that the alert menu is accessible from the display.
   To acknowledge alerts from the display, operators must have access to the alert menu.
2. Enable or disable **Acknowledge All Alerts** as desired.

Option	Description
Enabled (default)	Operators can use a single display command to acknowledge all alerts at once.
Disabled	Operators cannot acknowledge all alerts at once. Each alert must be acknowledged separately.

5.3 Configure security for the display menus

Display	**OFF-LINE MAINT → OFF-LINE CONFG → DISPLAY**
ProLink III	**Device Tools → Configuration → Transmitter Display → Display Security**
Field Communicator	**Configure → Manual Setup → Display → Offline Variable Menu Features**
Fieldbus host	**LDO TB → EN_LDO_OFFLINE_PWD (OD Index 18)** **LDO TB → LDO_OFFLINE_PWD (OD Index 21)**

You can control operator access to different sections of the display off-line menu. You can also configure a password to control access.

Procedure

1. To control operator access to the maintenance section of the off-line menu, enable or disable **Off-Line Menu**.

Option	Description
Disabled	Operator cannot access the maintenance section of the off-line menu.

2. To control operator access to the alert menu, enable or disable **Alert Menu**.

Option	Description
Enabled (default)	Operator can access the alert menu. This access is required to view and acknowledge alerts, but is not required for Smart Meter Verification (if applicable), configuration, or calibration.
Disabled	Operator cannot access the alert menu.

Note
The transmitter status LED changes color to indicate that there are active alerts, but does not show specific alerts.

3. To require a password for access to the maintenance section of the off-line menu and the Smart Meter Verification menu, enable or disable **Off-Line Password**.

Option	Description
Enabled	Operator is prompted for the off-line password at entry to the Smart Meter Verification menu (if applicable), or entry to the maintenance section of the off-line menu.
Disabled (default)	No password is required for entry to the Smart Meter Verification menu (if applicable) or entry to the maintenance section of the off-line menu.

4. To require a password to access the alert menu, enable or disable **Alert Password**.

Option	Description
Enabled	Operator is prompted for the off-line password at entry to the alert menu.
Disabled (default)	No password is required for entry to the alert menu.

If both **Off-Line Password** and **Alert Password** are enabled, the operator is prompted for the off-line password to access the off-line menu, but is not prompted thereafter.

5. Set **Off-Line Password** to the desired value.

The default value is 1234. The range is 0000 to 9999.

The same value is used for both the off-line password and the alert password.

Tip
Record your password for future reference.

5.4 Configure response time parameters

You can configure the rate at which process data is polled and process variables are calculated.

5.5 Configure alert handling

The alert handling parameters control the transmitter's response to process and device conditions.

5.5.1 Configure Fault Timeout

Display	Not available
ProLink III	**Device Tools → Configuration → Fault Processing**
Field Communicator	**Configure → Alert Setup → Alert Severity → Fault Timeout**
Fieldbus host	**Diag TB → LAST_MEASURED_VALUE_FAULT_TIMEOUT (OD Index 22)**

Fault Timeout controls the delay before fault actions are performed.

Restriction
Fault Timeout is applied only to the following alerts (listed by Status Alert Code): A003, A004, A005, A008, A016, A017, A033, A036. For all other alerts, fault actions are performed as soon as the alert is detected.

Procedure

Set **Fault Timeout** as desired.

The default value is 0 seconds. The range is 0 to 60 seconds.

If you set **Fault Timeout** to 0, fault actions are performed as soon as the alert condition is detected.

The fault timeout period begins when the transmitter detects an alert condition. During the fault timeout period, the transmitter continues to report its last valid measurements.

If the fault timeout period expires while the alert is still active, the fault actions are performed. If the alert condition clears before the fault timeout expires, no fault actions are performed.

5.5.2 Configure Status Alert Severity

Display	Not available
ProLink III	**Device Tools → Configuration → Alert Severity**
Field Communicator	**Configure → Alert Setup → Alert Severity → Set Alert Severity**
Fieldbus host	**Diag TB → ALARM_INDEX (OD Index 23)** **Diag TB → ALARM_SEVERITY (OD Index 24)**

Use **Status Alert Severity** to control the fault actions that the transmitter performs when it detects an alert condition.

Restriction

- For some alerts, **Status Alert Severity** is not configurable.
- For some alerts, **Status Alert Severity** can be set only to two of the three options.

Tip

Use the default settings for **Status Alert Severity** unless you have a specific requirement to change them.

Procedure

1. Select a status alert.
2. For the selected status alert, set **Status Alert Severity** as desired.

Option	Description
Fault	Actions when fault is detected: • The alert is posted to the Alert List. • Outputs go to the configured fault action (after **Fault Timeout** has expired, if applicable). • Digital communications go to the configured fault action (after **Fault Timeout** has expired, if applicable). • The status LED (if available) changes to red or yellow (depending on alert severity). Actions when alert clears: • Outputs return to normal behavior. • Digital communications return to normal behavior. • The status LED (if available) returns to green and may or may not flash.
Informational	Actions when fault is detected: • The alert is posted to the Alert List. • The status LED (if available) changes to red or yellow (depending on alert severity). Actions when alert clears: • The status LED (if available) returns to green and may or may not flash.

Status alerts and options for Status Alert Severity

Table 5-1: Status alerts and Status Alert Severity

Alert code	Status message	Default severity	Notes	Configurable?
A001	EEPROM Error (Core Processor)	Fault		No
A002	RAM Error (Core Processor)	Fault		No
A003	No Sensor Response	Fault		Yes
A004	Temperature Overrange	Fault		No
A005	Mass Flow Rate Overrange	Fault		Yes
A006	Characterization Required	Fault		Yes
A008	Density Overrange	Fault		Yes
A009	Transmitter Initializing/ Warming Up	Fault		Yes

Table 5-1: Status alerts and Status Alert Severity *(continued)*

Alert code	Status message	Default severity	Notes	Configurable?
A010	Calibration Failure	Fault		No
A011	Zero Calibration Failed: Low	Fault		Yes
A012	Zero Calibration Failed: High	Fault		Yes
A013	Zero Calibration Failed: Unstable	Fault		Yes
A014	Transmitter Failure	Fault		No
A016	Sensor RTD Failure	Fault		Yes
A018	EEPROM Error (Transmitter)	Fault		No
A019	RAM Error (Transmitter)	Fault		No
A020	Calibration Factors Missing	Fault		Yes
A021	Incorrect Sensor Type (K1)	Fault		No
A026	Sensor/Transmitter Communications Failure	Fault		No
A031	Low Power	Fault	Applies only to flowmeters with the enhanced core processor.	No
A032	Meter Verification in Progress: Outputs to Fault	Varies	Applies only to transmitters with Smart Meter Verification. If outputs are set to Last Measured Value, severity is Info. If outputs are set to Fault, severity is Fault.	No
A033	Insufficient Right/Left Pickoff Signal	Fault	Applies only to flowmeters with the enhanced core processor.	Yes
A034	Meter Verification Failed	Fault	Applies only to transmitters with Smart Meter Verification.	Yes
A035	Meter Verification Aborted	Fault	Applies only to transmitters with Smart Meter Verification.	Yes
A102	Drive Overrange	Informational		Yes
A104	Calibration in Progress	Informational	Can be set to either Informational or Ignore, but cannot be set to Fault.	Yes
A105	Slug Flow	Informational		Yes
A107	Power Reset Occurred	Informational	Normal transmitter behavior; occurs after every power cycle.	Yes
A116	Temperature Overrange (Petroleum)	Informational	Applies only to transmitters with the petroleum measurement application.	Yes

Table 5-1: Status alerts and Status Alert Severity *(continued)*

Alert code	Status message	Default severity	Notes	Configurable?
A117	Density Overrange (Petroleum)	Informational	Applies only to transmitters with the petroleum measurement application.	Yes
A120	Curve Fit Failure (Concentration)	Informational	Applies only to transmitters with the concentration measurement application.	No
A121	Extrapolation Alarm (Concentration)	Informational	Applies only to transmitters with the concentration measurement application.	Yes
A128	Factory Configuration Data Invalid	Fault		No
A129	Factory Config ChkSum Error	Fault		No
A131	Meter Verification in Progress: Outputs to Last Measured Value	Informational	Applies only to transmitters with Smart Meter Verification.	Yes

5.6 Configure informational parameters

The informational parameters can be used to identify or describe your meter. They are not used in process measurement and they are not required.

5.6.1 Configure Sensor Serial Number

Display	Not available
ProLink III	**Device Tools → Configuration → Informational Parameters → Sensor**
Field Communicator	**Configure → Manual Setup → Info Parameters → Sensor Information → Sensor Serial Number**
Fieldbus host	**Device Info TB → SENSOR_SN (OD Index 20)**

Sensor Serial Number lets you store the serial number of the sensor component of your flowmeter in transmitter memory. This parameter is not used in processing and is not required.

Procedure

1. Obtain the sensor serial number from your sensor tag.
2. Enter the serial number in the **Sensor Serial Number** field.

5.6.2 Configure Sensor Material

Display	Not available
ProLink III	**Device Tools → Configuration → Informational Parameters → Sensor**
Field Communicator	**Configure → Manual Setup → Info Parameters → Sensor Information → Tube Wetted Material**
Fieldbus host	**Device Info TB → SENSOR_MATERIAL (OD Index 23)**

Sensor Material lets you store the type of material used for your sensor's wetted parts in transmitter memory. This parameter is not used in processing and is not required.

Procedure

1. Obtain the material used for your sensor's wetted parts from the documents shipped with your sensor, or from a code in the sensor model number.

   To interpret the model number, refer to the product data sheet for your sensor.
2. Set **Sensor Material** to the appropriate option.

5.6.3 Configure Sensor Liner Material

Display	Not available
ProLink III	**Device Tools → Configuration → Informational Parameters → Sensor**
Field Communicator	**Configure → Manual Setup → Info Parameters → Sensor Information → Tube Lining**
Fieldbus host	**Device Info TB → SENSOR_LINER (OD Index 24)**

Sensor Liner Material lets you store the type of material used for your sensor liner in transmitter memory. This parameter is not used in processing and is not required.

Procedure

1. Obtain your sensor's liner material from the documents shipped with your sensor, or from a code in the sensor model number.

   To interpret the model number, refer to the product data sheet for your sensor.
2. Set **Sensor Liner Material** to the appropriate option.

5.6.4 Configure Sensor Flange Type

Display	Not available
ProLink III	**Device Tools → Configuration → Informational Parameters → Sensor**
Field Communicator	**Configure → Manual Setup → Info Parameters → Sensor Information → Sensor Flange**
Fieldbus host	**Device Info TB → SENSOR_END (OD Index 25)**

Sensor Flange Type lets you store your sensor's flange type in transmitter memory. This parameter is not used in processing and is not required.

Procedure

1. Obtain your sensor's flange type from the documents shipped with your sensor, or from a code in the sensor model number.

   To interpret the model number, refer to the product data sheet for your sensor.
2. Set **Sensor Flange Type** to the appropriate option.

5.6.5 Configure Descriptor

Display	Not available

ProLink III	**Device Tools → Configuration → Informational Parameters → Transmitter**
Field Communicator	**Configure → Manual Setup → Info Parameters → Transmitter Info → Descriptor**
Fieldbus host	**Device Info TB → DESCRIPTION (OD Index 19)**

Descriptor lets you store a description in transmitter memory. The description is not used in processing and is not required.

Procedure

Enter a description for the transmitter or device
You can use up to 16 characters for the description.

6 Complete the configuration

6.1 Back up transmitter configuration

ProLink III provides a configuration upload/download function which allows you to save configuration sets to your PC. This allows you to back up and restore your transmitter configuration. This is also a convenient way to replicate a configuration across multiple devices.

Restriction

This function is not available with any other communications tools.

CAUTION

The FF host "owns" the function blocks and engineering units. Using any communication tool to change the function blocks can cause a database mismatch. A database mismatch can cause the transmitter to go Out of Service (OOS).

Procedure

To back up the transmitter configuration using ProLink III:

a) Choose **Device Tools** → **Configuration Transfer** → **Save or Load Configuration Data**.

b) In the ***Configuration*** group box, select the configuration data you want to save.

c) Click **Save**, then specify a file name and location on your computer.

d) Click **Start Save**.

The backup file is saved to the specified name and location. It is saved as a text file and can be read using any text editor.

6.2 Return function blocks to In Service (Auto) mode

Display	Not available
ProLink III	Not available
Field Communicator	**Overview** → **Mode**
Fieldbus host	**All TBs** → **MODE_BLOCK (OD Index Number 005)**

After modifying function block parameters, the fieldbus function blocks must be placed in service (Auto) mode before you return the device to operation.

7 Transmitter operation

7.1 Record the process variables

Micro Motion suggests that you make a record of specific process variable measurements, including the acceptable range of measurements, under normal operating conditions. This data will help you recognize when the process or diagnostic variables are unusually high or low, and may help you diagnose and troubleshoot application issues.

Procedure

Record the following process and diagnostic variables, under normal operating conditions.

	Measurement		
Variable	**Typical average**	**Typical high**	**Typical low**
Flow rate			
Density			
Temperature			
Tube frequency			
Pickoff voltage			
Drive gain			

7.2 View process variables

Display	Scroll to the desired process variable. If **AutoScroll** is enabled, you can wait until the process variable is displayed. See View process variables using the display for more information.
ProLink III	View the desired variable on the main screen under **Process Variables**. See View process variables and other data using ProLink III for more information.
Field Communicator	**Overview** → **Shortcuts** → **Variables** → **Process Variables**

Process variables provide information about the state of the process fluid, such as flow rate, density, and temperature, as well as running totals. Process variables can also provide data about flowmeter operation, such as drive gain and pickoff voltage. This information can be used to understand and troubleshoot your process.

7.2.1 View process variables using the display

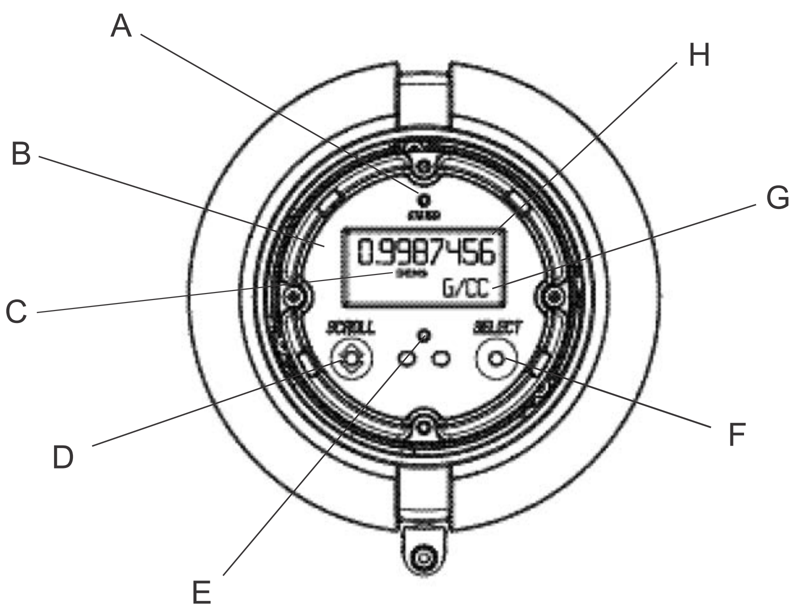
Procedure

View the desired process variables.

The display shows the configured display variables. For each display variable, the display reports the abbreviated name of the process variable (for example, DENS for density), the current value of that process variable, and the associated unit of measure (for example, G/CM^3).

If **Auto Scroll** is enabled, the display cycles through the display variables, showing each display variable for a user-specified number of seconds. Whether or not **Auto Scroll** is enabled, you can activate **Select** to move to the next display variable.

Figure 7-1: Transmitter display features



A. Status LED
B. Display (LCD panel)
C. Process variable
*D. **Scroll** optical switch*
*E. Optical switch indicator: turns red when either **Scroll** or **Select** is activated*
*F. **Select** optical switch*
G. Unit of measure for process variable
H. Current value of process variable

7.2.2 View process variables and other data using ProLink III

Monitor process variables, diagnostic variables, and other data to maintain process quality.

ProLink III automatically displays process variables, diagnostic variables, and other data on the main screen.

Tip
ProLink III allows you to choose the process variables that appear on the main screen. You can also choose whether to view data in Analog Gauge view or digital view, and you can customize the gauge settings. For more information, see the *Prolink III user manual*.

7.2.3 View process variables using the Field Communicator

Monitor process variables to maintain process quality.

Procedure

- To view current values of basic process variables, choose **Overview**.
- To view a more complete set of process variables, plus the current state of the outputs, choose **Service Tools** → **Variables**.

7.3 View transmitter status using the status LED

The status LED shows the current alert condition of the transmitter. The status LED is located on the face of the transmitter.

Procedure

Observe the status LED.

- If your transmitter has a display, you can view the status LED with the transmitter housing cover in place.
- If your transmitter does not have a display, it does not have a status LED. This option is not available.

To interpret the status LED, see the following table.

Restriction
If **LED Blinking** is disabled, the status LED will flash only during calibration. It will not flash to indicate an unacknowledged alarm.

LED state	Description	Recommendation
Solid green	No alerts are active.	Continue with configuration or process measurement.
Flashing green (if enabled)	Unacknowledged corrected condition (no alert)	Continue with configuration or process measurement. Acknowledge the alert if you choose.
Solid yellow	One or more low-severity alerts are active. A low severity alarm can mean one or more process variables is at a set output level (i.e. simulation or two phase timeout).	A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement, but Micro Motion still recommends identifying and resolving the alert condition.
Flashing yellow (if enabled)	Calibration in progress. One or more low-severity alerts are active and have not been acknowledged.	A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement, but Micro Motion still recommends identifying and resolving the alert condition.
Solid red	One or more high-severity alerts are active.	A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing.

LED state	Description	Recommendation
Flashing red (if enabled)	One or more high-severity alerts are active and have not been acknowledged.	A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing. Acknowledge the alert if you choose.

7.4 View and acknowledge status alerts

The transmitter posts status alerts whenever a process variable exceeds its defined limits or the transmitter detects a fault condition. You can view active alerts, and you can acknowledge alerts. Acknowledging alerts is not required.

7.4.1 View and acknowledge alerts using the display

You can view a list containing all alerts that are active, or inactive but unacknowledged. From this list, you can acknowledge individual alerts.

Prerequisites

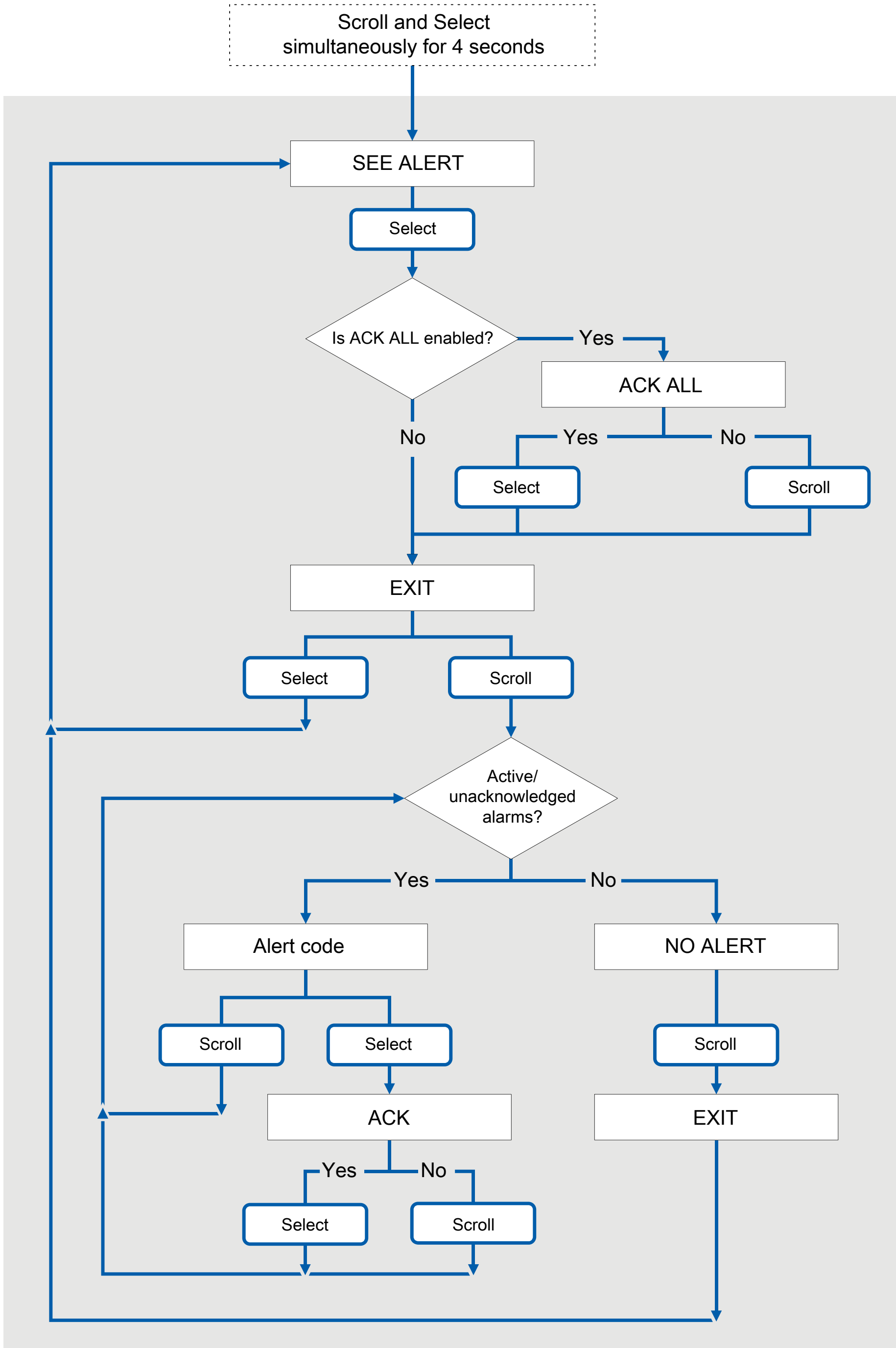
Operator access to the alert menu must be enabled (default setting). If operator access to the alert menu is disabled, you must use another method to view or acknowledge status alerts.

Note
Only Fault and Informational alerts are listed. The transmitter automatically filters out alerts with **Status Alert Severity** set to Ignore.

Procedure

See Figure 7-2.

Figure 7-2: Using the display to view and acknowledge the status alerts (alarms)



Postrequisites

- To clear the following alerts, you must correct the problem, acknowledge the alert, then power-cycle the transmitter: A001, A002, A010, A011, A012, A013, A018, A019, A022, A023, A024, A025, A028, A029, A031.
- For all other alerts:
  - If the alert is inactive when it is acknowledged, it will be removed from the list.
  - If the alert is active when it is acknowledged, it will be removed from the list when the alert condition clears.

Related information

Alert data in transmitter memory

7.4.2 View and acknowledge alerts using ProLink III

You can view a list containing all alerts that are active, or inactive but unacknowledged. From this list, you can acknowledge individual alerts or choose to acknowledge all alerts at once.

Procedure

1. View alerts on the ProLink III **Device Tools** → **Alerts** tab.

   All active or unacknowledged alerts are listed, and displayed according to the following categories:

Category	Description
Failed: Fix Now	A meter failure has occurred and must be addressed immediately.
Maintenance: Fix Soon	A condition has occurred that can be fixed at a later time.
Advisory: Informational	A condition has occurred, but requires no maintenance from you.

   Notes
   - All fault alerts are displayed in the **Failed: Fix Now** category.
   - All information alerts are displayed in either the **Maintenance: Fix Soon** category or the **Advisory: Informational** category. The category assignment is hard-coded.
   - The transmitter automatically filters out alerts with **Alert Severity** set to Ignore.

2. To acknowledge a single alert, check the **Ack** checkbox for that alert. To acknowledge all alerts at once, click **Ack All**.

Postrequisites

- To clear the following alerts, you must correct the problem, acknowledge the alert, then power-cycle the transmitter: A001, A002, A010, A011, A012, A013, A018, A019, A022, A023, A024, A025, A028, A029, A031.
- For all other alerts:
  - If the alert is inactive when it is acknowledged, it will be removed from the list.
  - If the alert is active when it is acknowledged, it will be removed from the list when the alert condition clears.

Related information

Alert data in transmitter memory

7.4.3 View alerts using the Field Communicator

You can view a list containing all alerts that are active, or inactive but unacknowledged.

Procedure

- To view active or unacknowledged alerts, choose **Overview** → **Device Status** or **Service Tools** → **Alerts**.

  All active alerts and unacknowledged alerts are listed.

  Note
  Only Fault and Information alerts are listed. The transmitter automatically filters out alerts with Status Alert Severity set to ignore.

- To refresh the list, choose **Service Tools** → **Alerts** → **Refresh Alerts**.

7.4.4 View alerts using a fieldbus host

Whenever an alert condition occurs, the transmitter sets the fieldbus output status to `Bad` or `Uncertain`. It also posts a Field Diagnostics alert. You can determine which alert and alert condition is active and use this information to choose the appropriate response.

Procedure

- To read alert status for an AI function block or the AO function block, read the BLOCK_ERR index (OD Index 6).
- To obtain more detailed information about active alerts:
  a) Identify the active alerts by reading the following parameters from the resource block:
     — FD_FAIL_ACTIVE (OD Index 43)
     — FD_OFFSPEC_ACTIVE (OD Index 44)
     — FD_MAINT_ACTIVE (OD Index 45)
     — FD_CHECK_ACTIVE (OD Index 46)
  b) For each active alert, obtain the alert detail by reading the status words (OD Index 17, 18, 19, 20, 120) from the Diagnostic transducer block.

Related information

Alert data in transmitter memory
Resource block
Meter verification transducer block

7.4.5 Alert data in transmitter memory

The transmitter maintains three sets of data for every alert that is posted.

For each alert occurrence, the following three sets of data are maintained in transmitter memory:

- Alert List

- Alert Statistics
- Recent Alerts

Alert data structure	Transmitter action if condition occurs	
	Contents	**Clearing**
Alert List	As determined by the alert status bits, a list of: • All currently active alerts • All previously active alerts that have not been acknowledged	Cleared and regenerated with every transmitter power cycle
Alert Statistics	One record for each alert (by alert number) that has occurred since the last master reset. Each record contains: • A count of the number of occurrences • Timestamps for the most recent posting and clearing	Not cleared; maintained across transmitter power cycles
Recent Alerts	50 most recent alert postings or alert clearings	Not cleared; maintained across transmitter power cycles

7.5 Read totalizer and inventory values

Display	To read a totalizer or inventory value from the display, it must be configured as a display variable.
ProLink III	View the desired variable on the main screen under **Process Variables**.
Field Communicator	**Service Tools** → **Variables** → **Totalizer Control**

Totalizers keep track of the total amount of mass or volume measured by the transmitter since the last totalizer reset. Inventories keep track of the total amount of mass or volume measured by the transmitter since the last inventory reset.

Tip
You can use the inventories to keep a running total of mass or volume across multiple totalizer resets.

7.6 Start and stop totalizers and inventories

Display	See Start and stop totalizers and inventories using the display .
ProLink III	**Device Tools** → **Totalizer Control** → **Totalizer and Inventories** → **Start All Totals** **Device Tools** → **Totalizer Control** → **Totalizer and Inventories** → **Stop All Totals**
Field Communicator	**Service Tools** → **Variables** → **Totalizer Control** → **All Totalizers** → **Start Totalizers** **Service Tools** → **Variables** → **Totalizer Control** → **All Totalizers** → **Stop Totalizers**

When you start a totalizer, it tracks process measurement. In a typical application, its value increases with flow. When you stop a totalizer, it stops tracking process measurement and its value does not change with flow. Inventories are started and stopped automatically, when totalizers are started and stopped.

Important
Totalizers and inventories are started or stopped as a group. When you start any totalizer, all other totalizers and all inventories are started simultaneously. When you stop any totalizer, all other totalizers and all inventories are stopped simultaneously. You cannot start or stop inventories directly.

7.6.1 Start and stop totalizers and inventories using the display

Prerequisites

- The Totalizer Start/Stop display function must be enabled.
- At least one totalizer must be configured as a display variable.

Procedure

- To start all totalizers and inventories using the display:

  Note
  If the PLC is connected and communicating, the start/stop and reset totalizers commands might be overriding any totalizer commands from the local display or from ProLink III.

  a) **Scroll** until the word TOTAL appears in the lower left corner of the display.

     Important
     Because all totalizers are started or stopped together, it does not matter which total you use.

  b) **Select**.
  c) **Scroll** until START appears beneath the current totalizer value.
     `Exit` displays beneath the current totalizer value.
  d) **Select**.
  e) **Select** again to confirm.
  f) **Scroll** to EXIT.

- To stop all totalizers and inventories using the display:
  a) **Scroll** until the word TOTAL appears in the lower left corner of the display.

     Important
     Because all totalizers are started or stopped together, it does not matter which total you use.

  b) **Select**.
  c) **Scroll** until STOP appears beneath the current totalizer value.
  d) **Select**.
  e) **Select** again to confirm.
  f) **Scroll** to EXIT.

7.7 Reset totalizers

Display	See Reset totalizers using the display
ProLink III	**Device Tools → Totalizer Control → Totalizer and Inventories → Reset Mass Total** **Device Tools → Totalizer Control → Totalizer and Inventories → Reset Volume Total** **Device Tools → Totalizer Control → Totalizer and Inventories → Reset Gas Total** **Device Tools → Totalizer Control → Totalizer and Inventories → Reset All Totals**
Field Communicator	**Service Tools → Variables → Totalizer Control → Mass → Mass Total** **Service Tools → Variables → Totalizer Control → Gas Standard Volume → Volume Total** **Service Tools → Variables → Totalizer Control → Gas Standard Volume → GSV Total** **Service Tools → Variables → Totalizer Control → All Totalizers → Reset All Totals**

When you reset a totalizer, the transmitter sets its value to 0. It does not matter whether the totalizer is started or stopped. If the totalizer is started, it continues to track process measurement.

Tip
When you reset a single totalizer, the values of other totalizers are not reset. Inventory values are not reset.

7.7.1 Reset totalizers using the display

Prerequisites

- The Totalizer Reset display function must be enabled.
- The totalizer that you want to reset must be configured as a display variable. For example:
  - If you want to reset the mass totalizer, **Mass Total** must be configured as a display variable.
  - If you want to reset the volume totalizer, **Volume Total** must be configured as a display variable.

Procedure

- To reset the mass totalizer:
  a) **Scroll** until the mass totalizer value appears.
  b) **Select**.
     `Exit` displays beneath the current totalizer value.
  c) Scroll until `Reset` displays beneath the current totalizer value.
  d) **Select**.
     `Reset` and `Yes?` alternately flash beneath the current totalizer value.
  e) **Select** again to confirm.
  f) **Scroll** to EXIT.
  g) **Select**.
- To reset the volume totalizer:
  a) **Scroll** until the volume totalizer value appears.
  b) **Select**.
     `Exit` displays beneath the current totalizer value.

c) Scroll until `Reset` displays beneath the current totalizer value.

d) **Select**.
`Reset` and `Yes?` alternately flash beneath the current totalizer value.

e) **Select** again to confirm.

f) **Scroll** to EXIT.

g) **Select**.

- To reset the gas standard volume totalizer:

  a) **Scroll** until the gas standard volume totalizer value appears.

  b) **Select**.
  `Exit` displays beneath the current totalizer value.

  c) Scroll until `Reset` displays beneath the current totalizer value.

  d) **Select**.
  `Reset` and `Yes?` alternately flash beneath the current totalizer value.

  e) **Select** again to confirm.

  f) **Scroll** to EXIT.

  g) **Select**.

7.8 Reset inventories

ProLink III	**Device Tools → Totalizer Control → Totalizer and Inventories → Reset Mass Inventory** **Device Tools → Totalizer Control → Totalizer and Inventories → Reset Volume Inventory** **Device Tools → Totalizer Control → Totalizer and Inventories → Reset Gas Inventory** **Device Tools → Totalizer Control → Totalizer and Inventories → Reset All Inventories**

When you reset an inventory, the transmitter sets its value to 0. It does not matter whether the inventory is started or stopped. If the inventory is started, it continues to track process measurement.

Tip
Mass and volume inventory totals cannot be set separately. They can only be reset together simultaneously.

Prerequisites

To use ProLink III to reset the inventories, the feature must be enabled.

To enable inventory reset in ProLink III:

1. Choose **Tools > Options**.

2. Select **Reset Inventories from ProLink III**.

3. Select **OK**.

Once enabled, this feature remains enabled until it is disabled.

8 Measurement support

8.1 Options for measurement support

Micro Motion provides several measurement support procedures to help you evaluate and maintain your flowmeter's accuracy.

The following methods are available:

- Smart Meter Verification (SMV) 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.
- Meter validation compares flowmeter measurements reported by the transmitter to an external measurement standard. Meter validation requires one data point.
- Calibration establishes the relationship between a process variable and the signal produced at the sensor. You can calibrate the flowmeter for zero, density, and temperature. Density and temperature calibration require two data points (low and high) and an external measurement for each.

Tip

- Perform SMV at regular intervals to get the best data on your meter's performance.
- To prove the meter against a regulatory standard, or to correct measurement error, use meter validation and meter factors.
- Before performing a field calibration, contact customer support to see if there is an alternative. In many cases, field calibrations have a negative effect on measurement accuracy.

8.2 Use Smart Meter Verification

Smart Meter Verification™ provides in-process flow meter health verification by analyzing the meter components related to measurement performance. You can run Smart Meter Verification without stopping the process. Use this section to run a Smart Meter Verification test, view and interpret the results, set up automatic execution, and check if a field reference point has been established.

8.2.1 SMV requirements

To use SMV, the transmitter must be paired with an 800 enhanced core processor.

See Table 8-1 for the minimum version of the transmitter, an 800 enhanced core processor, and communication tool needed to support SMV. (If you are going to perform SMV using the display, only the transmitter and enhanced core processor versions apply.)

Table 8-1: Minimum SMV version

Item	Minimum version (legacy)	Minimum basic SMV transmitter
Transmitter	6.0	9.0
Enhanced core processor	3.6	4.4
ProLink III	1.0	4.0

Table 8-1: Minimum SMV version *(continued)*

Item	Minimum version (legacy)	Minimum basic SMV transmitter
Field Communicator	FOUNDATION Fieldbus device description: device rev 6, DD rev 1	FOUNDATION Fieldbus device description: device rev 9, DD rev 1

8.2.2 SMV test preparation

Prerequisites

The following information pertains to the transmitter when connected to an 800 enhanced core processor greater than or equal to v4.7 .

- To avoid or reduce corrosion, erosion, and other process effects, make sure the sensor tube material is compatible with the process fluid in use. For more information, see the *Micro Motion Corrosion Guide*.
- **Important**
  Micro Motion highly recommends:
  - Running the first Smart Meter Verification test when the flow meter is installed in the pipeline according to the installation instructions, and the process is running at its normal operating conditions
  - Running all tests thereafter at similar operating conditions
- The Smart Meter Verification test runs best when process conditions are stable. If process conditions are too unstable, the test will abort. To maximize process stability:
  - Maintain a constant fluid temperature and pressure.
  - Maintain a constant flow rate. If possible, stop flow through the sensor. The sensor should be full of process fluid.
  - Avoid changes to fluid composition; for example, two-phase flow or settling.
- For all applications, run Smart Meter Verification while commissioning the meter at normal operating conditions and then run it regularly. Micro Motion also recommends using Smart Meter Verification results along with other diagnostics like drive gain and density to help determine the health of a sensor.
- In certain scenarios, Smart Meter Verification field upgrades for pre-installed meters are possible. Contact factory support to discuss pre-installed meter upgrades.

8.2.3 Smart Meter Verification capabilities

Capability	Basic	Professional
	Included	Licensed
Calibration coefficients audit	•	•
Zero audit	•	•
Electronics verification	•	•
Automatic test scheduler	•	•
History of previous 20 results	•	•

Capability	Basic	Professional
	Included	Licensed
Verification report		• (1)

(1) *Create and export with Prolink III, web page, or AMS SNAP-ON.*

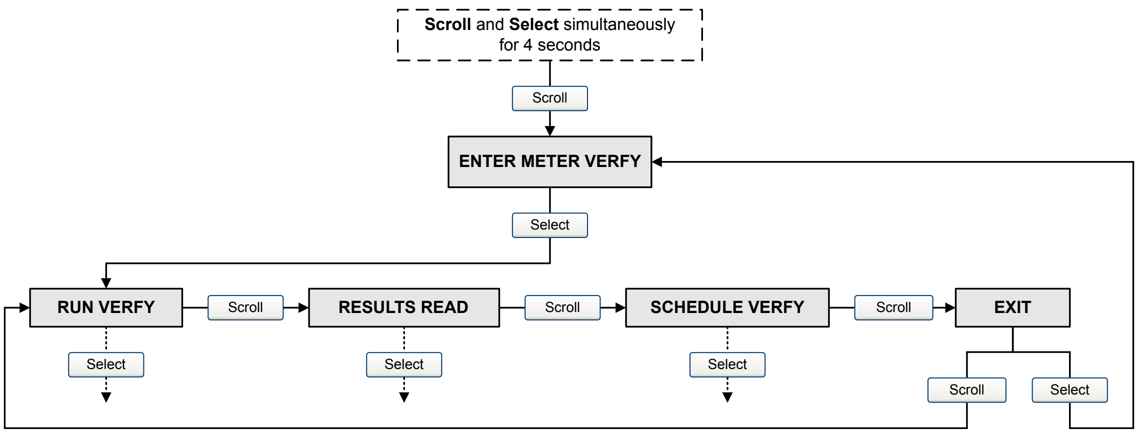
8.2.4 Run SMV

Run an SMV test using the display

Procedure

1. Navigate to the *Smart Meter Verification* menu.

Figure 8-1: SMV – Top-level menu



2. Choose **Run Verify**.
3. Choose **Outputs** and select the desired output behavior.

Option	Description
Continue Measuring	During the test, all outputs will continue to report their assigned process variable. The test will run for approximately 90 seconds.
Fault	During the test, all outputs will go to their configured fault action. The test will run for approximately 140 seconds.
Last Value	During the test, all outputs will report the last measured value of their assigned process variable. The test will run for approximately 140 seconds.

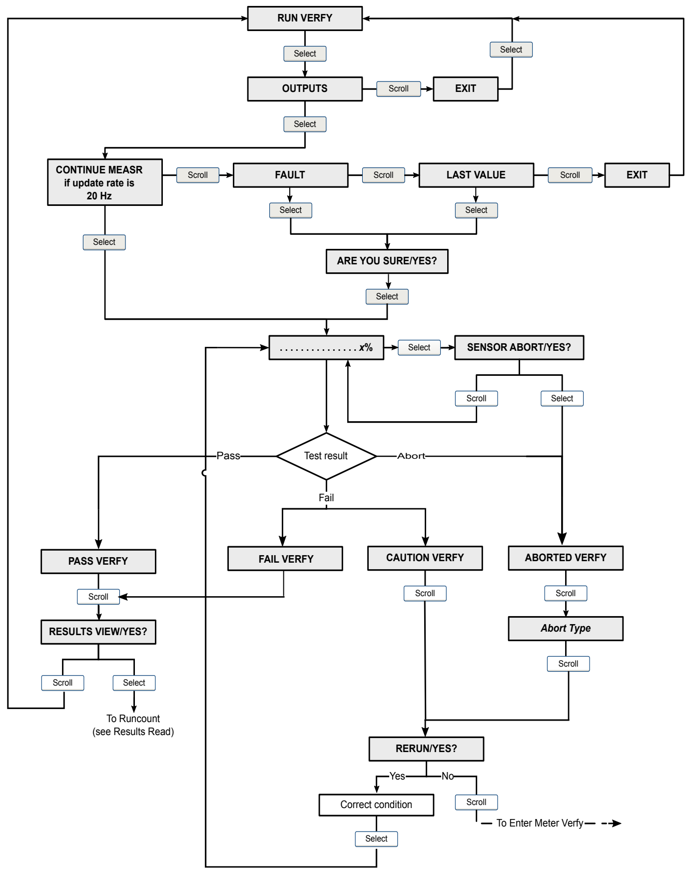
While the test is in progress, dots traverse the display and test progress is shown.

Postrequisites

View the test results and take any appropriate actions.

SMV flowchart: Running a test using the display

Figure 8-2: Running an SMV test using the display



Run an SMV test using ProLink III

Procedure

1. Choose **Device Tools** → **Diagnostics** → **Meter Verification** → **Run Test**.

   You may need to wait a few seconds while ProLink III synchronizes its database with the transmitter data.

2. Enter any desired information on the *Test Definition* screen, and click **Next**.

   All information on this screen is optional.

3. Choose the desired output behavior.

Option	Description
Continue Measuring	During the test, all outputs will continue to report their assigned process variable. The test will run for approximately 90 seconds.
Held at Last Value	During the test, all outputs will report the last measured value of their assigned process variable. The test will run for approximately 140 seconds.

Option	Description
Held at Fault	During the test, all outputs will go to their configured fault action. The test will run for approximately 140 seconds.

4. Press **Start**.
   Test progress is displayed on the screen.

Postrequisites

View the test results and take any appropriate actions. You can also print the report.

Run an SMV test using the Field Communicator

Procedure

1. Navigate to the *Smart Meter Verification* menu:
   - **Overview → Shortcuts → Meter Verification**
   - **Service Tools → Maintenance → Routine Maintenance → Meter Verification**
2. Choose **Manual Verification**.
3. Choose **Start**.
4. Set output behavior as desired, and press **OK** if prompted.

Option	Description
Continue Measuring	During the test, all outputs will continue to report their assigned process variable. The test will run for approximately 90 seconds.
Outputs Held at Last Value	During the test, all outputs will report the last measured value of their assigned process variable. The test will run for approximately 140 seconds.
Outputs Held at Fault	During the test, all outputs will go to their configured fault action. The test will run for approximately 140 seconds.

   Test progress is displayed on the screen.

Postrequisites

View the test results and take any appropriate actions.

8.2.5 View test data

You can view the results of the current test. You can also view results from previous tests.

Important
You can view previous test results and see detailed test reports only if SMV is licensed.

The transmitter stores the following information about the previous twenty SMV tests:

- Powered-on hours at the time of the test.
- Test result (Pass, Fail, Abort).
- Abort code, if applicable.

In addition, ProLink III provides a detailed test reporting and analysis framework. This information is stored on the PC where ProLink III is installed for tests that were run only on that PC. It includes:

- 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
- Customer and test descriptions (if entered by the user)

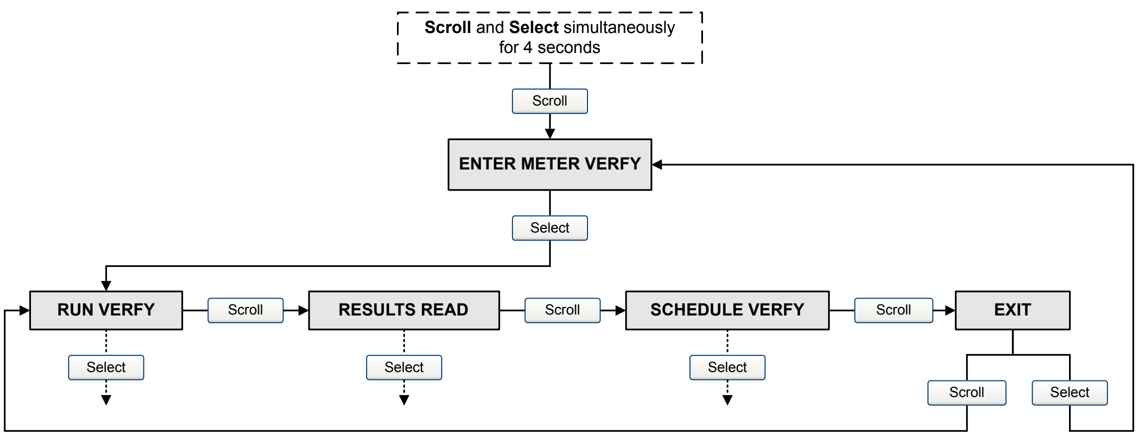
You can use ProLink III to run a test that displays a test result chart and a test report at the completion of the test. On-screen directions are provided to manipulate the test data or export the data to a CSV file for offline analysis.

View test result data using the display

Procedure

1. If you have just run a test, results are displayed automatically at the end of the test.
2. If SMV is licensed, and you want to view results from previous tests:
   a) Navigate to the *Smart Meter Verification* menu.

Figure 8-3: SMV – Top-level menu



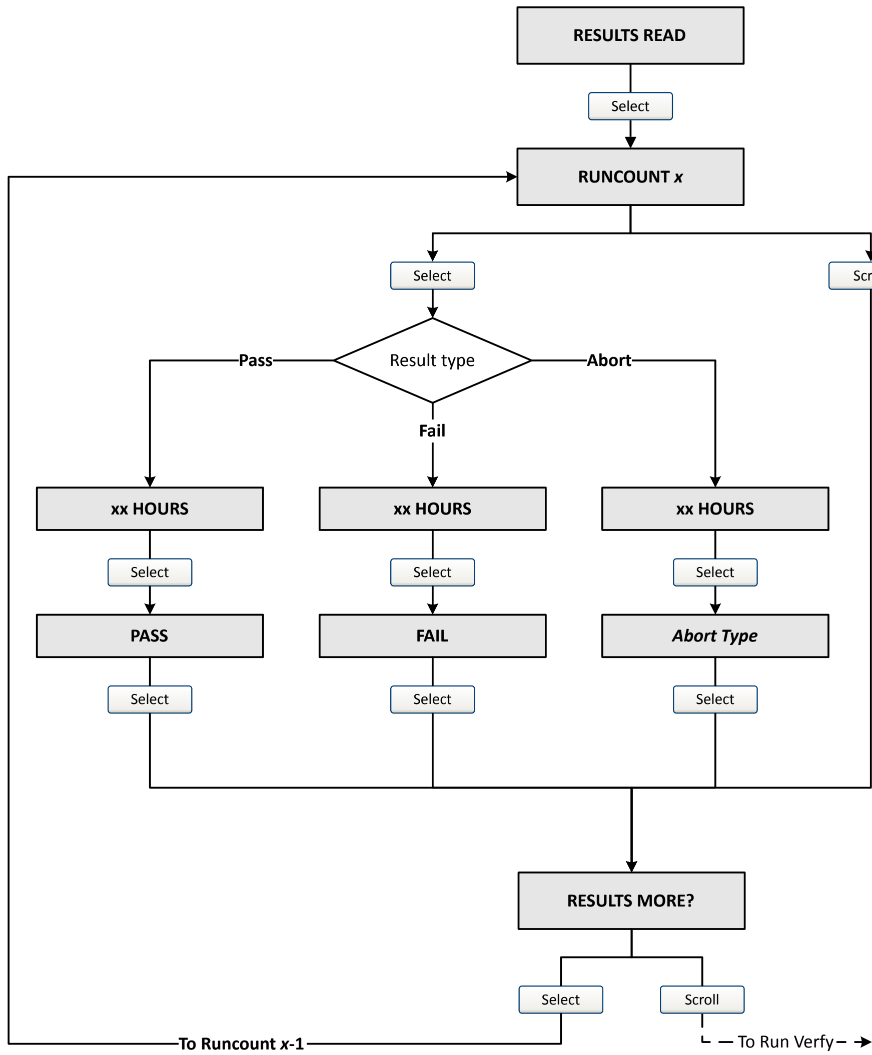
   b) Scroll to **Results Read** and press **Select**.
   The runcount of the most recent test is displayed.

   c) To view data for this test, press **Select**, then press **Scroll** to scroll through test data.

   d) To select a different test, press **Scroll**, then press **Select** when the transmitter displays **Results More?**. When the desired test appears, as identified by runcount, press **Select**.

SMV flowchart: Viewing test results using the display

Figure 8-4: Viewing SMV test results using the display



Note

If you have a basic (unlicensed version) of SMV, you will not be prompted for results.

View test result data using ProLink III

Prerequisites

You can view test result data only if your SMV is licensed and only for tests that were run on the PC you are currently using.

Procedure

1. Choose **Device Tools** → **Diagnostics** → **Meter Verification** and click **Previous Test Results**.
   The chart shows test results for all tests stored in the ProLink III database.

2. (Optional) Click **Next** to view and print a test report.
3. (Optional) Click **Export Data to CSV File** to save the data to a file on your PC.

View test result data using the Field Communicator

Prerequisites

You can view test result data only if your SMV is licensed.

Procedure

1. Navigate to the *Smart Meter Verification* menu:
   - **Overview → Shortcuts → Meter Verification**
   - **Service Tools → Maintenance → Routine Maintenance → Meter Verification**
2. (Optional) If the Field Communicator database is out of date, choose **Upload Results Data from Device**.
3. To view data from the most recent test, choose **Most Recent Test Results**.
4. To view data for all tests in the Field Communicator database:
   a) Press **Show Results Table**.
      Data from the most recent test is displayed.
   b) Press **OK** to scroll through data from previous tests.
   c) To exit the results table, press **Abort**.

Interpreting Smart Meter Verification results

When the Smart Meter Verification Basic or Professional test is completed, the result is reported as Pass, Fail, or Abort. (Some tools report the Fail result as `Advisory` instead.)

Pass The meter is performing within factory specifications.

Abort When you execute a Smart Meter Verification Basic or Professional test, the test performs a self-diagnostic check to ensure that the flow meter is stable prior to running the test. In the rare case that this check reveals an issue, Smart Meter Verification will report an abort code.

If you manually cancel an in-process Smart Meter Verification Basic or Professional test, the test result displays `Abort Code 1: User-Initiated Abort`. In this case, you can restart Smart Meter Verification without any further action. In the rare case any other abort occurs, contact factory support.

In all cases where a Smart Meter Verification Professional test aborts, no report will be generated.

Fail If a Smart Meter Verification Basic or Professional test ran at normal operating conditions while conditions were stable and failed, see Resolve a failed Smart Meter Verification test.

8.2.6 Resolving a failed Smart Meter Verification test

Use this procedure if a Smart Meter Verification Basic or Professional test ran at normal operating conditions while conditions were stable and failed.

Procedure

1. Verify the sensor by performing a visual inspection, density verification, or field proving.
2. If possible, run Smart Meter Verification Professional with Prolink III Basic or Professional and save the results as follows:
    - In a `.csv` file
    - In a report
3. Contact the factory for further evaluation and instructions.

8.2.7 Schedule automatic execution of the SMV test

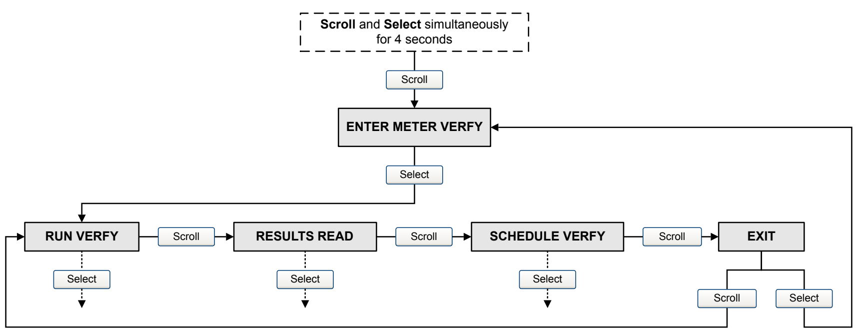
You can set up and run a single test at a user-defined future time. You can also set up and run tests on a regular schedule.

Manage scheduled test execution using the display

Procedure

1. Navigate to the *Smart Meter Verification* menu.

Figure 8-5: SMV – Top-level menu

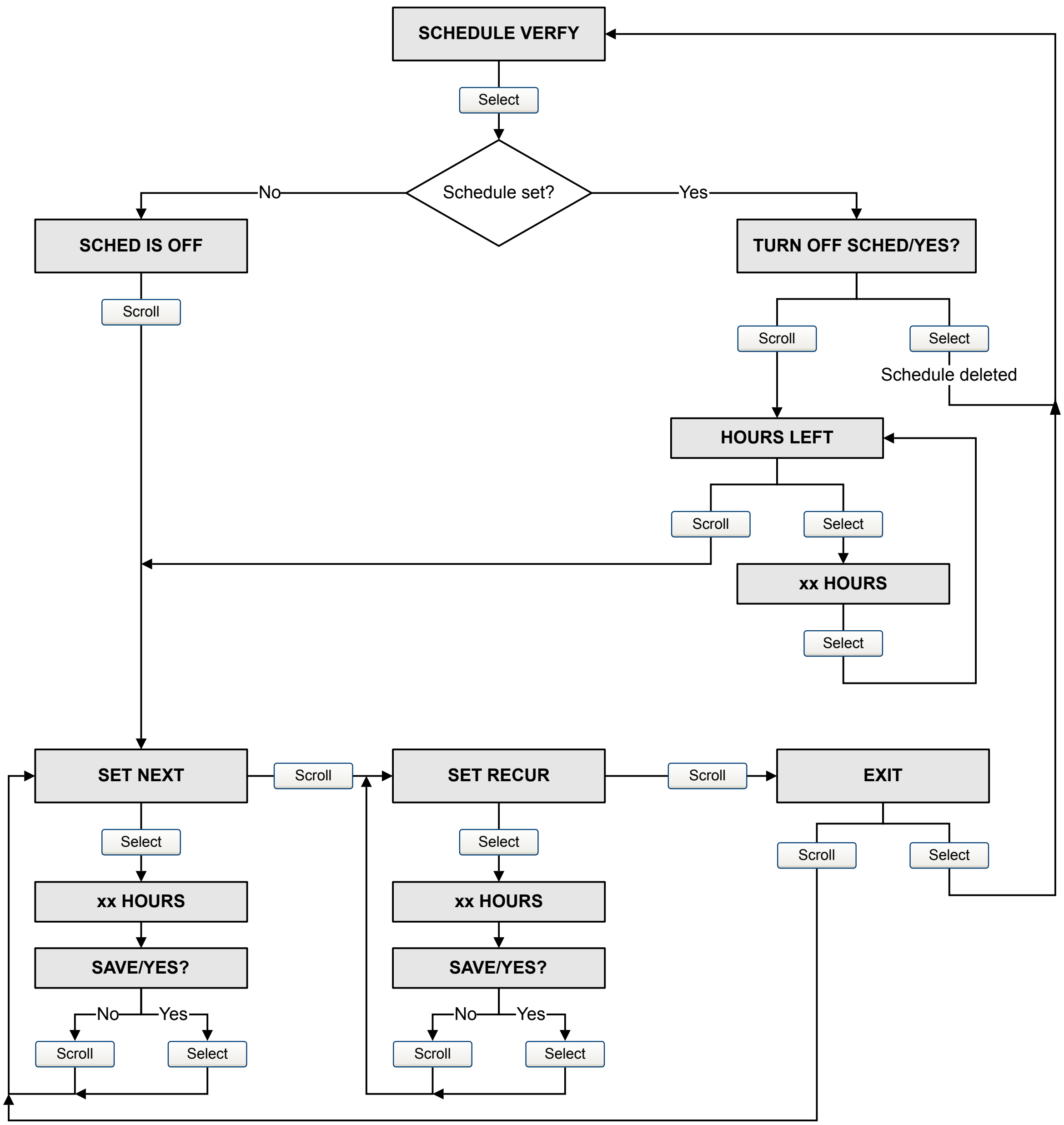


2. Scroll to **Schedule Verfy** and press **Select**.
3. To schedule a single test or the first test in recurring execution:
    a) Scroll to **Set Next** and press **Select**.
    b) Enter the number of hours that the transmitter will wait before beginning the test.
4. To schedule recurring execution:
    a) Scroll to **Set Recur** and press **Select**.
    b) Enter the number of hours that will elapse between tests.
5. To disable scheduled execution:

- To disable execution of a single scheduled test, set **Set Next** to 0.
- To disable recurring execution, set **Set Recur** to 0.
- To disable all scheduled execution, choose **Turn Off Sched** when you enter the *Smart Meter Verification* menu.

SMV flowchart: Scheduling test execution using the display

Figure 8-6: Scheduling SMV test execution using the display



Manage scheduled test execution using ProLink III

Procedure

1. Choose **Device Tools** → **Diagnostics** → **Meter Verification** → **Schedule Meter Verification**.
2. To schedule a single test or the first test in recurring execution, specify a value for **Hours Until Next Run**.
3. To schedule recurring execution, specify a value for **Hours Between Recurring Runs**.
4. To disable scheduled execution:
   - To disable execution of a single scheduled test, set **Hours Until Next Run** to 0.
   - To disable recurring execution, set **Hours Between Recurring Runs** to 0.
   - To disable all scheduled execution, click **Disable Scheduled Execution**.

8.3 Zero the meter

Display	**OFFLINE MAINT** → **ZERO** → **CAL ZERO** → **CAL/YES?** To restore the zero value set at the factory: **OFFLINE MAINT** → **ZERO** → **RESTORE ZERO** → **RESTORE/YES?** This function requires the enhanced core processor.
ProLink III	**Device Tools** → **Calibration** → **Zero Verification and Calibration** → **Calibrate Zero**
Field Communicator	**Service Tools** → **Maintenance** → **Zero Calibration** → **Perform Auto Zero**

Zeroing the meter establishes a baseline for process measurement by analyzing the sensor's output when there is no flow through the sensor tubes.

Prerequisites

Verify the zero and prepare the meter using the procedures in Verify the zero.

Procedure

Zero the meter.

If necessary, modify **Zero Time**. **Zero Time** controls the amount of time the transmitter takes to determine its zero-flow reference point. The default **Zero Time** is 20 seconds. For most applications, the default **Zero Time** is appropriate.

Postrequisites

Restore normal flow through the sensor by opening the valves. Verify that the sensor tubes are full.

Need help?

If the zero fails:

- Verify that there is no flow through the sensor, then retry.
- Remove or reduce sources of electromechanical noise, then retry.
- Set **Zero Time** to a lower value, then retry.
- If the zero continues to fail, contact customer service.

8.4 Validate the meter

Display	**OFF-LINE MAINT → Config MTR F**
ProLink III	**Device Tools → Configuration → Process Measurement → Flow** **Device Tools → Configuration → Process Measurement → Density**
Field Communicator	**Configure → Manual Setup → Measurements → Flow** **Configure → Manual Setup → Measurements → Density**

Meter validation compares flowmeter measurements reported by the transmitter to an external measurement standard. If the transmitter value for mass flow, volume flow, or density measurement is significantly different from the external measurement standard, you may want to adjust the corresponding meter factor. The flowmeter's actual measurement is multiplied by the meter factor, and the resulting value is reported and used in further processing.

Prerequisites

Identify the meter factor(s) that you will calculate and set. You may set any combination of the three meter factors: mass flow, volume flow, and density. Note that all three meter factors are independent:

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

Important
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.

If you plan to calculate the meter factor for volume flow, be aware that validating 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 measurement is to calculate the meter factor for volume flow from the meter factor for density. See Alternate method for calculating the meter factor for volume flow for instructions on this method.

Obtain a reference device (external measurement device) for the appropriate process variable.

Important
For good results, the reference device must be highly accurate.

Procedure

1. Determine the meter factor as follows:
   a) Set the meter factor to 1 to take a sample measurement.
   b) Measure the same sample using the reference device.
   c) Calculate the meter factor using the following formula:

$$NewMeterFactor = ConfiguredMeterFactor \times \left(\frac{ReferenceMeasurement}{FlowmeterMeasurement}\right)$$

2. Ensure that the calculated meter factor does not fall outside 0.98 and 1.02. If the meter factor is outside these limits, contact customer service.
3. Configure the meter factor in the transmitter.

Calculating the meter factor for mass flow

The flowmeter is installed and validated for the first time. The mass flow measurement from the transmitter is 250.27 lb. The mass flow measurement from the reference device is 250 lb. The mass flow meter factor is calculated as follows:

$$MeterFactor_{MassFlow} = 1 \times \left(\frac{250}{250.27}\right) = 0.9989$$

The first meter factor for mass flow is 0.9989.

One year later, the flowmeter is validated again. The mass flow measurement from the transmitter is 250.07 lb. The mass flow measurement from the reference device is 250.25 lb. The new mass flow meter factor is calculated as follows:

$$MeterFactor_{MassFlow} = 0.9989 \times \left(\frac{250.25}{250.07}\right) = 0.9996$$

The new meter factor for mass flow is 0.9996.

8.4.1 Alternate method for calculating the meter factor for volume flow

The alternate method for calculating the meter factor for volume flow is used to avoid the difficulties that may be associated with the standard method.

This alternate method is based on the fact that volume is inversely proportional to density. It provides partial correction of the volume flow measurement by adjusting for the portion of the total offset that is caused by the density measurement offset. Use this method only when a volume flow reference is not available, but a density reference is available.

Procedure

1. Calculate the meter factor for density, using the standard method.
2. Calculate the meter factor for volume flow from the meter factor for density:

   $$MeterFactor_{Volume} = \left(\frac{1}{MeterFactor_{Density}}\right)$$

   The following equation is mathematically equivalent to the first equation. You may use whichever version you prefer.

   $$MeterFactor_{Volume} = ConfiguredMeterFactor_{Density} \times \left(\frac{Density_{Flowmeter}}{Density_{ReferenceDevice}}\right)$$

3. Ensure that the calculated meter factor does not fall outside 0.98 and 1.02. If the meter factor is outside these limits, contact customer service.
4. Configure the meter factor for volume flow in the transmitter.

8.5 Perform a (standard) D1 and D2 density calibration

Density calibration establishes the relationship between the density of the calibration fluids and the signal produced at the sensor. Density calibration includes the calibration of the D1 (low-density) and D2 (high-density) calibration points.

Important
Micro Motion flow meters are calibrated at the factory, and normally do not need to be calibrated in the field. Calibrate the flow meter only if you must do so to meet regulatory requirements. Contact customer support before calibrating the flow meter.

Tip
Use meter validation and meter factors, rather than calibration, to prove the meter against a regulatory standard or to correct measurement error.

Prerequisites

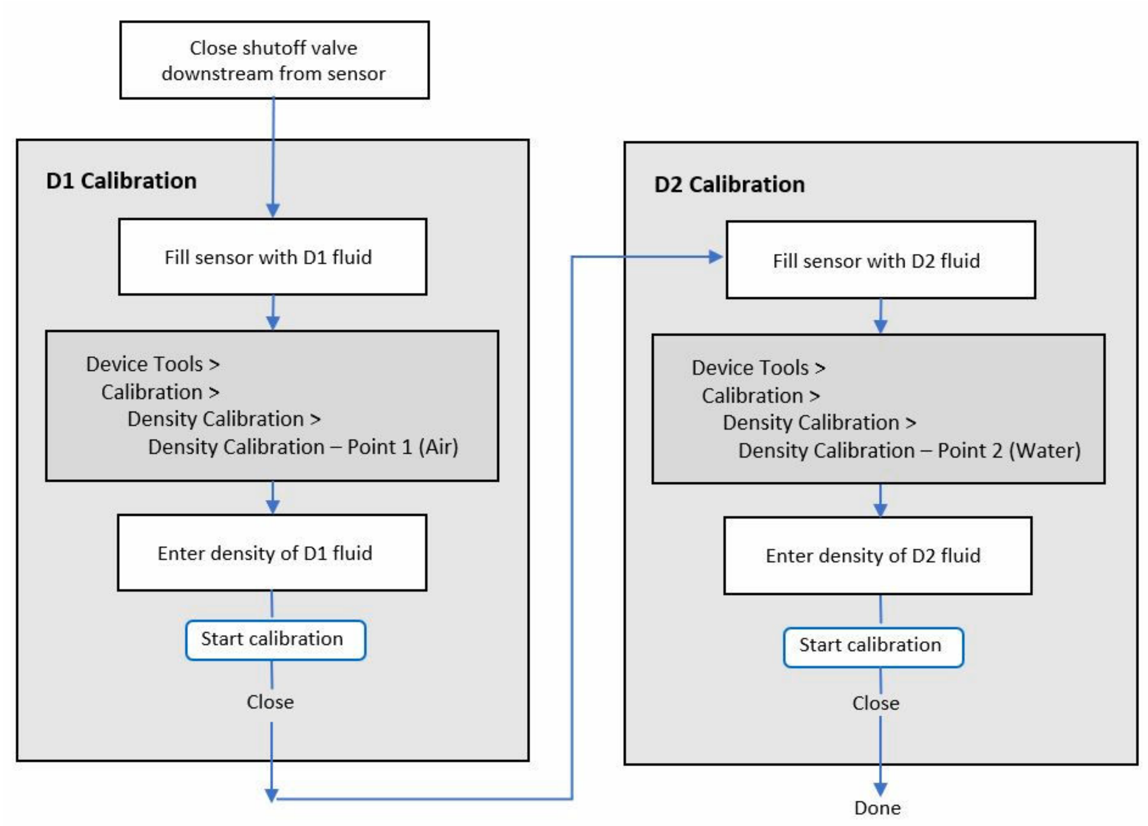
- During density calibration, the sensor must be completely filled with the calibration fluid, and flow through the sensor must be at the lowest rate allowed by your application. This is usually accomplished by closing the shutoff valve downstream from the sensor, then filling the sensor with the appropriate fluid.
- D1 and D2 density calibration require a D1 (low-density) fluid and a D2 (high-density) fluid. You may use air and water.
- If **LD Optimization** is enabled on your meter, disable it. To do this using a field communicator, choose **Configure** → **Manual Setup** → **Measurements** → **Optional Setup** → **LD Optimization**. **LD Optimization** is used only with large sensors in hydrocarbon applications. If you are not using a field communicator, contact Emerson before continuing.
- The calibrations must be performed without interruption, in the order shown. Make sure that you are prepared to complete the process without interruption.
- Before performing the calibration, record your current calibration parameters. You can do this by saving the current configuration to a file on the PC. If the calibration fails, restore the known values.

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

8.5.1 Perform a D1 and D2 density calibration using ProLink III

Procedure

1. Read the Prerequisites in Perform a (standard) D1 and D2 density calibration if you have not already done so.
2. See the following figure.

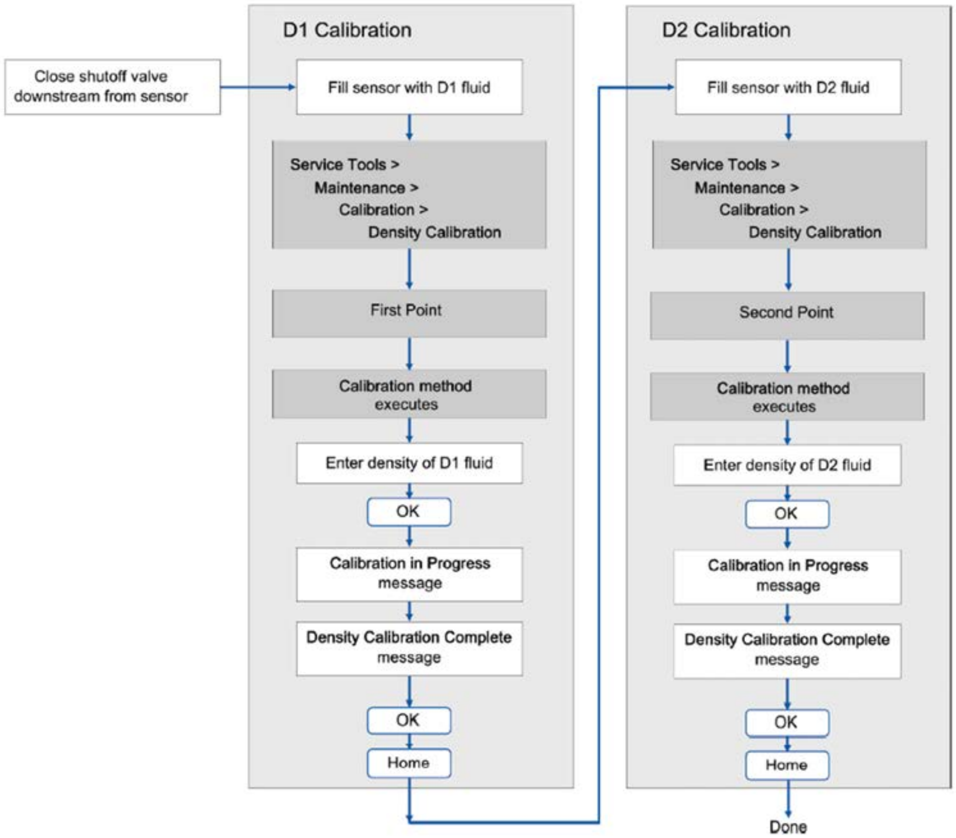


8.5.2 Perform a D1 and D2 density calibration using a field communicator

Procedure

1. Read the Prerequisites in Perform a (standard) D1 and D2 density calibration if you have not already done so.

2. See the following figure.



8.6 Perform temperature calibration

Temperature calibration establishes the relationship between the temperature of the calibration fluids and the signal produced by the sensor.

Prerequisites

The temperature calibration is a two-part procedure: temperature offset calibration and temperature slope calibration. The two parts must be performed without interruption, in the order shown. Ensure that you are prepared to complete the process without interruption. You will need a low-temperature calibration fluid and a high-temperature calibration fluid. You will not see the effect of the calibration until both the temperature offset calibration and the temperature slope calibration are complete.

Important
Consult customer support before performing a temperature calibration. Under normal circumstances, the temperature circuit is stable and should not need an adjustment.

8.6.1 Perform temperature calibration using a fieldbus host

Procedure

1. Write the temperature units to be used for calibration to **Calibration TB → CAL_TEMPERATURE_UNITS (OD Index 56)**.

Code in decimal	Description
1000	K
1001	degC
1002	degF
1003	degR

2. Fill the sensor with the low-temperature fluid.
3. Wait until the sensor achieves thermal equilibrium.
4. Enter the temperature of the low-temperature fluid: **Calibration TB → TEMP_VALUE (OD Index 44)**.
5. Write `1` to **Calibration TB → TEMP_LOW_CAL (OD Index 42)** to start the temperature offset calibration.
6. Monitor the calibration using **Calibration TB → SNS_ZeroInProgress (OD Index 55)**.
   - 0=No calibration in progress
   - 1=Calibration in progress

   When the calibration is complete, the updated temperature offset and temperature slope values are stored in transmitter memory.
7. Fill the sensor with the high-temperature fluid.
8. Wait until the sensor achieves thermal equilibrium.
9. Enter the temperature of the high-temperature fluid: **Calibration TB → TEMP_VALUE (OD Index 44)**.
10. Write `1` to **Calibration TB → TEMP_HIGH_CAL (OD Index 43)**to start the temperature slope calibration.
11. Monitor the calibration using **Calibration TB → SNS_ZeroInProgress (OD Index 55)**.
    - 0=No calibration in progress
    - 1=Calibration in progress

When the calibration is complete, the updated temperature offset and temperature slope values are stored in transmitter memory. To read them:

- Temperature offset: **Calibration TB → TEMP_OFFSET (OD Index 45)**
- Temperature slope: **Calibration TB → TEMP_SLOPE (OD Index 46)**

9 Troubleshooting

9.1 Density measurement problems

Problem	Possible causes	Recommended actions
Inaccurate density reading	• Problem with process fluid • Incorrect density calibration factors • Wiring problem • Incorrect grounding • Two-phase flow • Plugged or coated sensor tube • Incorrect sensor orientation • RTD failure • Physical characteristics of sensor have changed	• Check your process conditions against the values reported by the device. • Ensure that all of the calibration parameters have been entered correctly. See the sensor tag or the calibration sheet for your meter. • Check the wiring between the sensor and the transmitter. • Check the grounding of all components. • Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter. • Check for two-phase flow. • If two sensors with similar frequency are too near each other, separate them. • Purge the sensor tubes.
Unusually high density reading	• Plugged or coated sensor tube • Incorrect density calibration factors • Incorrect temperature measurement • RTD problem • In high-frequency meters, this can indicate erosion or corrosion • In low-frequency meters, this can indicate tube fouling	• Ensure that all of the calibration parameters have been entered correctly. See the sensor tag or the calibration sheet for your meter. • Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter. • Purge the sensor tubes. • Check for coating in the flow tubes.
Unusually low density reading	• Two-phase flow • Ensure that all of the calibration parameters have been entered correctly. See the sensor tag or the calibration sheet for your meter. • In low-frequency meters, this can indicate erosion or corrosion	• Check your process conditions against the values reported by the device. • Check for two-phase flow. • Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter. • Check the wiring between the sensor and the transmitter. • Check for tube erosion, especially if the process fluid is abrasive.

9.2 Check the drive gain

Excessive or erratic drive gain may indicate any of a variety of process conditions or sensor problems.

To know whether your drive gain is excessive or erratic, you must collect drive gain data during the problem condition and compare it to drive gain data from a period of normal operation.

Excessive (saturated) drive gain

Table 9-1: Possible causes and recommended actions for excessive (saturated) drive gain

Possible cause	Recommended actions
Bent sensor tube	Check the pickoff voltages (see Check the pickoff voltage). If either of them are close to zero (but neither is zero), the sensor tubes may be bent. The sensor will need to be replaced.
Cracked sensor tube	Replace the sensor.
Core processor or module failure	Contact customer support.
Flow rate out of range	Ensure that the flow rate is within sensor limits.
Open drive or pickoff sensor coil	Contact customer support.
Over-pressurized tubes	Contact customer support.
Plugged sensor tube	A dull, audible hum, and unusually high sensor vibration is usually accompanied by high, even saturated, drive gain. Check the pickoff voltages (see Check the pickoff voltage). If either of them are close to zero (but neither is zero), plugged tubes may be the source of your problem. Purge the tubes. In extreme cases, you may need to replace the sensor.
Sensor case full of process fluid	Replace the sensor.
Sensor imbalance	Contact customer support.
Sensor tubes not completely full	Correct process conditions so that the sensor tubes are full.
Two-phase flow	Check for two-phase flow. See Check for two-phase flow (slug flow).
Vibrating element not free to vibrate	Ensure that the vibrating element is free to vibrate.

Erratic drive gain

Table 9-2: Possible causes and recommended actions for erratic drive gain

Possible cause	Recommended actions
Foreign material caught in sensor tubes	• Purge the sensor tubes. • Replace the sensor.

9.2.1 Collect drive gain data

Drive gain data can be used to diagnose a variety of process and equipment conditions. Collect drive gain data from a period of normal operation, and use this data as a baseline for troubleshooting.

Procedure

1. Navigate to the drive gain data.
2. Observe and record drive gain data over an appropriate period of time, under a variety of process conditions.

9.3 Check for internal electrical problems

Shorts between sensor terminals or between the sensor terminals and the sensor case can cause the sensor to stop working.

Possible cause	Recommended action
Moisture inside the sensor junction box	Ensure that the junction box is dry and no corrosion is present.
Liquid or moisture inside the sensor case	Contact customer support.
Internally shorted feedthrough	Contact customer support.
Faulty cable	Replace the cable.
Improper wire termination	Verify wire terminations inside the sensor junction box. See Micro Motion 9-Wire Flowmeter Cable Preparation and Installation Manual *Micro Motion 9-Wire Flow Meter Cable Preparation and Installation Guide*.
Shorts to the housing created by trapped or damaged wires	Contact customer support.
Loose wires or connectors	Contact customer support.
Liquid or moisture inside the housing	Contact customer support.

9.3.1 Check the sensor coils

Checking the sensor coils can identify a cause for a no sensor response alert.

Restriction
This procedure applies only to 9-wire remote-mount transmitters and remote transmitters with remote core processors.

Procedure

1. Disconnect power to the transmitter.

   WARNING
   If the transmitter is in a hazardous area, wait five minutes after disconnecting the power. Failure to do so could result in an explosion causing death or injury.

2. Unplug the terminal blocks from the terminal board on the core processor.
3. Using a digital multimeter (DMM), check the pickoff coils by placing the DMM leads on the unplugged terminal blocks for each terminal pair. See the following table for a list of the coils. Record the values.

Table 9-3: Coils and test terminal pairs

Coil	Sensor model	Terminal colors
Drive coil	All	Brown to red
Left pickoff coil (LPO)	All	Green to white
Right pickoff coil (RPO)	All	Blue to gray
Resistance temperature detector (RTD)	All	Yellow to violet
Lead length compensator (LLC)	All except T-Series and CMF400 (see note)	Yellow to orange
Composite RTD	All CMFSs, T-Series, H300, and F300	Yellow to orange
Fixed resistor (see note)	CMFS007, CMFS010, CMFS015, CMF400, and F300	Yellow to orange

There should be no open circuits, that is, no infinite resistance readings. The left pickoff and right pickoff readings should be the same or very close (±5 Ω). If there are any unusual readings, repeat the coil resistance tests at the sensor junction box to eliminate the possibility of faulty cable. The readings for each coil pair should match at both ends.

4. Test the terminals in the sensor junction box for shorts to case.

   Test results will be inconclusive with nonconductive process fluids such as hydrocarbons.

   a) Leave the terminal blocks disconnected.
   b) Remove the lid of the junction box.
   c) Testing one terminal at a time, place a DMM lead on the terminal and the other lead on the sensor case.

      With the DMM set to its highest range, there should be infinite resistance on each lead. If there is any resistance at all, there is a short to case.

5. Test the resistance of junction box terminal pairs.

   a) Test the brown terminal against all other terminals except the red one.
   b) Test the red terminal against all other terminals except the brown one.
   c) Test the green terminal against all other terminals except the white one.
   d) Test the white terminal against all other terminals except the green one.
   e) Test the blue terminal against all other terminals except the gray one.
   f) Test the gray terminal against all other terminals except the blue one.
   g) Test the orange terminal against all other terminals except the yellow and violet ones.
   h) Test the yellow terminal against all other terminals except the orange and violet ones.
   i) Test the violet terminal against all other terminals except the yellow and orange ones.

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

Postrequisites

To return to normal operation:

1. Plug the terminal blocks into the terminal board.
2. Replace the lid on the sensor junction box.

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

9.4 Flow measurement problems

Problem	Possible causes	Recommended actions
Non-zero flow reading at no-flow conditions or at zero offset	• Misaligned piping (especially in new installations) • Open or leaking valve • Incorrect sensor zero	• If the reading is not excessively high, review the live zero. You may need to restore the factory zero. • Check for open or leaking valves or seals. • Check for mounting stress on the sensor (e.g., sensor being used to support piping, misaligned piping). • Contact customer support.
Erratic non-zero flow rate at no-flow conditions	• Leaking valve or seal • Two-phase flow • Incorrect sensor orientation • Wiring problem • Vibration in pipeline at rate close to sensor tube frequency • Damping value too low • Mounting stress on sensor • Empty sensor when reading liquid volume flow	• Verify that the sensor orientation is appropriate for your application (refer to the sensor installation manual). • Check the drive gain and the pickoff voltage. • If the wiring between the sensor and the transmitter includes a 9-wire segment, verify that the 9-wire cable shields are correctly grounded. • Check the wiring between the sensor and the transmitter. • For sensors with a junction box, check for moisture in the junction box. • Purge the sensor tubes. • Check for open or leaking valves or seals. • Check for sources of vibration. • Verify damping configuration. • Verify that the measurement units are configured correctly for your application. • Check for two-phase flow. • Check for radio frequency interference. • Contact customer support.

Problem	Possible causes	Recommended actions
Erratic non-zero flow rate when flow is steady	• Two-phase flow • Damping value too low • Plugged or coated sensor tube • Output wiring problem • Problem with receiving device • Wiring problem	• Verify that the sensor orientation is appropriate for your application (refer to the sensor installation manual). • Check the drive gain and the pickoff voltage. • If the wiring between the sensor and the transmitter includes a 9-wire segment, verify that the 9-wire cable shields are correctly grounded. • Check for air entrainment, tube fouling, flashing, or tube damage. • Check the wiring between the sensor and the transmitter. • For sensors with a junction box, check for moisture in the junction box. • Purge the sensor tubes. • Check for open or leaking valves or seals. • Check for sources of vibration. • Verify damping configuration. • Verify that the measurement units are configured correctly for your application. • Check for two-phase flow. • Check for radio frequency interference. • Contact customer support.
Inaccurate flow rate or batch total	• Wiring problem • Inappropriate measurement unit • Incorrect flow calibration factor • Incorrect meter factor • Incorrect density calibration factors • Incorrect grounding • Two-phase flow • Problem with receiving device • Incorrect sensor zero • Incorrect measurement unit configured for a process variable - for example, selecting g/min instead of USGPM	• Check the wiring between the sensor and the transmitter. • Verify that the measurement units are configured correctly for your application. • Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter. • Perform a bucket test to verify batch totals. • Zero the meter. • Check the grounding of all components. • Check for two-phase flow. • Verify the receiving device, and the wiring between the transmitter and the receiving device. • Check sensor coil resistance and for shorts to case. • Replace the transmitter.

9.5 Check grounding

The sensor and the transmitter must be grounded.

Prerequisites

You will need an:

- Installation manual for your sensor
- Installation manual for your transmitter (remote-mount installations only)

Procedure

Refer to the sensor and transmitter installation manuals for grounding requirements and instructions.

9.6 Check the pickoff voltage

If the pickoff voltage readings are unusually low, you may have any of a variety of process or equipment problems.

To know whether your pickoff voltage is unusually low, you must collect pickoff voltage data during the problem condition and compare it to pickoff voltage data from a period of normal operation.

Drive gain and pickoff voltage are inversely proportional. As drive gain increases, pickoff voltages decrease and vice versa.

Table 9-4: Possible causes and recommended actions for low pickoff voltage

Possible cause	Recommended actions
Faulty wiring runs between the sensor and transmitter	Verify wiring between sensor and transmitter.
Process flow rate beyond the limits of the sensor	Verify that the process flow rate is not out of range of the sensor.
Sensor tubes are not vibrating	• Check for plugging or deposition. • Ensure that the vibrating element is free to vibrate (no mechanical binding). • Verify wiring.
Moisture in the sensor electronics	Eliminate the moisture in the sensor electronics.
The sensor is damaged, or sensor magnets may have become demagnetized	Replace the sensor.

9.6.1 Collect pickoff voltage data

Pickoff voltage data can be used to diagnose a variety of process and equipment conditions. Collect pickoff voltage data from a period of normal operation, and use this data as a baseline for troubleshooting.

Procedure

1. Navigate to the pickoff voltage data.
2. Observe and record data for both the left pickoff and the right pickoff, over an appropriate period of time, under a variety of process conditions.

9.7 Check power supply wiring

If the power supply wiring is damaged or improperly connected, the transmitter may not receive enough power to operate properly.

Prerequisites

- You will need the installation manual for your transmitter.
- When using DC power, a minimum of 1.5 amps of startup current is required.

Procedure

1. Use a voltmeter to test the voltage at the transmitter power supply terminals.
    - If the voltage is within the specified range, you do not have a power supply problem.
    - If the voltage is low, ensure that the power supply is adequate at the source, the power cable is sized correctly, there is no damage to the power cable, and an appropriate fuse is installed.
    - If there is no power, continue with this procedure.
2. **WARNING**
   If the transmitter is in a hazardous area, wait five minutes after disconnecting the power. Failure to do so could result in an explosion causing death or injury.

   Before inspecting the power supply wiring, disconnect the power source.
3. Ensure that the terminals, wires, and wiring compartment are clean and dry.
4. Ensure that the power supply wires are connected to the correct terminals.
5. Ensure that the power supply wires are making good contact, and are not clamped to the wire insulation.
6. Inspect the voltage label inside the wiring compartment.
   The voltage supplied to the transmitter should match the voltage specified on the label.
7. **WARNING**
   If the transmitter is in a hazardous area, do not reapply power to the transmitter with the housing cover removed. Reapplying power to the transmitter while the housing cover is removed could cause an explosion.

   Reapply power to the transmitter.
8. Test the voltage at the terminals.
   If there is no power, contact customer service.

9.8 Check for radio frequency interference (RFI)

The transmitter Frequency Output or Discrete Output can be affected by radio frequency interference (RFI). Possible sources of RFI include a source of radio emissions, or a large transformer, pump, or motor that can generate a strong electromagnetic field. Several methods to reduce RFI are available. Use one or more of the following suggestions, as appropriate to your installation.

Procedure

- Use shielded cable between the output and the receiving device.

    - Terminate the shielding at the receiving device. If this is impossible, terminate the shielding at the cable gland or conduit fitting.
    - Do not terminate the shielding inside the wiring compartment.
    - 360-degree termination of shielding is unnecessary.
- Eliminate the RFI source.
- Move the transmitter.

9.9 Check for two-phase flow (slug flow)

Two-phase flow can cause rapid changes in the drive gain. This can cause a variety of measurement issues.

Procedure

1. Check for two-phase flow alerts (e.g., A105).
   If the transmitter is not generating two-phase flow alerts, verify that two-phase flow limits have been set. If limits are set, two-phase flow is not the source of your problem.
2. Check the process for cavitation, flashing, or leaks.
3. Monitor the density of your process fluid output under normal process conditions.
4. Check the settings of **Two-Phase Flow Low Limit**, **Two-Phase Flow High Limit**, and **Two-Phase Flow Timeout**.

   Tip
   You can reduce the occurrence of two-phase flow alerts by setting **Two-Phase Flow Low Limit** to a lower value, **Two-Phase Flow High Limit** to a higher value, or **Two-Phase Flow Timeout** to a higher value. Micro Motion recommends leaving the **Two-Phase Flow High Limit** at the default value.

9.10 Status alerts, causes, and recommendations

Not all of these alerts may apply to your type of transmitter.

9.10.1 A001

Alert

EEPROM Error

Cause

The transmitter has detected a problem communicating with the sensor.

Recommended actions

1. Cycle power to the meter.
2. Replace the core processor.
3. Contact customer support.

9.10.2 A002

Alert

RAM Error

Cause

The transmitter has detected a problem communicating with the sensor.

Recommended actions

1. Cycle power to the meter.
2. Replace the core processor.
3. Contact customer support.

9.10.3 A003

Alert

No Sensor Response

Cause

The transmitter is not receiving one or more basic electrical signals from the sensor.

This alert often occurs in conjunction with Alert 102.

Recommended actions

1. Check the drive gain and the pickoff voltage.
2. Check the wiring between the sensor and the transmitter.
3. Verify that internal wiring is secure and that there are no internal electrical problems.
4. Check the integrity of the sensor tubes.
5. Perform sensor coil resistence checks.

9.10.4 A004

Alert

Temperature Overrange

Cause

The RTD resistance is out of range for the sensor. The tube RTD resistance is out of range for the sensor.

Recommended actions

1. Check your process conditions against the values reported by the device.
2. Verify temperature characterization or calibration parameters.
3. Verify that internal wiring is secure and that there are no internal electrical problems.
4. Check the wiring between the sensor and the transmitter.
5. Contact customer support.

9.10.5 A006

Alert

Characterization Required

Cause

- Calibration factors have not been entered
- The sensor type is incorrect
- The calibration factors are incorrect for the sensor type

Recommended actions

1. Verify all of the characterization or calibration parameters.

   See the sensor tag or the calibration sheet for your meter.
2. Verify the setting of the Sensor Type parameter.
3. If **Sensor Type** = **Curved Tube**, ensure that no parameters specific to **Straight Tube** have been set.
4. Verify that internal wiring is secure and that there are no internal electrical problems.
5. Replace the core processor.
6. Contact customer support.

9.10.6 A008

Alert

Density Overrange

Cause

The line density is greater than 10 g/cm^3 (10000 kg/m^3).

Recommended actions

1. If other alerts are present, resolve those alert conditions first. If the current alert persists, continue with the following steps.
2. Check for air in the flow tubes, tubes not filled, foreign material in the tubes, coating in the tubes, or other process problems.
3. Check for two-phase flow.
4. Verify all of the characterization or calibration parameters.

   See the sensor tag or the calibration sheet for your meter.
5. Check the drive gain and the pickoff voltage.
6. Perform Smart Meter Verification.
7. Perform density calibration.
8. Contact customer support.

9.10.7 A009

Alert

Transmitter Initializing/Warming Up

Cause

Transmitter is in power-up mode.

This alert often occurs in conjunction with Alert 14.

Recommended actions

1. Allow the meter to complete its power-up sequence. The alert should clear automatically.
2. If other alerts are present, resolve those alert conditions first. If the current alert persists, continue with the following steps.
3. Verify that the tubes are full of process fluid.
4. Check the wiring between the sensor and the transmitter.
5. Verify that the transmitter is receiving sufficient power. If using DC power, verify that there is a minimum of 1.5 amps of startup current available.

Option	Description
If no	Correct the problem and cycle power to the meter.
If yes	The transmitter probably has an internal power issue. Replace the transmitter.

6. Ensure that the process fluid is stable.

   Check for two-phase flow, high process noise, or a fast transition between two fluids of different densities.

9.10.8 A010

Alert

Calibration Failure

Cause

There are many possible causes. This alert will not clear until you cycle power to the meter.

Recommended actions

1. Ensure that your calibration procedure meets the documented requirements, cycle power to the meter, then retry the procedure.
2. If this alert appears during zeroing:
   a) Verify that there is no flow through the sensor.
   b) Cycle power to the meter.
   c) Retry the procedure.

9.10.9 A011

Alert

Zero Calibration Failed: Low

Cause

There are many possible causes, such as:

- Too much flow, especially reverse flow through the sensor during a calibration procedure
- A zero result occurred that is too low.

This alert is accompanied by A010, and will not clear until you cycle power to the meter.

Recommended actions

1. Verify that there is no flow through the sensor.
2. Cycle power to the meter.
3. Retry the procedure.

9.10.10 A012

Alert

Zero Calibration Failed: High

Cause

There are many possible causes, such as:

- Too much flow, especially forward flow through the sensor during a calibration procedure
- A zero result occurred that is too high.

This alert is accompanied by A010, and will not clear until you cycle power to the meter.

Recommended actions

1. Verify that there is no flow through the sensor.
2. Cycle power to the meter.
3. Retry the procedure.

9.10.11 A013

Alert

Zero Calibration Failed: Unstable

Cause

There was too much process instability during the calibration procedure.

This alert will not clear until you cycle power to the meter.

Recommended actions

1. Remove or reduce sources of electromechanical noise.

   Example

   Pumps, vibration, or pipe stress
2. Cycle power to the meter.
3. Retry the procedure.

9.10.12 A014

Alert

Transmitter Failure

Cause

There are many possible causes.

Recommended actions

1. Ensure that all wiring compartment covers are installed correctly
2. Ensure that all transmitter wiring meets specifications and that all cable shields are properly terminated.
3. Check the grounding of all components.
4. Evaluate the environment for sources of high electromagnetic interference (EMI) and relocate the transmitter or wiring as necessary.
5. Contact customer support.

9.10.13 A016

Alert

Sensor Temperature (RTD) Failure

Cause

The value computed for the resistance of the line RTD is outside limits.

Recommended actions

1. Check your process conditions against the values reported by the device.
2. Check the wiring between the sensor and the transmitter.
3. Verify that internal wiring is secure and that there are no internal electrical problems.
4. Contact customer support.

9.10.14 A017

Alert

Sensor Case Temperature (RTD) Failure

Cause

The values computed for the resistance of the meter and case RTDs are outside limits.

Recommended actions

1. Check your process conditions against the values reported by the device.
   Temperature should be between -200 °F (-129 °C) and +400 °F (+204 °C).
2. Verify all of the characterization or calibration parameters.
   See the sensor tag or the calibration sheet for your meter.
3. Check the wiring between the sensor and the transmitter.
4. Verify that internal wiring is secure and that there are no internal electrical problems.
5. Contact customer support.

9.10.15 A020

Alert

Calibration Factors Missing

Cause

Some calibration factors have not been entered or are incorrect.

Recommended actions

1. Verify all of the characterization or calibration parameters.
   See the sensor tag or the calibration sheet for your meter.
2. Verify the setting of the **Sensor Type** parameter.
3. If **Sensor Type** = Curved Tube, ensure that no parameters specific to Straight Tube have been set.

9.10.16 A021

Alert

Transmitter/Sensor/Software Mismatch

Cause

The configured board type does not match the physical board, or the configured sensor type does not match the physical sensor.

Recommended actions

1. Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.
2. Ensure that the correct board is installed.
3. Verify the setting of the **Sensor Type** parameter.
4. If **Sensor Type**=Curved Tube, ensure that no parameters specific to Straight Tube have been set.

9.10.17 A022

Alert

Configuration Database Corrupt

Cause

There has been an internal electronics failure.

Recommended actions

1. Cycle power to the meter.
2. Contact customer support.

9.10.18 A023

Alert

Internal Totals Corrupt

Cause

There has been an internal electronics failure.

Recommended actions

1. Cycle power to the meter.
2. Contact customer support.

9.10.19 A024

Alert

Program Corrupt (Core Processor)

Cause

There has been an internal electronics failure.

Recommended actions

1. Cycle power to the meter.
2. Contact customer support.

9.10.20 A026

Alert

Sensor/Transmitter Communications Failure

Cause

The transmitter has lost communication with the core processor. There may be a problem with the wiring or with either component.

This alert often occurs in conjunction with alerts A009 and A014.

Recommended actions

1. Check the wiring between the sensor and the transmitter.
2. Check for noise in the wiring or in the transmitter environment.
3. Verify that internal wiring is secure and that there are no internal electrical problems.
4. Check the status LED on the core processor.
5. Check the resistance across core processor terminals.
6. If the alert persists:
    a) Replace the core processor.
    b) If that does not solve the problem, restore the original core processor and replace the transmitter.
    c) If that does not solve the problem, replace both the transmitter and the core processor.

9.10.21 A028

Alert

Core Processor Write Failure

Cause

There is an internal electronics failure.

Recommended actions

1. Cycle power to the meter.
2. Contact customer support.

9.10.22 A029

Alert

Internal Electronics Failure

Cause

This can indicate a loss of communication between the transmitter and the display module.

Recommended actions

1. Cycle power to the meter.
2. Replace the display module.
3. Contact customer support.

9.10.23 A030

Alert

Incorrect Board Type

Cause

The loaded software is not compatible with the programmed board type.

Recommended actions

Contact customer support.

9.10.24 A031

Alert

Low Power

Cause

The transmitter is not receiving enough power.

This alert will not clear until you cycle power to the meter.

Recommended actions

1. Check the wiring between the transmitter and the core processor.
2. Cycle power to the meter.
3. Check the wiring of the transmitter.
4. Cycle power to the meter.
5. Verify that the transmitter is receiving sufficient power.

Option	Description
If it is not	a. Correct the problem. b. Cycle power to the meter.
If it is	The transmitter probably has an internal power issue. Replace the transmitter.

9.10.25 A032

Alert

Meter Verification in Progress: Outputs to Fault

Cause

A meter verification test is in progress, with outputs set to Fault.

Recommended actions

Allow the procedure to complete.

9.10.26 A033

Alert

Insufficient Pickoff Signal

Cause

The signal from the sensor pickoff(s) is insufficient. This suggests that the sensor tubes or vibrating elements are not vibrating. This alert often occurs in conjunction with Alert 102.

Recommended actions

1. Check for air in the flow tubes, tubes not filled, foreign material in the tubes, coating in the tubes, or other process problems.
2. Check for foreign material in the process gas or fluid, coating, or other process problems.
3. Check for fluid separation by monitoring the density value and comparing the results against expected density values.
4. Ensure that the sensor orientation is appropriate for your application.

   Settling from a two-phase or three-phase fluid can cause this alert even if the flow tubes are full.

9.10.27 A035

Alert

Meter Verification Aborted

Cause

The meter verification test did not complete, possibly because of a manual abort.

Recommended actions

1. Verify that process conditions are stable, then retry the test.
2. Contact customer support.

9.10.28 A102

Alert

Drive Overrange

Cause

The drive power (current/voltage) is at its maximum.

Recommended actions

1. Check the drive gain and the pickoff voltage.
2. Check the wiring between the sensor and the transmitter.
3. Verify that internal wiring is secure and that there are no internal electrical problems.
4. Check for air in the flow tubes, tubes not filled, foreign material in the tubes, coating in the tubes, or other process problems.
5. Check for fluid separation by monitoring the density value and comparing the results against expected density values.
6. Ensure that the sensor orientation is appropriate for your application. Settling from a two-phase or three-phase fluid can cause this alert even if the flow tubes are full.

9.10.29 A103

Alert

Data Loss Possible (Totals and Inventories)

Cause

Totalizers are not properly saved. The device was unable to store the totalizers during the last power-down, and must rely on the saved totals. The saved totals can be as much as two hours out of date.

Recommended actions

1. Check the wiring between the transmitter and the core processor, then cycle power to the meter.
2. Verify that the transmitter is receiving sufficient power.

Option	Description
If it is not	a. Correct the problem. b. Cycle power to the meter.
If it is	The transmitter probably has an internal power issue. Replace the transmitter.

9.10.30 A104

Alert

Calibration in Progress

Cause

A calibration procedure is in process.

Recommended actions

1. Allow the procedure to complete.
2. For zero calibration:
   a) Abort the calibration.
   b) Set **Zero Time** to a lower value.
   c) Restart the calibration.

9.10.31 A105

Alert

Two-Phase Flow

Cause

The line density is outside the user-defined two-phase flow limits.

Recommended actions

1. Check for two-phase flow.
2. Check the live density reading against the upper and lower two-phase flow limit settings.

9.10.32 A107

Alert

Power Reset Occurred

Cause

The transmitter has been restarted.

Recommended actions

No action is required.
If desired, you can set **Alert Severity Level** to Ignore.

9.10.33 A120

Alert

Curve Fit Failure (Concentration)

Cause

The transmitter was unable to calculate a valid concentration matrix from the current data.

Recommended actions

Verify the configuration of the concentration measurement application.

9.10.34 A121

Alert

Extrapolation Alert (Concentration)

Cause

The line density or line temperature is outside the range of the concentration matrix plus the configured extrapolation limit.

Recommended actions

1. Check your process conditions against the values reported by the device.
2. Verify the configuration of the concentration measurement application.

9.10.35 A131

Alert

Meter Verification in Progress: Outputs to Last Measured Value

Cause

A meter verification test is in progress, with outputs set to Last Measured Value.

Recommended actions

Allow the procedure to complete.

9.10.36 A132

Alert

Sensor Simulation Active

Cause

Sensor simulation is enabled.

Recommended actions

Disable sensor simulation.

9.10.37 A133

Alert

EEPROM Error (Display)

Cause

There is a memory error in the display module.

Recommended actions

1. Cycle power to the meter.
2. Replace the display module.
3. Contact customer support.

9.10.38 Density FD Calibration in Progress

Cause

A flowing density calibration is in progress.

Recommended actions

No action required.

9.10.39 Density D1 Calibration in Progress

Cause

A D1 density calibration is in progress.

Recommended actions

No action required.

9.10.40 Density D2 Calibration in Progress

Cause

A D2 density calibration is in progress.

Recommended actions

No action required.

9.10.41 Density D3 Calibration in Progress

Cause

A D3 density calibration is in progress.

Recommended actions

No action required.

9.10.42 Density D4 Calibration in Progress

Cause

A D4 density calibration is in progress.

Recommended actions

No action required.

9.10.43 Zero Calibration in Progress

Cause

A zero calibration is in progress.

Recommended actions

No action required.

9.10.44 Reverse Flow

Cause

Flow through the device is in the reverse direction (against the flow arrow).

Recommended actions

No action is required.

9.11 Temperature measurement problems

Problem	Possible causes	Recommended actions
Temperature reading significantly different from process temperature	• RTD failure • Incorrect compensation factors • Line temperature in bypass does not match temperature in main line	• Verify that the temperature compensation factors match the value on the sensor tag or calibration sheet. • If Alert A004, A016, or A017 is active, perform the actions recommended for that alert.
Temperature reading slightly different from process temperature	• Sensor temperature not yet equalized • Sensor leaking heat	• If the error is within the temperature specification for the sensor, there is no problem. If the temperature measurement is outside the specification, contact customer support. • The temperature of the fluid may be changing rapidly. Allow sufficient time for the sensor to equalize with the process fluid. • The electrical connection between the RTD and the sensor may be damaged. This may require replacing the sensor.

A Transducer blocks and views

List of transducer blocks

The fieldbus interface is implemented via the following transducer blocks.

Table A-1: Transducer blocks

Transducer block	Description
Measurement	Configuration parameters and data for mass flow rate, volume flow rate, density, and temperature
Calibration	Calibration parameters and data for mass flow, auto zero, density, T-Series coefficients, temperature, pressure compensation, and temperature compensation
Diagnostics	Diagnostic parameters for slug flow setup, alarm status, general diagnostics, and meter fingerprinting
Device information	Contains informational static data such as software revisions, serial numbers, and sensor data
Local display	Contains local display (LDO) configuration data
Petroleum measurement	Contains PM process variables and configuration data
Concentration measurement	Contains concentration measurement process variables and configuration data
Density Viscosity meter	Contains parameters and data for the Density Viscosity meters

A.1 Descriptions of transducer block table entries

Use the following definitions for the transducer block details tables:

Index of the FOUNDATION Fieldbus parameter in the object dictionary

Name Name of the fieldbus parameter used in the code

Description Provides a description of the parameter.

Msg type

VAR	Variable — a variable value
ENUM	Enumeration — a value from a discrete list
METHOD	Method — initiates an action within the device
STR	String — a length of ASCII characters (letters, numerals, symbols, and punctuation marks)
ARR	Array — data structure that contains an organized group of elements
REC	Record — a record defined by the FOUNDATION Fieldbus organization — see section 5.13 of FF-890-1.3

Data type (size in bytes) The FOUNDATION Fieldbus data type. The size of the data in bytes is in parenthesis. For example, FLOAT (4) would mean the variable is a float of size 4 bytes.

Store The class of memory required, and the update rate in Hz if applicable.

Dynamic	Cyclic data, parameter updated periodically
Dynamic/20	Cyclic data, parameter updated periodically in 20 Hz
Nonvolatile	Nonvolatile parameter that must be saved on the Model 2700 transmitter.
Static	Acyclic data, parameter changed on a deliberate write

Access The type of access allowed for the parameter.

Table A-2: Access

Read only	Read only access is allowed for the parameter
RW in any mode	Read/write, with the transducer block in any mode
RW (OOS)	Read/write, with the transducer block in Out of Service (OOS) mode
RW (Auto)	Read/write, with the transducer block in Auto mode

List of values The list of valid values to write to an enumerated parameter. This field is not applicable for read only parameters. Valid value ranges for variable type parameters are specified in the tables.

Definitions for view list

Up to four views are defined for each transducer block.

View	Description
VIEW 1	Access to the dynamic operating parameters of the transducer block
VIEW 2	Access to the static operating parameters of the transducer block
VIEW 3	Access to all the dynamic parameters of the transducer block
VIEW 4	Access to static parameters not included in VIEW 2

The number in the cell represents the size of the parameter in bytes. The maximum size of a view is 122 bytes.

Use the following definitions for the transducer block views tables:

View and size in view The views that contain the parameter, and the size of the parameter in the view, in bytes. The number in the cell indicates that the variable is contained in that particular view. The number is the size of the parameter in bytes.

A.2 Measurement transducer blocks

A.2.1 View list for the measurement transducer block

The following table lists the parameters contained in the measurement transducer block for measurement parameters.

Four views are defined for the measurement transducer block. The table also shows the applicable views for each parameter, and the size of the parameter in that view, in bytes.

Table A-3: Measurement transducer block parameters view list

Index	Name	View			
		1	2	3	4
0	BLOCK_STRUCTURE	—	—	—	—
1	ST_REV	2	2	2	2
2	TAG_DESC	—	—	—	—
3	STRATEGY	—	—	—	2
4	ALERT_KEY	—	—	—	1
5	MODE_BLK	4	—	4	—
6	BLOCK_ERR	2	—	2	—
7	UPDATE_EVT	—	—	—	—
8	BLOCK_ALM	—	—	—	—
9	TRANSDUCER_DIRECTORY	—	—	—	—
10	TRANSDUCER_TYPE	2	2	2	2
11	TRANSDUCER_TYPE_VER	2	2	2	2
12	XD_ERROR	1	—	1	—
13	COLLECTION_DIRECTORY	—	—	—	—
14	MFLOW	—	—	—	—
15	MFLOW_UNITS	5	2	5	—
16	MFLOW_SPECIAL_UNIT_BASE	—	—	—	2
17	MFLOW_SPECIAL_UNIT_TIME	—	—	—	2
18	MFLOW_SPECIAL_UNIT_CONV	—	—	—	4
19	MFLOW_SPECIAL_UNIT_STR	—	—	—	8
20	TEMPERATURE	5	—	5	—
21	TEMPERATURE_UNITS	—	2	—	—
22	DENSITY	5	—	5	—
23	DENSITY_UNITS	—	2	—	—
24	VOLUME_FLOW	5	—	5	—
25	VOLUME_FLOW_UNITS	—	2	—	—

Table A-3: Measurement transducer block parameters view list *(continued)*

Index	Name	View			
		1	2	3	4
26	VOL_SPECIAL_UNIT_BASE	—	—	—	2
27	VOL _SPECIAL_UNIT_TIME	—	—	—	2
28	VOL _SPECIAL_UNIT_CONV	—	—	—	4
29	VOL _SPECIAL_UNIT_STR	—	—	—	8
30	MASS_TOT_INV_SPECIAL_ STR	—	—	—	8
31	VOLUME_TOT_INV_ SPECIAL_ STR	—	—	—	8
32	FLOW_DAMPING	—	4	—	—
33	TEMPERATURE_DAMPING	—	4	—	—
34	DENSITY_DAMPING	—	4	—	—
35	MFLOW_M_FACTOR	—	4	—	—
36	DENSITY_M_FACTOR	—	4	—	—
37	VOL_M_FACTOR	—	4	—	—
38	MASS_LOW_CUT	—	4	—	—
39	VOLUME_FLOW_LOW_CUTOFF	—	4	—	—
40	DENSITY_LOW_CUTOFF	—	4	—	—
41	FLOW_DIRECTION	—	2	—	—
42	HIGH_MASS_LIMIT	—	4	—	—
43	HIGH_TEMP_LIMIT	—	4	—	—
44	HIGH_DENSITY_LIMIT	—	4	—	—
45	HIGH_VOLUME_LIMIT	—	4	—	—
46	LOW_MASS_LIMIT	—	4	—	—
47	LOW_TEMP_LIMIT	—	4	—	—
48	LOW_DENSITY_LIMIT	—	4	—	—
49	LOW_VOLUME_LIMIT	—	4	—	—
50	INTEGRATOR_FB_CONFIG	—	2	—	—
51	START_STOP_TOTALS	—	2	—	—
52	RESET_TOTALS	—	2	—	—
53	RESET_INVENTORIES	—	2	—	—
54	RESET_MASS_TOTAL	—	2	—	—
55	RESET_VOLUME_TOTAL	—	2	—	—
56	MASS_TOTAL	5	—	5	—
57	VOLUME_TOTAL	5	—	5	—

Table A-3: Measurement transducer block parameters view list *(continued)*

Index	Name	View			
		1	2	3	4
58	MASS_INVENTORY	5	—	5	—
59	VOLUME_INVENTORY	5	—	5	—
60	MASS_TOT_INV_UNITS	—	2	—	—
61	VOLUME_TOT_INV_UNITS	—	2	—	—
62	GSV_Gas_Dens	—	4	—	—
63	GSV_Vol_Flow	5	—	5	—
64	GSV_Vol_Tot	5	—	5	—
65	GSV_Vol_Inv	5	—	5	—
66	SNS_EnableGSV	—	—	—	2
67	SNS_GSV_FlowUnits	—	—	—	2
68	SNS_GSV_TotalUnits	—	—	—	2
69	SNS_GSVflowBaseUnit	—	—	—	2
70	SNS_GSVflowBaseTime	—	—	—	2
71	SNS_GSVflowFactor	—	—	—	4
72	SNS_GSVflowText	—	—	—	8
73	SNS_GSVtotText	—	—	—	8
74	SNS_GSV_FlowCutoff	—	—	—	2
75	SNS_ResetGSVolTotal	—	2	—	—
76	SNS_ResetAPIGSVInv	—	2	—	—
77	SNS_ResetMassInventory	—	2	—	—
78	SNS_ResetVolumeInventory	—	2	—	—
79	SNS_ActualFlowDirection	—	2	—	—
80	MEAS_SYS_AttachedCoreType	—	—	—	2
81	CORE_SW_REV_MSTB	—	—	—	2

A.2.2 Standard fieldbus parameters for measurement transducer blocks

Index and name	Description	List of values
#0 BLOCK_STRUCTURE	The beginning of the transducer block. Msg type = VAR Data type = DS_64 (5) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—

Index and name	Description	List of values
#1 ST_REV	The revision level of the static data associated with the function block. Incremented with each write of static store. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	—
#2 TAG_DESC	The user description of the intended block application. Msg type = STR Data type = OCTET STRING (32) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	Any 32 characters
#3 STRATEGY	Used to identify grouping of blocks. This data is not checked or processed by the block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—
#4 ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Msg type = VAR Data type = Unsigned8 (1) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	1 to 255
#5 MODE_BLK	The actual, target, permitted, and normal modes of the block. Msg type = REC Data type = DS-69 (4) Store = Mixed Access = RW (OOS) or RW (Auto) Available in Release 1.0	See section 2.6 of FF-891
#6 BLOCK_ERR	The error status associated with the hardware or software components associated with a block. Msg type = STR Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	See section 4.8 of FF-903

Index and name	Description	List of values
#7 UPDATE_EVT	Occurs when a static parameter is changed while a block mode is not in out of service (OOS) mode, or when the mode changes from OOS mode and one or more static parameters changed while the block was OOS. Msg type = REC Data type = DS-73 Store = Dynamic Access = RW in any mode Available in Release 1.0	—
#8 BLOCK_ALM	A predefined set of 16 conditions that may occur within a block. Msg type = REC Data type = DS-72 Store = Dynamic Access = RW in any mode Available in Release 9.0	—
#9 TRANSDUCER_ DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#10 TRANSDUCER_ TYPE	Identifies the transducer that follows. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#11 TRANSDUCER_ TYPE_VER	Identifies the version of the transducer block. Format is *XXYY* where *XX* is the major spec revision and *YY* is the manufacturer revision. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#12 XD_ERROR	Used for all config, H/W, connection failure of system problems in the block. Msg type = VAR Data type = Unsigned8 (1) Store = Dynamic Access = RW (OOS) Available in Release 1.0	0 = No Error 18 = Calibration Error 19 = Configuration Error 20 = Electronics Failure 21 = Sensor Failure 26 = Process Error 27 = Calibration in Progress

Index and name	Description	List of values
#13 COLLECTION_ DIRECTORY	Used for all config, H/W, and connection failures of system problems in the block. Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = RW (OOS) Available in Release 9.0	—

A.2.3 Process variables for measurement transducer blocks

Table A-4: Process variables for measurement transducer blocks

Index and name	Description	List of values	HW
#14 MFLOW	Mass flow rate Msg type = VAR Data type = DS_65 (5) Store = Dynamic/20 Access = Read Available in Release 1.0	—	700 800
#15 MFLOW_UNITS	Standard or special mass flow rate unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 1.0	1318 = g/s 1319 = g/min 1320 = g/h 1322 = kg/s 1323 = kg/min 1324 = kg/h 1325 = kg/d 1327 = t/min 1328 = t/h 1329 = t/d 1330 = lb/s 1331 = lb/min 1332 = lb/h 1333 = lb/d 1335 = STon/min 1336 = STon/h 1337 = STon/d 1340 = LTon/h 1341 = LTon/d 253 = Special	700 800
#16 MFLOW_SPECIAL_UNIT_BA SE	Base mass unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 1.0	1089 = g 1088 = kg 1092 = t 1094 = lb 1095 = STon 1096 = Lton	700 800

Table A-4: Process variables for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#17 MFLOW_SPECIAL_UNIT_TIME	Base time unit for special mass unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 1.0	1058 = min 1054 = s 1059 = h 1060 = d	700 800
#18 MFLOW_SPECIAL_UNIT_CONV	Special mass unit conversion factor Msg type = VAR Data type = FLOAT (4) Store = Static Access = RW (OOS) Available in Release 1.0	—	700 800
#19 MFLOW_SPECIAL_UNIT_STR	Special mass flow unit string Msg type = STR Data type = VISIBLE STRING (8) Store = Static Access = RW (OOS) Available in Release 1.0	Any 8 characters	700 800
#20 TEMPERATURE	The error status associated with the hardware or software components associated with a block. Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read Available in Release 1.0	—	700 800 CDM FDM FVM
#21 TEMPERATURE_UNITS	Temperature unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 1.0	1000 = K 1001 = Deg C 1002 = Deg F 1003 = Deg R	700 800 CDM FDM FVM
#22 DENSITY	Density Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read Available in Release 1.0	—	700 800 CDM FDM FVM

Table A-4: Process variables for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#23 DENSITY_UNITS	Density unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 1.0	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 [700, 800][(1)] 1114 = SGU [700, 800] 253 = Special [CDM, FDM, FVM]	700 800 CDM FDM FVM
#24 VOLUME_FLOW	Volume flow rate Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read Available in Release 1.0	—	700 800 CDM (2.0 and above)
#25 VOLUME_FLOW_UNITS	Standard or special volume flow rate unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 1.0	1347 = m3/s 1348 = m 3/min 1349 = m3/h 1350 = m3/d 1351 = L/s 1352 = L/min 1353 = L/h 1355 = ML/d 1356 = CFS 1357 = CFM 1358 = CFH 1359 = ft3/d 1362 = gal/s 1363 = GPM 1364 = gal/h 1365 = gal/d 1366 = Mgal/d 1367 = ImpGal/s 1368 = ImpGal/m 1369 = ImpGal/h 1370 = Impgal/d 1371 = bbl/s 1372 = bbl/min 1373 = bbl/h 1374 = bbl/d 1631 = barrel (US Beer)/d 1632 = barrel (US Beer)/h 1633 = barrel (US Beer)/min 1634 = barrel (US Beer)/s 253 = Special [not applicable for CDM]	700 800 CDM (2.0 and above)

Table A-4: Process variables for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#26 VOL_SPECIAL_UNIT_BASE	Base volume unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 1.0	1048 = gallons 1038 = L 1049 = ImpGal 1043 = ft^3 1034 = m^3 1051 = bbl	700 800
#27 VOL_SPECIAL_UNIT_TIME	Base time unit for special volume unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 1.0	1058 = min 1054 = s 1059 = h 1060 = d	700 800
#28 VOL_SPECIAL_UNIT_CONV	Special volume unit conversion factor Msg type = VAR Data type = FLOAT (4) Store = Static Access = RW (OOS) Available in Release 1.0	—	700 800
#29 VOL_SPECIAL_UNIT_STR	Special volume unit string Msg type = STR Data type = VISIBLE STRING (8) Store = Static Access = RW (OOS) Available in Release 1.0	Any 8 characters	700 800
#30 MASS_TOT_INV_SPECIAL_STR	Special mass total and inventory unit string Msg type = STR Data type = VISIBLE STRING (8) Store = Static Access = RW (OOS) Available in Release 1.0	Any 4 characters	700 800
#31 VOLUME_TOT_INV_SPECIAL_ STR	Special volume total and inventory unit string Msg type = STR Data type = VISIBLE STRING (8) Store = Static Access = RW (OOS) Available in Release 1.0	Any 4 characters	700 800
#32 FLOW_DAMPING	Flow rate (mass and volume) internal damping in seconds Msg type = VAR Data type = FLOAT (4) Store = Static Access = RW (OOS) Available in Release 1.0	—	700 800

Table A-4: Process variables for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#33 TEMPERATURE_DAMPING	Temperature internal damping in seconds Msg type = VAR Data type = FLOAT (4) Store = Static Access = RW (OOS) Available in Release 1.0	—	700 800 CDM FDM FVM
#34 DENSITY_DAMPING	Density internal damping in seconds Msg type = VAR Data type = FLOAT (4) Store = Static Access = RW (OOS) Available in Release 1.0	—	700 800 CDM FDM FVM
#35 MFLOW_M_FACTOR	Mass rate factor Msg type = VAR Data type = FLOAT (4) Store = Static Access = RW (OOS) Available in Release 1.0	—	700 800
#36 DENSITY_M_FACTOR	Density factor Msg type = VAR Data type = FLOAT (4) Store = Static Access = RW (OOS) Available in Release 1.0	—	700 800
#37 VOL_M_FACTOR	Volume rate factor Msg type = VAR Data type = FLOAT (4) Store = Static Access = RW (OOS) Available in Release 1.0	—	700 800
#38 MASS_LOW_CUT	Mass flow cutoff for internal totalizers Msg type = VAR Data type = FLOAT (4) Store = Static Access = RW (OOS) Available in Release 1.0	—	700 800
#39 VOLUME_FLOW_LOW_CUT OFF	Volume flow cutoff for internal totalizers Msg type = VAR Data type = FLOAT (4) Store = Static Access = RW (OOS) Available in Release 1.0	—	700 800

Table A-4: Process variables for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#40 DENSITY_LOW_CUTOFF	Density cutoff for internal totalizers Msg type = VAR Data type = FLOAT (4) Store = Static Access = RW (OOS) Available in Release 1.0	—	700 800 CDM FDM FVM
#41 FLOW_DIRECTION	Flow direction Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = RW in any mode Available in Release 1.0	0 = Forward Only 1 = Reverse Only 2 = Bi-Directional 3 = Absolute Value 4 = Negate/Forward Only 5 = Negate/Bi-Dir	700 800 CDM
#42 HIGH_MASS_LIMIT	High mass flow limit of sensor Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800
#43 HIGH_TEMP_LIMIT	High temperature limit of sensor Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#44 HIGH_DENSITY_LIMIT	High density limit of sensor in g/cc Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#45 HIGH_VOLUME_LIMIT	High volume flow limit of sensor Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800
#46 LOW_MASS_LIMIT	Low mass flow limit of sensor Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800

Table A-4: Process variables for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#47 LOW_TEMP_LIMIT	Low temperature limit of sensor Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#48 LOW_DENSITY_LIMIT	Low density limit of sensor in g/cc Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#49 LOW_VOLUME_LIMIT	Low volume flow limit of sensor Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800

(1) The list within the square bracket contains cores that support this value.

A.2.4 Totalizers for measurement transducer blocks

Table A-5: Totalizers for measurement transducer blocks

Index and name	Description	List of values	HW
#50 INTEGRATOR_ FB_CONFIG	Configuration of integrator function block Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	0 = Standard 1 = Internal Mass Total 2 = Internal Vol Total 3 = Internal Mass Inv. 4 = Internal Vol Inv. 5 = Int Gas Vol Tot 6 = Int Gas Vol Inv 7 = Int API Vol Tot 8 = Int API Vol Inv 9 = Int ED Std Vol Tot 10= Int ED Std Vol Inv 11= Int ED Net Mass Tot 12= Int ED Net Mass Inv 13= Int ED Net Vol Tot 14= Int ED Net Vol Inv	700 800
#51 START_STOP_TOTALS	Starts and stops all totalizers Msg type = VAR Data type = DS-66 (2) Store = — Access = R/W in any mode Available in Release 1.0	Value part of DS-66 0 = Stop Totals 1 = Start Totals	700 800

Table A-5: Totalizers for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#52 RESET_TOTALS	Reset all totals Msg type = VAR Data type = DS-66 (2) Store = — Access = R/W in any mode Available in Release 1.0	Value part of DS-66 1 = Reset	700 800
#53 RESET_INVENTORIES	Reset all inventories Msg type = METHOD Data type = Unsigned16 (2) Store = — Access = R/W in any mode Available in Release 1.0	Value part of DS-66 1 = Reset	700 800
#54 RESET_MASS_TOTAL	Reset mass total Msg type = VAR Data type = DS-66 (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	Value part of DS-66 1 = Reset	700 800
#55 RESET_VOLUME_TOTAL	Reset volume total Msg type = VAR Data type = DS-66 (2) Store = — Access = Read only Available in Release 1.0	Value part of DS-66 1 = Reset	700 800
#56 MASS_TOTAL	Mass total Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 1.0	—	700 800
#57 VOLUME_TOTAL	Volume total Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 1.0	—	700 800
#58 MASS_INVENTORY	Mass inventory Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 1.0	—	700 800

Table A-5: Totalizers for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#59 VOLUME_INVENTORY	Volume inventory Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 1.0	—	700 800
#60 MASS_TOT_INV_UNITS	Standard or special mass total and mass inventory unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	1089 = g 1088 = kg 1092 = t 1094 = lb 1095 = STon 1096 = Lton 253 = Special units	700 800
#61 VOLUME_TOT_INV_ UNITS	Standard or special volume total or mass inventory unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	1034 = m3 1036 = cm3 1038 = L 1043 = ft3 1048 = gallon 1049 = ImpGal 1051 = bbl 253 = Special units	700 800

A.2.5 Gas process variables for measurement tranducer blocks

Table A-6: Gas process variables for measurement transducer blocks

Index and name	Description	List of values	HW
#62 GSV_Gas_Dens	Gas density used to calculate reference volume gas flow and totals Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800
#63 GSV_Vol_Flow	Reference volume gas flow rate (not valid when API or ED is enabled) Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800

Table A-6: Gas process variables for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#64 GSV_Vol_Tot	Reference volume gas total (not valid when petroleum measurement or concentration measurement is enabled) Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800
#65 GSV_Vol_Inv	Reference volume gas inventory (not valid when petroleum measurement or concentration measurement is enabled) Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800
#66 SNS_EnableGSV	Enable/Disable gas standard volume flow and totals Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 4.0	0 = disabled (liquid) 1 = enabled (gas)	800
#67 SNS_GSV_FlowUnits	Gas standard volume flow engineering units Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 4.0	1723 = SCFS 1722 = SCFD 1360 = SCFM 1361 = SCFH 1522 = Nm3/s 1523 = Nm3/min 1524 = Nm3/h 1525 = Nm3/d 1527 = Sm3/s 1528 = Sm3/min 1529 = Sm3/h 1530 = Sm3/d 1532 = NL/s 1533 = NL/min 1534 = NL/h 1535 = NL/d 1537 = SL/s 1538 = SL/min 1539 = SL/h 1540 = SL/d 253 = Special	800

Table A-6: Gas process variables for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#68 SNS_GSV_TotalUnits	Gas standard volume total and inventory engineering units Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 4.0	1053 = SCF 1521 = Nm3 1526 = Sm3 1531 = NL 1536 = SL 253 = Special units	800
#69 SNS_GSVflowBaseUnit	Base gas standard volume unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W OOS Available in Release 4.0	1521 = Nm3 1531 = NL 1053 = SCF 1536 = SL 1526 = Sm3	800
#70 SNS_GSVflowBaseTime	Base time unit for special gas standard volume unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W OOS Available in Release 4.0	1058 = min 1054 = s 1059 = h 1060 = d	800
#71 SNS_GSVflowFactor	Special gas standard volume unit conversion factor Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W OOS Available in Release 4.0	—	800
#72 SNS_GSVflowText	Special gas standard volume unit string Msg type = STR Data type = VISIBLE STRING (8) Store = Static Access = R/W OOS Available in Release 4.0	Any 8 characters	800
#73 SNS_GSVtotText	Special gas standard volume total and inventory unit string Msg type = STR Data type = VISIBLE STRING (8) Store = Static Access = R/W OOS Available in Release 4.0	Any 8 characters	800
#74 SNS_GSV_FlowCutoff	Gas standard volume low flow cutoff Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W OOS Available in Release 4.0	Must be >= 0.0	700 800

Table A-6: Gas process variables for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#75 SNS_ResetGSVolTotal	Reset gas standard volume total Msg type = VAR Data type = DS-66 (2) Store = Static Access = R/W in any mode Available in Release 4.0	Value part of DS-66 1 = Reset	800
#76 SNS_ResetAPIGSVInv	Reset gas standard volume inventory Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	1 = Reset	700 800

A.2.6 Other additions for measurement transducer blocks

Table A-7: Other additions for measurement transducer blocks

Index and name	Description	List of values	HW
#77 SNS_ResetMass Inventory	Reset mass inventory Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	1 = Reset	700 800
#78 SNS_ResetVolume Inventory	Reset volume inventory Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	1 = Reset	700 800
#79 SNS_ActualFlowDirection	Indicates whether flow is moving in the forward or reverse direction Msg type = VAR Data type = DS-66 (2) Store = — Access = Read only Available in Release 7.0	Value part of DS-66 0 = Forward or Zero Flow 1 = Reverse Flow	700 800 CDM
#80 MEAS_SYS_AttachedCoreType	Indicates the attached core type Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	0 = CORE_UNKNOWN 1 = CORE_700 2 = CORE_ECP 3 = CORE_S 4 = CORE_DENSITY 5 = CORE_DEN_CDM 6 = CORE_DEN_FDM 7 = CORE_DEN_FVM	700 800 CDM FDM FVM

Table A-7: Other additions for measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#81 CORE_SW_REV_MSTB	Model 700 transmitter software revision Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 9.0	—	700 800 CDM FDM FVM

A.3 Calibration transducer blocks

A.3.1 View list for calibration transducer block

The following table lists the parameters contained in the transducer block for calibration parameters.

Four views are defined for the calibration transducer block. The table also shows the applicable views for each parameter, and the size of the parameter in that view, in bytes.

Index	Name	View			
		1	2	3	4
0	BLOCK_STRUCTURE	—	—	—	—
1	ST_REV	2	2	2	2
2	TAG_DESC	—	—	—	—
3	STRATEGY	—	—	—	2
4	ALERT_KEY	—	—	—	1
5	MODE_BLK	4	—	4	—
6	BLOCK_ERR	2	—	2	—
7	UPDATE_EVT	—	—	—	—
8	BLOCK_ALM	—	—	—	—
9	TRANSDUCER_DIRECTORY	—	—	—	—
10	TRANSDUCER_TYPE	2	2	2	2
11	TRANSDUCER_TYPE_VER	2	2	2	2
12	XD_ERROR	1	—	1	—
13	COLLECTION_DIRECTORY	—	—	—	—
14	MASS_FLOW_GAIN	—	4	—	—
15	MASS_FLOW_T_COMP	—	4	—	—
16	ZERO_CAL	—	2	—	—
17	ZERO_TIME	—	2	—	—
18	ZERO_STD_DEV	—	—	4	—

Index	Name	View			
		1	2	3	4
19	ZERO_OFFSET	—	—	4	—
20	ZERO_FAILED_VALUE	—	—	4	—
21	LOW_DENSITY_CAL	—	2	—	—
22	HIGH_DENSITY_CAL	—	2	—	—
23	FLOWING_DENSITY_CAL	—	2	—	—
24	D3_DENSITY_CAL	—	2	—	—
25	D4_DENSITY_CAL	—	2	—	—
26	K1	—	4	—	—
27	K2	—	4	—	—
28	FD	—	4	—	—
29	K3	—	4	—	—
30	K4	—	4	—	—
31	D1	—	4	—	—
32	D2	—	4	—	—
33	FD_VALUE	—	4	—	—
34	D3	—	4	—	—
35	D4	—	4	—	—
36	DENS_T_COEFF	—	4	—	—
37	T_FLOW_TG_COEFF	—	4	—	—
38	T_FLOW_FQ_COEFF	—	4	—	—
39	T_DENSITY_TG_COEFF	—	4	—	—
40	T_DENSITY_FQ_COEFF1	—	4	—	—
41	T_DENSITY_FQ_COEFF2	—	4	—	—
42	TEMP_LOW_CAL	—	2	—	—
43	TEMP_HIGH_CAL	—	2	—	—
44	TEMP_VALUE	—	4	—	—
45	TEMP_OFFSET	—	—	4	—
46	TEMP_SLOPE	—	—	4	—
47	PRESSURE_COMP	5	—	5	—
48	PRESSURE_UNITS	—	2	—	—
49	ENABLE_PRESSURE_COMP	—	—	—	2
50	PRESSURE_FACTOR_FLOW	—	—	—	4
51	PRESSURE_FACTOR_DENS	—	—	—	4

Index	Name	View			
		1	2	3	4
52	PRESSURE_FLOW_CAL	—	—	—	4
53	SNS_PuckEnableExtTemp	—	2	—	—
54	SNS_ExternalTempInput	5	—	—	—
55	SNS_ZeroInProgress	—	—	—	2
56	CAL_TEMPERATURE_UNITS	2	—	—	—
57	PRESSURE_TYPE	—	—	—	2
58	PRESSURE_INPUT_TYPE	—	—	—	2

A.3.2 Standard fieldbus parameters for calibration transducer blocks

Index and name	Description	List of values
#0 BLOCK_STRUCTURE	The beginning of the transducer block. Msg type = VAR Data type = DS_64 (5) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—
#1 ST_REV	The revision level of the static data associated with the function block. Incremented with each write of static store. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	—
#2 TAG_DESC	The user description of the intended block application. Msg type = STR Data type = OCTET STRING (32) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	Any 32 characters
#3 STRATEGY	Used to identify grouping of blocks. This data is not checked or processed by the block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—

Index and name	Description	List of values
#4 ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Msg type = VAR Data type = Unsigned8 (1) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	1 to 255
#5 MODE_BLK	The actual, target, permitted, and normal modes of the block. Msg type = REC Data type = DS-69 (4) Store = Mixed Access = RW (OOS) or RW (Auto) Available in Release 1.0	See section 2.6 of FF-891
#6 BLOCK_ERR	The error status associated with the hardware or software components associated with a block. Msg type = STR Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	See section 4.8 of FF-903
#7 UPDATE_EVT	Occurs when a static parameter is changed while a block mode is not in out of service (OOS) mode, or when the mode changes from OOS mode and one or more static parameters changed while the block was OOS. Msg type = REC Data type = DS-73 Store = Dynamic Access = RW in any mode Available in Release 1.0	—
#8 BLOCK_ALM	A predefined set of 16 conditions that may occur within a block. Msg type = REC Data type = DS-72 Store = Dynamic Access = RW in any mode Available in Release 9.0	—
#9 TRANSDUCER_ DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—

Index and name	Description	List of values
#10 TRANSDUCER_ TYPE	Identifies the transducer that follows. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#11 TRANSDUCER_ TYPE_VER	Identifies the version of the transducer block. Format is *XXYY* where *XX* is the major spec revision and *YY* is the manufacturer revision. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#12 XD_ERROR	Used for all config, H/W, connection failure of system problems in the block. Msg type = VAR Data type = Unsigned8 (1) Store = Dynamic Access = RW (OOS) Available in Release 1.0	0 = No Error 18 = Calibration Error 19 = Configuration Error 20 = Electronics Failure 21 = Sensor Failure 26 = Process Error 27 = Calibration in Progress
#13 COLLECTION_ DIRECTORY	Used for all config, H/W, and connection failures of system problems in the block. Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = RW (OOS) Available in Release 9.0	—

A.3.3 Calibration transducer blocks

Table A-8: Calibration transducer blocks

Index and name	Description	List of values	HW
#14 MASS_FLOW_GAIN	Flow calibration factor Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800 CDM FDM FVM
#15 MASS_FLOW_T_COMP	Temperature coefficient for flow Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800

Table A-8: Calibration transducer blocks *(continued)*

Index and name	Description	List of values	HW
#16 ZERO_CAL	Perform auto zero Msg type = VAR Data type = DS-66 (2) Store = — Access = R/W (OOS) Available in Release 1.0	Value part of DS-66 0 = Abort Zero Cal 1 = Start Zero Cal	700 800 CDM
#17 ZERO_TIME	Maximum zeroing time Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800 CDM
#18 ZERO_STD_DEV	Standard deviation of auto zero Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM
#19 ZERO_OFFSET	Present flow signal offset at zero flow in µsec Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800 CDM
#20 ZERO_FAILED_VALUE	Value of the zero if the zero calibration failed Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM
#21 LOW_DENSITY_CAL	Perform low-density calibration Msg type = METHOD Data type = Unsigned16 (2) Store = — Access = R/W (OOS) Available in Release 1.0	0 = None 1 = Start Cal	700 800
#22 HIGH_DENSITY_CAL	Perform high-density calibration Msg type = METHOD Data type = Unsigned16 (2) Store = — Access = R/W (OOS) Available in Release 1.0	0 = None 1 = Start Cal	700 800

Table A-8: Calibration transducer blocks *(continued)*

Index and name	Description	List of values	HW
#23 FLOWING_DENSITY_CAL	Perform flowing-density calibration Msg type = METHOD Data type = Unsigned16 (2) Store = — Access = R/W in any mode Available in Release 1.0	0 = None 1 = Start Cal	700 800
#24 D3_DENSITY_CAL	Perform third point calibration Msg type = METHOD Data type = Unsigned16 (2) Store = — Access = R/W (OOS) Available in Release 1.0	0 = None 1 = Start Cal	700 800
#25 D4_DENSITY_CAL	Perform fourth point calibration Msg type = METHOD Data type = Unsigned16 (2) Store = — Access = R/W (OOS) Available in Release 1.0	0 = None 1 = Start Cal	700 800
#26 K1	Density calibration constant 1 (msec) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#27 K2	Density calibration constant 2 (msec) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#28 FD	Flowing density calibration constant Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#29 K3	Density calibration constant 3 (msec) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800

Table A-8: Calibration transducer blocks *(continued)*

Index and name	Description	List of values	HW
#30 K4	Density calibration constant 4 (msec) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#31 D1	Density 1 (g/cc) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#32 D2	Density 2 (g/cc) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#33 FD_VALUE	Flowing density (g/cc) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W in any mode Available in Release 1.0	—	700 800
#34 D3	Density 3 (g/cc) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#35 D4	Density 4 (g/cc) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#36 DENS_T_COEFF	Density temperature coefficient Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800

Table A-8: Calibration transducer blocks *(continued)*

Index and name	Description	List of values	HW
#37 T_FLOW_TG_COEFF	T-Series: Flow TG Coefficient (FTG) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#38 T_FLOW_FQ_COEFF	T-Series: Flow FQ Coefficient (FFQ) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#39 T_DENSITY_TG_COEFF	T-Series: Density TG Coefficient (DTG) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#40 T_DENSITY_FQ_COEFF1	T-Series: Density FQ Coefficient #1 (DFQ1) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#41 T_DENSITY_FQ_COEFF2	T-Series: Density FQ Coefficient #2 (DFQ2) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800
#42 TEMP_LOW_CAL	Perform temperature calibration at the low point (point 1) Msg type = METHOD Data type = Unsigned16 (2) Store = — Access = R/W (OOS) Available in Release 1.0	0 = None 1 = Start Cal	700 800 CDM FDM FVM
#43 TEMP_HIGH_CAL	Perform temperature calibration at the high point (point 2) Msg type = METHOD Data type = Unsigned16 (2) Store = — Access = R/W (OOS) Available in Release 1.0	0 = None 1 = Start Cal	700 800 CDM FDM FVM

Table A-8: Calibration transducer blocks *(continued)*

Index and name	Description	List of values	HW
#44 TEMP_VALUE	Temperature value for temperature calibrations (in degC) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800 CDM FDM FVM
#45 TEMP_OFFSET	Temperature calibration offset Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800 FDM FVM
#46 TEMP_SLOPE	Temperature calibration slope Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 1.0	—	700 800 FDM FVM

A.3.4 Pressure compensation for calibration transducer blocks

Table A-9: Pressure compensation for calibration transducer blocks

Index and name	Description	List of values	HW
#47 PRESSURE_COMP	Pressure Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = R/W in any mode Available in Release 2.0	—	700 800 CDM FDM FVM
#48 PRESSURE_UNITS	Pressure unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 2.0	1148 = inH2O (68°F) 1724 = InH2O@60°F 1156 = inHg (0°C) 1154 = ftH2O (68°F) 1151 = mmH2O (68°F) 1158 = mmHg (0°C) 1141 = psi 1137 = bar 1138 = mbar 1144 = g/cm2 1145 = kg/cm2 1130 = Pa 1132 = MPa 1133 = kPa 1139 = torr 1140 = atm 1147 = inH2O (4°C) 1150 = mmH2O (4°C)	700 800 CDM FDM FVM

Table A-9: Pressure compensation for calibration transducer blocks *(continued)*

Index and name	Description	List of values	HW
#49 ENABLE_PRESSURE_COMP	Enable/Disable pressure compensation Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 2.0	0= disabled 1 = enabled	700 800
#50 PRESSURE_FACTOR_FLOW	Pressure correction factor for flow Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 2.0	—	700 800
#51 PRESSURE_FACTOR_DENS	Pressure correction factor for density Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 2.0	—	700 800
#52 PRESSURE_FLOW_CAL	Flow calibration pressure Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 2.0	—	700 800

A.3.5 Temperature compensation for calibration transducer blocks

Table A-10: Temperature compensation for calibration transducer blocks

Index and name	Description	List of values	HW
#53 SNS_ PuckEnableExtTemp	Enable/Disable temperature compensation Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 4.0	0 = disabled 1 = enabled	700 800 CDM FDM FVM
#54 SNS_ ExternalTempInput	External temperature Msg type = VAR Data type = DS-65 (5) Store = Static Access = R/W in any mode Available in Release 4.0	—	700 800 CDM FDM FVM

A.3.6 Other additions for calibration transducer blocks

Table A-11: Other additions for calibration transducer blocks

Index and name	Description	List of values	HW
#55 SNS_ ZeroInProgress	Indicates whether a zero calibration, density calibration, or temperature calibration is running. Msg type = VAR Data type = DS-66 (2) Store = — Access = Read only Available in Release 7.0	Value part of DS-66 0 = Not Running 1 = Calibration Running	700 800 CDM FDM FVM
#56 CAL_TEMPERATURE_ UNITS	Temperature unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1000 = K 1001 = Deg C 1002 = Deg F 1003 = Deg R	700 800 CDM FDM FVM
#57 PRESSURE_TYPE	Pressure yype Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 9.0	0 = Gauge 1 = Absolute	CDM FDM FVM
#58 PRESSURE_INPUT_TYPE	Pressure input type Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 9.0	1 = Digital Comm 2 = Fixed	CDM FDM FVM

A.4 Diagnostics transducer blocks

A.4.1 View list for diagnostic transducer block

The following table lists the parameters contained in the transducer block for diagnostic parameters.

Six views are defined for the diagnostics transducer block. The table also shows the applicable views for each parameter, and the size of the parameter in that view, in bytes.

Index	Name	View					
		1	2	3	4	4_1	4_2
0	BLOCK_STRUCTURE	—	—	—	—	—	—
1	ST_REV	2	2	2	2	2	2
2	TAG_DESC	—	—	—	—	—	—
3	STRATEGY	—	—	—	2	—	—
4	ALERT_KEY	—	—	—	1	—	—

Index	Name	View					
		1	2	3	4	4_1	4_2
5	MODE_BLK	4	—	4	—	—	—
6	BLOCK_ERR	2	—	2	—	—	—
7	UPDATE_EVT	—	—	—	—	—	—
8	BLOCK_ALM	—	—	—	—	—	—
9	TRANSDUCER_DIRECTORY	—	—	—	—	—	—
10	TRANSDUCER_TYPE	2	2	2	2	—	—
11	TRANSDUCER_TYPE_VER	2	2	2	2	—	—
12	XD_ERROR	1	—	1	—	—	—
13	COLLECTION_DIRECTORY	—	—	—	—	—	—
14	SLUG_TIME	—	—	—	4	—	—
15	SLUG_LOW_LIMIT	—	—	—	4	—	—
16	SLUG_HIGH_LIMIT	—	—	—	4	—	—
17	ALARM1_STATUS	2	—	2	—	—	—
18	ALARM2_STATUS	2	—	2	—	—	—
19	ALARM3_STATUS	2	—	2	—	—	—
20	ALARM4_STATUS	2	—	2	—	—	—
21	FAULT_LIMIT	—	2	—	—	—	—
22	LAST_MEASURED_VALUE_ FAULT_TIMEOUT	—	2	—	—	—	—
23	ALARM_INDEX	—	—	—	2	—	—
24	ALARM_SEVERITY	—	—	—	2	—	—
25	DRIVE_GAIN	5	—	5	—	—	—
26	TUBE_FREQUENCY	—	—	4	—	—	—
27	LIVE_ZERO	—	—	4	—	—	—
28	LEFT_PICKUP_VOLTAGE	—	—	4	—	—	—
29	RIGHT_PICKUP_VOLTAGE	—	—	4	—	—	—
30	BOARD_TEMPERATURE	—	—	4	—	—	—
31	ELECT_TEMP_MAX	—	—	4	—	—	—
32	ELECT_TEMP_MIN	—	—	4	—	—	—
33	ELECT_TEMP_AVG	—	—	4	—	—	—
34	SENSOR_TEMP_MAX	—	—	4	—	—	—
35	SENSOR_TEMP_MIN	—	—	4	—	—	—
36	SENSOR_TEMP_AVG	—	—	4	—	—	—
37	RTD_RESISTANCE_CABLE	—	—	4	—	—	—

Index	Name	View					
		1	2	3	4	4_1	4_2
38	RTD_RESISTANCE_METER	—	—	4	—	—	—
39	CP_POWER_CYCLE	—	—	2	—	—	—
40	MFP_SAVE_FACTORY	—	—	—	2	—	—
41	MFP_RESET_STATS	—	—	—	2	—	—
42	EN_MFP	—	—	—	2	—	—
43	MFP_UNITS	—	—	—	2	—	—
44	MFP_TV_INDEX	—	—	—	2	—	—
45	MFP_TYPE	—	—	—	2	—	—
46	MFP_TV_INST	—	—	4	—	—	—
47	MFP_TV_INST	—	—	4	—	—	—
48	MFP_TV_STD_DEV	—	—	4	—	—	—
49	MFP_TV_MAX	—	—	4	—	—	—
50	MFP_TV_MIN	—	—	4	—	—	—
51	DIAG_FEATURE_KEY	—	—	—	2	—	—
52	SYS_PowerOnTimeSec	—	—	4	—	—	—
53	SNS_InputVoltage	—	—	4	—	—	—
54	SNS_TargetAmplitude	—	—	4	—	—	—
55	SNS_CaseRTDRes	—	—	4	—	—	—
56	SYS_RestoreFactoryConfig	—	2	—	—	—	—
57	SNS_FlowZeroRestore	—	2	—	—	—	—
58	SNS_AutoZeroFactory	—	2	—	—	—	—
59	SYS_ResetPowerOnTime	—	2	—	—	—	—
60	FRF_EnableFCFValidation	—	2	—	—	—	—
61	FRF_FaultAlarm	—	2	—	—	—	—
62	FRF_StiffnessLimit	—	4	—	—	—	—
63	FRF_AlgoState	—	—	—	—	2	—
64	FRF_AbortCode	—	—	—	—	2	—
65	FRF_StateAtAbort	—	—	—	—	2	—
66	FRF_Progress	—	—	—	—	2	—
67	FRF_StiffOutLimLpo	—	—	—	—	2	—
68	FRF_StiffOutLimRpo	—	—	—	—	2	—
69	FRF_StiffnessLpo_mean	—	—	—	—	4	—
70	FRF_StiffnessRpo_mean	—	—	—	—	4	—

Index	Name	View					
		1	2	3	4	4_1	4_2
71	FRF_Damping_mean	—	—	—	—	4	—
72	FRF_MassLpo_mean	—	—	—	—	4	—
73	FRF_MassRpo_mean	—	—	—	—	4	—
74	FRF_StiffnessLpo_stddev	—	—	—	—	4	—
75	FRF_StiffnessRpo_stddev	—	—	—	—	4	—
76	FRF_Damping_stddev	—	—	—	—	4	—
77	FRF_MassLpo_stddev	—	—	—	—	4	—
78	FRF_MassRpo_stddev	—	—	—	—	4	—
79	FRF_StiffnessLpo_air	—	—	—	—	4	—
80	FRF_StiffnessRpo_air	—	—	—	—	4	—
81	FRF_Damping_air	—	—	—	—	4	—
82	FRF_MassLpo_air	—	—	—	—	4	—
83	FRF_MassRpo_air	—	—	—	—	4	—
84	FRF_StiffnessLpo_water	—	—	—	—	4	—
85	FRF_StiffnessRpo_water	—	—	—	—	4	—
86	FRF_Damping_water	—	—	—	—	4	—
87	FRF_MassLpo_water	—	—	—	—	4	—
88	FRF_MassRpo_water	—	—	—	—	4	—
89	ALERT_TIMEOUT	—	2	—	—	—	—
90	FRF_FCFValidCounter	—	—	—	—	2	—
91	FRF_StartMeterVer	—	—	—	—	—	2
92	FRF_MV_Index	—	—	—	—	—	2
93	FRF_MV_Counter	—	—	—	—	—	2
94	FRF_MV_Status	—	—	—	—	—	2
95	FRF_MV_Time	—	—	—	—	—	4
96	FRF_MV_LPO_Norm	—	—	—	—	—	4
97	FRF_MV_RPO_Norm	—	—	—	—	—	4
98	FRF_DriveCurr	—	—	—	—	—	4
99	FRF_DL_T	—	—	—	—	—	4
100	FRF_Temp	—	—	—	—	—	4
101	FRF_Density	—	—	—	—	—	4
102	FRF_DriveFreq	—	—	—	—	—	4

Index	Name	View					
		1	2	3	4	4_1	4_2
103	FRF_LpoFilt	—	—	—	—	—	4
104	FRF_RpoFilt	—	—	—	—	—	4
105	FRF_DataSetSelIndex	—	—	—	—	—	4
106	FRF_MV_FirstRun_Time	—	—	—	—	—	4
107	FRF_MV_Elapse_Time	—	—	—	—	—	4
108	FRF_MV_Time_Left	—	—	—	—	—	4
109	FRF_ToneLevel	—	—	—	—	—	4
110	FRF_ToneRampTime	—	—	—	—	—	4
111	FRF_BlCoeff	—	—	—	—	—	4
112	FRF_DriveTarget	—	—	—	—	—	4
113	FRF_DrivePCoeff	—	—	—	—	—	4
114	FRF_ToneSpacingMult	—	—	—	—	—	4
115	FRF_Freq_DriftLimit	—	—	—	—	—	4
116	FRF_Max_Current_mA	—	—	—	—	—	4
117	FRF_KFQ2	—	—	—	—	—	4
118	SYS_AnalogOutput_Fault	2	—	—	—	—	—
119	SNS_MV_Failed	2	—	—	—	—	—
120	ALARM5_STATUS	2	—	—	—	—	—
121	DIAG_TEMPERATURE_UNITS	2	—	—	—	—	—
122	DIAG_MASSFLOW_UNITS	2	—	—	—	—	—
123	DIAG_SYS_AttachedCoreType	—	2	—	—	—	—
124	DIAG_FRF_OUTPUT_STATES	—	—	—	2	—	—
125	DIAG_FRF_LPO_METER_FACTOR	—	—	—	4	—	—
126	DIAG_FRF_RPO_METER_FACTOR	—	—	—	4	—	—
127	DIAG_FRF_LPO_CI_SPREAD	—	—	—	4	—	—
128	DIAG_FRF_RPO_CI_SPREAD	—	—	—	4	—	—
129	DIAG_FRF_SYMMETRY_CI_SPREAD	—	—	—	4	—	—

A.4.2 Standard fieldbus parameters for diagnostic transducer blocks

Index and name	Description	List of values
#0 BLOCK_STRUCTURE	The beginning of the transducer block. Msg type = VAR Data type = DS_64 (5) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—
#1 ST_REV	The revision level of the static data associated with the function block. Incremented with each write of static store. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	—
#2 TAG_DESC	The user description of the intended block application. Msg type = STR Data type = OCTET STRING (32) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	Any 32 characters
#3 STRATEGY	Used to identify grouping of blocks. This data is not checked or processed by the block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—
#4 ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Msg type = VAR Data type = Unsigned8 (1) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	1 to 255
#5 MODE_BLK	The actual, target, permitted, and normal modes of the block. Msg type = REC Data type = DS-69 (4) Store = Mixed Access = RW (OOS) or RW (Auto) Available in Release 1.0	See section 2.6 of FF-891

Index and name	Description	List of values
#6 BLOCK_ERR	The error status associated with the hardware or software components associated with a block. Msg type = STR Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	See section 4.8 of FF-903
#7 UPDATE_EVT	Occurs when a static parameter is changed while a block mode is not in out of service (OOS) mode, or when the mode changes from OOS mode and one or more static parameters changed while the block was OOS. Msg type = REC Data type = DS-73 Store = Dynamic Access = RW in any mode Available in Release 1.0	—
#8 BLOCK_ALM	A predefined set of 16 conditions that may occur within a block. Msg type = REC Data type = DS-72 Store = Dynamic Access = RW in any mode Available in Release 9.0	—
#9 TRANSDUCER_ DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#10 TRANSDUCER_ TYPE	Identifies the transducer that follows. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#11 TRANSDUCER_ TYPE_VER	Identifies the version of the transducer block. Format is *XXYY* where *XX* is the major spec revision and *YY* is the manufacturer revision. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—

Index and name	Description	List of values
#12 XD_ERROR	Used for all config, H/W, connection failure of system problems in the block. Msg type = VAR Data type = Unsigned8 (1) Store = Dynamic Access = RW (OOS) Available in Release 1.0	0 = No Error 18 = Calibration Error 19 = Configuration Error 20 = Electronics Failure 21 = Sensor Failure 26 = Process Error 27 = Calibration in Progress
#13 COLLECTION_ DIRECTORY	Used for all config, H/W, and connection failures of system problems in the block. Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = RW (OOS) Available in Release 9.0	—

A.4.3 Slug flow setup for diagnostic transducer blocks

Table A-12: Slug flow setup for diagnostic transducer blocks

Index and name	Description	List of values	HW
#14 SLUG_TIME	Slug duration in seconds Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W in any mode Available in Release 1.0	—	700 800 CDM FDM FVM
#15 SLUG_LOW_LIMIT	Low density limit in g/cc Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W in any mode Available in Release 1.0	—	700 800 CDM FDM FVM
#16 SLUG_HIGH_LIMIT	High density limit in g/cc Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W in any mode Available in Release 1.0	—	700 800 CDM FDM FVM

A.4.4 Alarm status for diagnostic transducer blocks

Table A-13: Alarm status for diagnostic transducer blocks

Index and name	Description	List of values	HW
#17 ALARM1_STATUS	Status Word 1 Msg type = ENUM Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	0x0001 = Transmitter Fail 0x0002 = Sensor Fail 0x0004 = EEPROM error (CP) 0x0008 = RAM error (CP) 0x0010= Boot Fail (CP) 0x0020 = Uncofig – FloCal 0x0040 = Uncofig – K1 0x0080 = Input Overrange 0x0100 = Temp. Overrange 0x0200 = Dens. Overrange 0x0800 = Cal Failed 0x1000= Xmitter Init 0x2000 = Sns/Xmitter comm fault 0x8000 = Xmitter Not Characterized	700 800 CDM FDM FVM
#18 ALARM2_STATUS	Status Word 2 Msg type = ENUM Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	0x0001 = Line RTD Over 0x0002 = Meter RTD Over 0x0004 = CP Exception 0x0008 = API: Temp OOL 0x0010= API:Density OOL 0x0020 = ED: Unable to fit curve data 0x0040 = ED: Extrapolation alarm 0x0080 = Not Used 0x0100 = EEPROM err 0x0200 = RAM err 0x0400 = Factoy Config err 0x0800 = Low Power 0x1000= Tube not full 0x2000 = Meter Verification Aborted 0x4000 = Meter Verification Failed 0x8000 = Not Used	700 800 CDM FDM FVM

Table A-13: Alarm status for diagnostic transducer blocks *(continued)*

Index and name	Description	List of values	HW
#19 ALARM3_STATUS	Status Word 3 Msg type = ENUM Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	0x0001 = Drive Overrange 0x0002 = Slug Flow 0x0004 = Cal in Progress 0x0008 = Data Loss Possible 0x0010 = Upgrade Series 2000 0x0020 = Simulation Mode 0x0080 = Warming Up 0x0100 = Power Reset 0x0200 = Reverse Flow 0x0400 = AI/AO Simulation Active 0x0800 =Meter Verification/ Outputs Fixed 0x1000= Meter Verification In Progress 0x2000 = Not Used 0x4000 = Not Used 0x8000 = Not Used	700 800 CDM FDM FVM
#20 ALARM4_STATUS	Status Word 4 Msg type = ENUM Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	0x0001 = Cal Fail: Low 0x0002 = Cal Fail: High 0x0004 = Cal Fail: Noisy 0x0008 = Auto Zero IP 0x0010 = D1 Cal in Progress 0x0020 = D2 Cal in Progress 0x0040 = FD Cal in Progress 0x0080 = Temp slope Cal in Progress 0x0100 = Temp offset Cal in Progress 0x0200 = D3 Cal in Progress 0x0400 = D4 Cal in Progress 0x0800 = Factory configuration invalid 0x1000 = Factory configuration data checksum invalid 0x2000 = Core EEPROM DB corrupt 0x4000 = Core EEPROM Totals corrupt 0x8000 = Core EEPROM Program corrupt	700 800 CDM FDM FVM
#21 FAULT_LIMIT	Fault limit code Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 1.0	0 = Upscale 1 = Downscale 2 = Zero 3 = NAN 4 = Flow goes to zero 5 = None	700 800 CDM FDM FVM

Table A-13: Alarm status for diagnostic transducer blocks *(continued)*

Index and name	Description	List of values	HW
#22 LAST_MEASURED_ VALUE_FAULT_TIMEOUT	Last measure value fault timeout Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW in any mode Available in Release 1.0	—	700 800 CDM FDM FVM

Table A-13: Alarm status for diagnostic transducer blocks *(continued)*

Index and name	Description	List of values	HW
#23 ALARM_INDEX	Alarm index Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = RW in any mode Available in Release 3.0	0 = No Alarm 1 = A001 - (E)EPROM Error (CP) 2 = A002 - RAM Error (CP) 3 = A003 - Sensor Failure 4 = A004 - Temperature Sensor Failure 5 = A005 - Mass Flow Outside Limits 6 = A006 - Characterization Required 8 = A008 - Density Overrange 9 = A009 - Transmitter Initializing/Warming Up 10 = A010 - Calibration Failure 11 = A011 - Zero Too Low 12 = A012 - Zero Too High 13 = A013 - Zero Too Noisy 14 = A014 - Transmitter Failure 16 = A016 - Line RTD Temperature Out-of-Range 17 = A017 - Meter RTD Temperature Out-of-Range 18 = A018 - (E)EPROM Checksum Error (2000) 19 = A019 - RAM or ROM Test Error (2000) 20 = A020 - Calibration Factors Unentered (FlowCal) 21 = A021 - Incorrect Sensor Type (K1) 22 = A022 - Core EEPROM DB Corrupt 23 = A023 - Core EEPROM Totals Corrupt 24 = A024 - Core EEPROM Program Corrupt 25 = A025 - Protected Boot Sector Fault (CP) 26 = A026 - Sensor/Transmitter Communication Error 28 = A028 - Core Processor Write Failure 31 = A031 - Low Power 32 = A032 - Meter Verification/ Outputs in Fault 33 = A033 - Insufficient Pickoff Signal 34 = A034 - Meter Verification Failed 35 = A035 - Meter Verification Aborted 36 = A036 - Viscosity Out of Limits	700 800 CDM FDM FVM

Table A-13: Alarm status for diagnostic transducer blocks *(continued)*

Index and name	Description	List of values	HW
		37 = A037 - Sensor Check Failed 38 = A038 - Time Period Out of Range 42 = A102 - Drive Overrange/ Partially Full Tube 43 = A103 - Data Loss Possible 44 = A104 - Calibration in Progress 45 = A105 - Two-Phase Flow 47 = A107:Power Reset Occurred 60 = A120 - ED: Unable to Fit Curve Data 56 = A116 - API: Temperature Outside Standard Range 57 = A117 - API: Density Outside Standard Range 61 = A121 - ED: Extrapolation Alarm 62 = A122 - API:Pressure Out of Range 68 = A128 - Factory configuration invalid 69 = A129 - Factory configuration checksum invalid 71 = A131 - Meter Verification/ Outputs at Last Value 72 = A132 - Sensor Simulation Mode Active 74 = A134 - Tube-Case Temperature Difference Out of Range 77 = A137 - API Non Conversion	
#24 ALARM_SEVERITY	Alarm severity Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 3.0	0 = Ignore 1 = Info 2 = Fault	700 800 CDM FDM FVM

A.4.5 Device diagnostics from diagnostics transducer block

Table A-14: Device diagnostics from diagnostics transducer block

Index and name	Description	List of values	HW
#25 DRIVE_GAIN	Drive gain Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM

Table A-14: Device diagnostics from diagnostics transducer block *(continued)*

Index and name	Description	List of values	HW
#26 TUBE_ FREQUENCY	Raw tube period Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#27 LIVE_ZERO	Live zero (mass flow) Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 1.0	—	700 800
#28 LEFT_PICKUP_ VOLTAGE	Left pickoff voltage Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#29 RIGHT_PICKUP_ VOLTAGE	Right pickoff voltage Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 1.0	—	700 800 CDM FVM
#30 BOARD_ TEMPERATURE	Board temperature in degC Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#31 ELECT_TEMP_ MAX	Maximum electronics temperature Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 2.0	—	700 800 CDM FDM FVM
#32 ELECT_TEMP_ MIN	Minimum electronics temperature Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 2.0	—	700 800 CDM FDM FVM

Table A-14: Device diagnostics from diagnostics transducer block *(continued)*

Index and name	Description	List of values	HW
#33 ELECT_TEMP_ AVG	Average electronics temperature Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 2.0	—	700 800 CDM FDM FVM
#34 SENSOR_TEMP_ MAX	Maximum sensor temperature Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM
#35 SENSOR_TEMP_ MIN	Minimum sensor temperature Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM
#36 SENSOR_TEMP_ AVG	Average sensor temperature Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM
#37 RTD_RESISTANCE_ CABLE	9-wire cable RTD resistance in ohms Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM
#38 RTD_RESISTANCE_ METER	Meter RTD resistance in ohms Msg type = VAR Data type = FLOAT (4) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM
#39 CP_POWER_ CYCLE	Number of core processor power cycles Msg type = VAR Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM

A.4.6 Meter fingerprinting for diagnostic transducer blocks

Table A-15: Meter fingerprinting for diagnostic transducer blocks

Index and name	Description	List of values	HW
#40 MFP_SAVE_FACTORY	Save factory calibration meter fingerprint Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0x0000 = no action 0x0001 = save	700 800
#41 MFP_RESET_STATS	Reset meter current fingerprint statistics Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0x0000 = no action 0x0001 = save	700 800
#42 EN_MFP	Enable/Disable meter fingerprinting Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0x0000 = disabled 0x0001 = enabled	700 800
#43 MFP_UNITS	Meter fingerprint in SI (0) or English (1) units Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0x0000 = SI 0x0001 = English	700
#44 MFP_TV_INDEX	Meter fingerprint transmitter variable index Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0 = Mass Flow Rate 1 = Temperature 3 = Density 5 = Volume Flow Rate 46 = Raw Tube Frequency 47 = Drive Gain 48 = Case Temperature 49 = LPO Amplitude 50 = RPO Amplitude 51 = Board Temperature 52 = Input Voltage 54 = Live Zero	700
#45 MFP_TYPE	Fingerprint type Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0 = Current 1 = Factory Cal 2 = Installation 3 = Last Zero	700

Table A-15: Meter fingerprinting for diagnostic transducer blocks *(continued)*

Index and name	Description	List of values	HW
#46 MFP_TYPE	Transmitter variable, instantaneous (only valid for current print) Msg type = VAR Data type = FLOAT (4) Store = Dynamic Access = Read only Available in Release 3.0	—	700
#47 MFP_TV_STD_DEV	Transmitter variable, average (1-min rolling) Msg type = VAR Data type = FLOAT (4) Store = Dynamic Access = Read only Available in Release 3.0	—	700
#48 MFP_TV_AVG	Transmitter variable, std dev (1-min rolling) Msg type = VAR Data type = FLOAT (4) Store = Dynamic Access = Read only Available in Release 3.0	—	700
#49 MFP_TV_MAX	Transmitter variable, maximum (since last statistics reset) Msg type = VAR Data type = FLOAT (4) Store = Dynamic Access = Read only Available in Release 3.0	—	700
#50 MFP_TV_MIN	Transmitter variable, minimum (since last statistics reset) Msg type = VAR Data type = FLOAT (4) Store = Dynamic Access = Read only Available in Release 3.0	—	700

A.4.7 Other additions for diagnostics transducer blocks

Table A-16: Other additions for diagnostics transducer blocks

Index and name	Description	List of values	HW
#51 DIAG_FEATURE_KEY	Enabled features Msg type = STR Data type = BIT STRING (2) Store = Static Access = Read only Available in Release 4.0	0x0000 = standard 0x0800 = Meter verification 0x0008 = Enhhanced density 0x0010 = API	700 800 CDM FDM FVM

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#52 SYS_PowerOnTimeSec	Power on time (seconds since last reset) Msg type = VAR Data type = Unsigned32 (4) Store = Dynamic Access = Read only Available in Release 4.0	—	700 800 CDM FDM FVM
#53 SNS_InputVoltage	Input voltage (volts) Msg type = VAR Data type = FLOAT (4) Store = Dynamic Access = Read only Available in Release 4.0	—	700 800 CDM FDM FVM
#54 SNS_TargetAmplitude	Actual target amplitude (mV/Hz) (pre 700 2.1, actual & override) Msg type = VAR Data type = FLOAT (4) Store = Dynamic Access = Read only Available in Release 4.0	—	700 800 CDM FDM FVM
#55 SNS_CaseRTDRes	Case RTD resistance (ohms) Msg type = VAR Data type = FLOAT (4) Store = Dynamic Access = Read only Available in Release 4.0	—	700 800
#56 SYS_RestoreFactoryConfig	Restore factory configuration Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 4.0	0 = no action 1 = Restore	700 800 CDM FDM FVM
#57 SNS_FlowZeroRestore	Restore factory zero Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 4.0	0 = no action 1 = Restore	800
#58 SNS_AutoZeroFactory	Factory flow signal offset at zero flow (units of uSec) Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#59 SYS_ResetPowerOnTime	Reset power-on time Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 4.0	0 = no action 1 = Reset	800 CDM FDM FVM
#60 FRF_EnableFCFValidation	Start/Stop meter verification - (applicable only if meter verification is enabled) Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 4.0	0= Disabled 1 = Fixed output mode 2 = Factory air verification 3 = Factory water verification 4 = Special debug mode 5 = Abort 6 = Continue measurement mode	800
#61 FRF_FaultAlarm	The state of the outputs when the meter verification routine is running - (applicable only if meter verification is enabled) Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	0 = Last Value 1 = Fault	800
#62 FRF_StiffnessLimit	The setpoint of the stiffness limit. Represents percentage - (applicable only if meter verification is enabled) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W in any mode Available in Release 4.0	—	800
#63 FRF_AlgoState	The current state of the meter verification routine Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 4.0	1 through 18	800

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#64 FRF_AbortCode	The reason the meter verification routine aborted Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 4.0	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	800
#65 FRF_StateAtAbort	The state of the meter verification routine when it aborted Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 4.0	1 through 18	800
#66 FRF_Progress	Progress (% complete) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 4.0	—	800
#67 FRF_StiffOutLimLpo	Is the LPO stiffness out of limits? Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 4.0	—	800
#68 FRF_StiffOutLimRpo	Is the RPO stiffness out of limits? Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 4.0	—	800
#69 FRF_StiffnessLpo_mean	The current LPO stiffness calculated as a mean Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#70 FRF_StiffnessRpo_mean	The current RPO stiffness calculated as a mean Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#71 FRF_Damping_mean	The current damping calculated as a mean Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#72 FRF_MassLpo_mean	The current LPO mass calculated as a mean Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#73 FRF_MassRpo_mean	The current RPO mass calculated as a mean Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#74 FRF_StiffnessLpo_stddev	The current LPO stiffness calculated as a standard deviation Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#75 FRF_StiffnessRpo_stddev	The current RPO stiffness calculated as a standard deviation Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#76 FRF_Damping_stddev	The current damping calculated as a standard deviation Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#77 FRF_MassLpo_stddev	The current LPO mass calculated as a standard deviation Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#78 FRF_MassRpo_stddev	The current RPO mass calculated as a standard deviation Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#79 FRF_StiffnessLpo_air	The LPO stiffness calculated as a mean during Factory Cal of Air Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#80 FRF_StiffnessRpo_air	The RPO stiffness calculated as a mean during Factory Cal of Air Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#81 FRF_Damping_air	The damping calculated as a mean during Factory Cal of Air Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#82 FRF_MassLpo_air	The LPO mass calculated as a mean during Factory Cal of Air Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#83 FRF_MassRpo_air	The RPO mass calculated as a mean during Factory Cal of Air Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#84 FRF_StiffnessLpo_water	The LPO stiffness calculated as a mean during Factory Cal of Water Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#85 FRF_StiffnessRpo_water	The RPO stiffness calculated as a mean during Factory Cal of Water Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#86 FRF_Damping_water	The damping calculated as a mean during Factory Cal of Water Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#87 FRF_MassLpo_water	The LPO mass calculated as a mean during Factory Cal of Water Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#88 FRF_MassRpo_water	The RPO mass calculated as a mean during Factory Cal of Water Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 4.0	—	800
#89 ALERT_TIMEOUT	Alert timeout Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	0 to 300 seconds	700 800 CDM FDM FVM
#90 FRF_FCFValidCounter	Counts the number of times the meter verification algorithm has run successfully Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 5.0	—	800
#91 FRF_StartMeterVer	Start on-line meter verification - equivalent to Reg 3000 = 6 - applicable only if meter verification is enabled) Msg type = VAR Data type = DS-66 (2) Store = Static Access = R/W in any mode Available in Release 6.0	Value part of DS-66 0 = no action 1 = start meter verification in continue measurement mode	800
#92 FRF_MV_Index	FCF Datalog Index (0-19, 0 = most recent run) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 6.0	—	800
#93 FRF_MV_Counter	FCF Datalog Item 1: Run Number Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 6.0	—	800

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#94 FRF_MV_Status	FCF Datalog Item 2: Status; Abort states are compressed to fit into 3 bits Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 6.0	Bit 7 = FCF pass/fail Bits 6-4 = state Bits 3-0 = abort code	800
#95 FRF_MV_Time	FCF Datalog Item 3: Time Initiated Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = Read only Available in Release 6.0	—	800
#96 FRF_MV_LPO_Norm	FCF Datalog Item 4: LPO Normalized Data Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 6.0	—	800
#97 FRF_MV_RPO_Norm	FCF Datalog Item 5: RPO Normalized Data Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 6.0	—	800
#98 FRF_DriveCurr	Drive current Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 6.0	—	800
#99 FRF_DL_T	Delta T Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 6.0	—	800
#100 FRF_Temp	Temperature Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 6.0	—	800

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#101 FRF_Density	Density Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 6.0	—	800
#102 FRF_DriveFreq	Drive frequency Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 6.0	—	800
#103 FRF_LpoFilt	LPO filter Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 6.0	—	800
#104 FRF_RpoFilt	RPO filter Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 6.0	—	800
#105 FRF_DataSetSelIndex	FCF verification data set selection Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 6.0	0 = Current data means 1 = Current data standard deviations 2 = Factory calibration of air means 3 = Factory calibration of water means 4 = Running average data 5 = Standard error of the estimate	800
#106 FRF_MV_FirstRun_Time	FCF timers: time until first run in hours (applicable only if meter verification feature is enabled) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W in any mode Available in Release 7.0	—	800

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#107 FRF_MV_Elapse_Time	FCF timers: time between each run after the first run initiated in hours (applicable only if meter verification feature is enabled) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W in any mode Available in Release 7.0	—	800
#108 FRF_MV_Time_Left	FCF timers: time until next run in hours Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 7.0	—	800
#109 FRF_ToneLevel	FRF tone level (mA) (applicable only if meter verification feature is enabled) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 7.0	—	800
#110 FRF_ToneRampTime	Tone ramp time in seconds (applicable only if meter verification feature is enabled) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 7.0	—	800
#111 FRF_BlCoeff	BL coefficient (applicable only if meter verification feature is enabled) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 7.0	—	800
#112 FRF_DriveTarget	FRF drive target (applicable only if meter verification feature is enabled) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 7.0	—	800

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#113 FRF_DrivePCoeff	FRF drive P coefficient (applicable only if meter verification feature is enabled) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 7.0	—	800
#114 FRF_ToneSpacingMult	Tone spacing multiplier (applicable only if meter verification feature is enabled) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 7.0	—	800
#115 FRF_Freq_DriftLimit	Frequency drift limit (applicable only if meter verification feature is enabled) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 7.0	—	800
#116 FRF_Max_Current_mA	Maximum sensor current (applicable only if meter verification feature is enabled) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 7.0	—	800
#117 FRF_KFQ2	KFQ2 linear density correction for stiffness value Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 7.0	—	800
#118 SYS_AnalogOutput_Fault	Indicates if a critical fault is present Msg type = VAR Data type = DS-66 (2) Store = — Access = Read only Available in Release 7.0	Value part of DS-66 0 = No critical fault 1 = Critical fault present	700 800 CDM FDM FVM

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#119 SNS_MV_Failed	Indicates if meter verification failed Msg type = VAR Data type = DS-66 (2) Store = — Access = Read only Available in Release 7.0	Value part of DS-66 0 = Meter verification did not fail 1 = Meter verification failed	800
#120 ALARM5_STATUS	Status Word 5 Msg type = ENUM Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 8.0	0x0001 = Viscosity out of limits 0x0002 = Sensor check fail 0x0004 = PM: pressure out of range 0x0008 = Incorrect display type 0x0010 = Incorrect board type 0x0020 = Time period out of limits 0x0040 = Case/Meter temperature differential out of range 0x0080 = API non-convergence 0x0100 = Not used 0x0200 = Not used 0x0400 = Not used 0x0800 = Not used 0x1000 = Not used 0x2000 = Not used 0x4000 = Not used 0x8000 = Not used	CDM FDM FVM
#121 DIAG_TEMPERATURE_UNITS	Temperature unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1000 = K 1001 = Deg C 1002 = Deg F 1003 = Deg R	700 800 CDM FDM FVM

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#122 DIAG_MASSFLOW_UNITS	Mass flow unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	1318 = g/s 1319 = g/min 1320 = g/h 1322 = kg/s 1323 = kg/min 1324 = kg/h 1325 = kg/d 1327 = t/min 1328 = t/h 1329 = t/d 1330 = lb/s 1331 = lb/min 1332 = lb/h 1333 = lb/d 1335 = STon/min 1336 = STon/h 1337 = STon/d 1340 = LTon/h 1341 = LTon/d 253 = Special	700 800
#123 DIAG_SYS_AttachedCoreTy pe	Indicates the attached core type Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	0 = CORE_UNKNOWN 1 = CORE_700 2 = CORE_ECP 3 = CORE_S 4 = CORE_DENSITY 5 = CORE_DEN_CDM 6 = CORE_DEN_FDM 7 = CORE_DEN_FVM	700 800 CDM FDM FVM
#124 DIAG_FRF_OUTPUT_STATE S	Indexed by R2984 Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	—	800
#125 DIAG_FRF_LPO_METER_FA CTOR	Indexed by R2984 Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 8.0	—	800
#126 DIAG_FRF_RPO_METER_FA CTOR	Indexed by R2984 Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 8.0	—	800

Table A-16: Other additions for diagnostics transducer blocks *(continued)*

Index and name	Description	List of values	HW
#127 DIAG_FRF_LPO_CI_SPREAD	Indexed by R2984 Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 8.0	—	800
#128 DIAG_FRF_RPO_CI_SPREAD	Indexed by R2984 Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 8.0	—	800
#129 DIAG_FRF_SYMMETRY_CI_SPREAD	Indexed by R2984 Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 8.0	—	800

A.5 Device information transducer blocks

A.5.1 View list for device information transducer block

The following table lists the parameters contained in the tranducer block for device information parameters.

Four views are defined for the device information tranducer block. The table also shows the applicable views for each parameter, and the size of the parameter in that view, in bytes.

Index	Name	View			
		1	2	3	4
0	BLOCK_STRUCTURE	—	—	—	—
1	ST_REV	2	2	2	2
2	TAG_DESC	—	—	—	—
3	STRATEGY	—	—	—	2
4	ALERT_KEY	—	—	—	1
5	MODE_BLK	4	—	4	—
6	BLOCK_ERR	2	—	2	—
7	UPDATE_EVT	—	—	—	—
8	BLOCK_ALM	—	—	—	—
9	TRANSDUCER_DIRECTORY	—	—	—	—
10	TRANSDUCER_TYPE	2	2	2	2
11	TRANSDUCER_TYPE_VER	2	2	2	2

Index	Name	View			
		1	2	3	4
12	XD_ERROR	1	—	1	—
13	COLLECTION_DIRECTORY	—	—	—	—
14	SERIAL_NUMBER	—	4	—	—
15	OPTION_BOARD_CODE	—	—	—	2
16	700_SW_REV	—	2	—	—
17	2700_SW_REV	—	2	—	—
18	CEQ_NUMBER	—	2	—	—
19	DESCRIPTION	—	—	—	16
20	SENSOR_SN	—	4	—	—
21	SENSOR_TYPE	—	—	—	16
22	SENSOR_TYPE_CODE	—	—	—	2
23	SENSOR_MATERIAL	—	—	—	2
24	SENSOR_LINER	—	—	—	2
25	SENSOR_END	—	—	—	2
26	MASS_MIN_RANGE	—	—	—	4
27	TEMP_MIN_RANGE	—	—	—	4
28	DENSITY_MIN_RANGE	—	—	—	4
29	VOLUME_MIN_RANGE	—	—	—	4
30	SNS_PuckDeviceTypeCode	—	—	—	2
31	AI_SIMULATE_MODE	—	—	—	2
32	SNS_DeviceID	—	—	—	4
33	SYS_DeviceType	—	—	—	2
34	SYS_ManufacturerID	—	—	—	2
35	DEV_SYS_AttachedCoreType	—	2	—	—

A.5.2 Standard fieldbus parameters for device information transducer blocks

Index and name	Description	List of values
#0 BLOCK_STRUCTURE	The beginning of the transducer block. Msg type = VAR Data type = DS_64 (5) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—

Index and name	Description	List of values
#1 ST_REV	The revision level of the static data associated with the function block. Incremented with each write of static store. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	—
#2 TAG_DESC	The user description of the intended block application. Msg type = STR Data type = OCTET STRING (32) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	Any 32 characters
#3 STRATEGY	Used to identify grouping of blocks. This data is not checked or processed by the block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—
#4 ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Msg type = VAR Data type = Unsigned8 (1) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	1 to 255
#5 MODE_BLK	The actual, target, permitted, and normal modes of the block. Msg type = REC Data type = DS-69 (4) Store = Mixed Access = RW (OOS) or RW (Auto) Available in Release 1.0	See section 2.6 of FF-891
#6 BLOCK_ERR	The error status associated with the hardware or software components associated with a block. Msg type = STR Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	See section 4.8 of FF-903

Index and name	Description	List of values
#7 UPDATE_EVT	Occurs when a static parameter is changed while a block mode is not in out of service (OOS) mode, or when the mode changes from OOS mode and one or more static parameters changed while the block was OOS. Msg type = REC Data type = DS-73 Store = Dynamic Access = RW in any mode Available in Release 1.0	—
#8 BLOCK_ALM	A predefined set of 16 conditions that may occur within a block. Msg type = REC Data type = DS-72 Store = Dynamic Access = RW in any mode Available in Release 9.0	—
#9 TRANSDUCER_ DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#10 TRANSDUCER_ TYPE	Identifies the transducer that follows. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#11 TRANSDUCER_ TYPE_VER	Identifies the version of the transducer block. Format is *XXYY* where *XX* is the major spec revision and *YY* is the manufacturer revision. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#12 XD_ERROR	Used for all config, H/W, connection failure of system problems in the block. Msg type = VAR Data type = Unsigned8 (1) Store = Dynamic Access = RW (OOS) Available in Release 1.0	0 = No Error 18 = Calibration Error 19 = Configuration Error 20 = Electronics Failure 21 = Sensor Failure 26 = Process Error 27 = Calibration in Progress

Index and name	Description	List of values
#13 COLLECTION_ DIRECTORY	Used for all config, H/W, and connection failures of system problems in the block. Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = RW (OOS) Available in Release 9.0	—

A.5.3 Transmitter data for device information transducer blocks

Table A-17: Transmitter data for device information transducer blocks

Index and name	Description	List of values	HW
#14 SERIAL_NUMBER	Serial number of this device Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = R/W in any mode Available in Release 1.0	0	700 800 CDM FDM FVM
#15 OPTION_BOARD_CODE	Code for the output option board Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	20 = FOUNDATION Fieldbus	700 800 CDM FDM FVM
#16 700_SW_REV	Model 700 transmitter software revision Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#17 2700_SW_REV	Model 2700 transmitter software revision Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#18 CEQ_NUMBER	Model 2700 transmitter CEQ number Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM

Table A-17: Transmitter data for device information transducer blocks *(continued)*

Index and name	Description	List of values	HW
#19 DESCRIPTION	User text Msg type = STR Data type = VISIBLE STRING (16) Store = Static Access = R/W in any mode Available in Release 3.0	—	700 800 CDM FDM FVM

A.5.4 Sensor data for device information transducer blocks

Table A-18: Sensor data for device information transducer blocks

Index and name	Description	List of values	HW
#20 SENSOR_SN	Sensor serial number Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = R/W in any mode Available in Release 1.0	0	700 800 CDM FDM FVM
#21 SENSOR_TYPE	Sensor type (i.e. F200, CMF025) Msg type = STR Data type = VISIBLE STRING (16) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#22 SENSOR_TYPE_CODE	Sensor type code Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0 = Curve tube 1 = Straight tube	700 800 CDM FDM FVM
#23 SENSOR_MATERIAL	Sensor material Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	3 = Hastelloy C-22 [CP, ECP, CDM, FDM](1) 4 = Monel [CP, ECP] 5 = Tantalum [CP, ECP] 6 = Titanium [CP, ECP, FDM] 19 = 316L stainless steel 23 = Inconel [CP, ECP] 252 = Unknown 253 = Special	700 800 CDM FDM FVM
#24 SENSOR_LINER	Liner material Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	10 = PTFE (teflon) [CP, ECP](1) 11 = Halar [CP, ECP] 16 = Tefzel [CP, ECP] 251 = None [CP, ECP, CDM] 252 = Unknown [CP, ECP, CDM] 253 = Special [CP, ECP, CDM]	700 800 CDM

Table A-18: Sensor data for device information transducer blocks *(continued)*

Index and name	Description	List of values	HW
#25 SENSOR_END	Flange type Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	0 = ANSI 150 [CP, ECP, FDM, FVM](1) 1 = ANSI 300 2 = ANSI 600 5 = PN 40 7 = JIS 10K [CP, ECP] 8 = JIS 20K [CP, ECP] 9 = ANSI 900 [CP, ECP, CDM, FDM] 10 = Sanitary clamp fitting [CP, ECP, FDM] 11 = Union [CP, ECP] 12 = PN 100 [CP, ECP, CDM] 13 = PN 16 [FDM, FVM] 14 = ANSI 1500 [FDM] 15 = Cone seat compression fitting [FDM, FVM] 251 = None 252 = Unknown 253 = Special	700 800 CDM FDM FVM
#26 MASS_MIN_RANGE	Mass flow minimum range Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM
#27 TEMP_MIN_RANGE	Temperature minimum range Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#28 DENSITY_MIN_RANGE	Density minimum range (g/cc) Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800 CDM FDM FVM
#29 VOLUME_MIN_RANGE	Volume flow minimum range Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 1.0	—	700 800

Table A-18: Sensor data for device information transducer blocks *(continued)*

Index and name	Description	List of values	HW
#30 SNS_PuckDeviceTypeCode	Device type for the attached core processor Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 4.0	40 = 700 [CP][(1)] 50 = 800 [ECP] 61 = Density	700 800 CDM FDM FVM
#31 AI_SIMULATE_MODE	AI simulate mode Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	0 = disabled 1 = enabled	700
#32 SNS_DeviceID	Core processor unique ID Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = Read only Available in Release 5.0	—	—
#33 SYS_DeviceType	Transmitter device type Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 5.0	—	700 800 CDM FDM FVM
#34 SYS_ManufacturerID	Manufacturer ID Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	—	700 800 CDM FDM FVM
#35 DEV_SYS_Attached CoreType	Indicates the attached core type Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	0 = CORE_UNKNOWN 1 = CORE_700 2 = CORE_ECP 3 = CORE_S 4 = CORE_DENSITY 5 = CORE_DEN_CDM 6 = CORE_DEN_FDM 7 = CORE_DEN_FVM	700 800 CDM FDM FVM

(1) The list within the square bracket contains cores that support this value.

A.6 Local display transducer blocks

A.6.1 View list for local display transducer block

The following table lists the parameters contained in the transducer block for local display parameters.

Four views are defined for the local display transducer block. The table also shows the applicable views for each parameter, and the size of the parameter in that view, in bytes.

Index	Name	View			
		1	2	3	4
0	BLOCK_STRUCTURE	—	—	—	—
1	ST_REV	2	2	2	2
2	TAG_DESC	—	—	—	—
3	STRATEGY	—	—	—	2
4	ALERT_KEY	—	—	—	1
5	MODE_BLK	4	—	4	—
6	BLOCK_ERR	2	—	2	—
7	UPDATE_EVT	—	—	—	—
8	BLOCK_ALM	—	—	—	—
9	TRANSDUCER_DIRECTORY	—	—	—	—
10	TRANSDUCER_TYPE	2	2	2	2
11	TRANSDUCER_TYPE_VER	2	2	2	2
12	XD_ERROR	1	—	1	—
13	COLLECTION_DIRECTORY	—	—	—	—
14	EN_LDO_TOT_RESET	—	—	—	2
15	EN_LDO_TOT_START_STOP	—	—	—	2
16	EN_LDO_AUTO_SCROLL	—	—	—	2
17	EN_LDO_OFFLINE_MENU	—	—	—	2
18	EN_LDO_OFFLINE_PWD	—	—	—	2
19	EN_LDO_ALARM_MENU	—	—	—	2
20	EN_LDO_ACK_ALL_ALARMS	—	—	—	2
21	LDO_OFFLINE_PWD	—	2	—	—
22	LDO_SCROLL_RATE	—	—	—	2
23	LDO_BACKLIGHT_ON	—	—	—	2
24	UI_Language	—	—	—	2
25	LDO_VAR_1_CODE	—	—	—	2
26	LDO_VAR_2_CODE	—	—	—	2

Index	Name	View			
		1	2	3	4
27	LDO_VAR_3_CODE	—	—	—	2
28	LDO_VAR_4_CODE	—	—	—	2
29	LDO_VAR_5_CODE	—	—	—	2
30	LDO_VAR_6_CODE	—	—	—	2
31	LDO_VAR_7_CODE	—	—	—	2
32	LDO_VAR_8_CODE	—	—	—	2
33	LDO_VAR_9_CODE	—	—	—	2
34	LDO_VAR_10_CODE	—	—	—	2
35	LDO_VAR_11_CODE	—	—	—	2
36	LDO_VAR_12_CODE	—	—	—	2
37	LDO_VAR_13_CODE	—	—	—	2
38	LDO_VAR_14_CODE	—	—	—	2
39	LDO_VAR_15_CODE	—	—	—	2
40	FBUS_UI_ProcVarIndex	—	—	—	2
41	UI_NumDecimals	—	—	—	2
42	UI_UpdatePeriodmsec	—	—	—	2
43	UI_EnableStatusLedBlinking	—	—	—	2
44	UI_EnableAlarmPassword	—	—	—	2
45	LDO_FEATURE_KEY	—	—	—	—
46	LDO_SYS_AttachedCoreType	—	2	—	—

A.6.2 Standard fieldbus parameters for local display transducer blocks

Index and name	Description	List of values
#0 BLOCK_STRUCTURE	The beginning of the transducer block. Msg type = VAR Data type = DS_64 (5) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—

Index and name	Description	List of values
#1 ST_REV	The revision level of the static data associated with the function block. Incremented with each write of static store. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	—
#2 TAG_DESC	The user description of the intended block application. Msg type = STR Data type = OCTET STRING (32) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	Any 32 characters
#3 STRATEGY	Used to identify grouping of blocks. This data is not checked or processed by the block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—
#4 ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Msg type = VAR Data type = Unsigned8 (1) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	1 to 255
#5 MODE_BLK	The actual, target, permitted, and normal modes of the block. Msg type = REC Data type = DS-69 (4) Store = Mixed Access = RW (OOS) or RW (Auto) Available in Release 1.0	See section 2.6 of FF-891
#6 BLOCK_ERR	The error status associated with the hardware or software components associated with a block. Msg type = STR Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	See section 4.8 of FF-903

Index and name	Description	List of values
#7 UPDATE_EVT	Occurs when a static parameter is changed while a block mode is not in out of service (OOS) mode, or when the mode changes from OOS mode and one or more static parameters changed while the block was OOS. Msg type = REC Data type = DS-73 Store = Dynamic Access = RW in any mode Available in Release 1.0	—
#8 BLOCK_ALM	A predefined set of 16 conditions that may occur within a block. Msg type = REC Data type = DS-72 Store = Dynamic Access = RW in any mode Available in Release 9.0	—
#9 TRANSDUCER_ DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#10 TRANSDUCER_ TYPE	Identifies the transducer that follows. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#11 TRANSDUCER_ TYPE_VER	Identifies the version of the transducer block. Format is *XXYY* where *XX* is the major spec revision and *YY* is the manufacturer revision. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#12 XD_ERROR	Used for all config, H/W, connection failure of system problems in the block. Msg type = VAR Data type = Unsigned8 (1) Store = Dynamic Access = RW (OOS) Available in Release 1.0	0 = No Error 18 = Calibration Error 19 = Configuration Error 20 = Electronics Failure 21 = Sensor Failure 26 = Process Error 27 = Calibration in Progress

Index and name	Description	List of values
#13 COLLECTION_ DIRECTORY	Used for all config, H/W, and connection failures of system problems in the block. Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = RW (OOS) Available in Release 9.0	—

A.6.3 Local display transducer blocks

Table A-19: Local display transducer blocks

Index and name	Description	List of values	HW
#14 EN_LDO_TOT_RESET	Enable/Disable LDO totalizer reset Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	0 = Disable 1 = Enable	700 800
#15 EN_LDO_TOT_START_ STOP	Enable/Disable LDO totalizer start/stop option Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0 = Disable 1 = Enable	700 800
#16 EN_LDO_AUTO_SCROLL	Enable/Disable LDO auto scroll feature Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	0 = Disable 1 = Enable	700 800 CDM FDM FVM
#17 EN_LDO_OFFLINE_MENU	Enable/Disable LDO offline menu feature Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	0 = Disable 1 = Enable	700 800 CDM FDM FVM
#18 EN_LDO_OFFLINE_PWD	Enable/Disable LDO offline password Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	0 = Disable 1 = Enable	700 800 CDM FDM FVM

Table A-19: Local display transducer blocks *(continued)*

Index and name	Description	List of values	HW
#19 EN_LDO_ALARM_MENU	Enable/Disable LDO alarm menu Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	0 = Disable 1 = Enable	700 800 CDM FDM FVM
#20 EN_LDO_ACK_ ALL_ALARMS	Enable/Disable LDO acknowledge all alarms feature Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	0 = Disable 1 = Enable	700 800 CDM FDM FVM
#21 LDO_OFFLINE_PWD	LDO offline password Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	0 - 9999	700 800 CDM FDM FVM
#22 LDO_SCROLL_RATE	LDO scroll rate Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0	1 - 30	700 800 CDM FDM FVM
#23 LDO_BACKLIGHT_ON	LDO backlight control Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0 = off 1 = on	700 800 CDM FDM FVM
#24 UI_Language	Display the language selection Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	0 = English 1 = German 2 = French 3 = Reserved 4 = Spanish	700 800 CDM FDM FVM

Table A-19: Local display transducer blocks *(continued)*

Index and name	Description	List of values	HW
#25 LDO_VAR_1_CODE #26 LDO_VAR_2_CODE #27 LDO_VAR_3_CODE #28 LDO_VAR_4_CODE #29 LDO_VAR_5_CODE #30 LDO_VAR_6_CODE #31 LDO_VAR_7_CODE #32 LDO_VAR_8_CODE #33 LDO_VAR_9_CODE #34 LDO_VAR_10_CODE #35 LDO_VAR_11_CODE #36 LDO_VAR_12_CODE #37 LDO_VAR_13_CODE #38 LDO_VAR_14_CODE #39 LDO_VAR_15_CODE	Displays the variable associated with the code on the LDO Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0 (4.0 for R/W)	0 = Mass Flow Rate [700, 800][1] 1 = Temperature 2 = Mass Total [700, 800] 3 = Density 4 = Mass Inventory [700, 800] 5 = Volume Flow Rate [700, 800] 6 = Volume Total [700, 800] 7 = Volume Inventory [700, 800] 15 = API: Corr Density 16 = API: Corr Vol Flow [700, 800] 17 = API: Corr Vol Total [700, 800] 18 = API: Corr Vol Inv [700, 800] 19 = API: Avg Density [700, 800] 20 = API: Avg Temp [700, 800] 21 = ED: Density At Ref 22 = ED: Density [SGU] 23 = ED: Std Vol Flow Rate [700, 800] 24 = ED: Std Vol Total [700, 800] 25 = ED: Std Vol Inventory [700, 800] 26 = ED: Net Mass Flow [700, 800] 27 = ED: Net Mass Total [700, 800] 28 = ED: Net Mass Inv [700, 800] 29 = ED: Net Vol Flow Rate [700, 800] 30 = ED: Net Vol Total [700, 800] 31 = ED: Net Vol Inventory [700, 800] 32 = ED: Concentration 33 = API: CTL [700, 800] 46 = Raw Tube Frequency [700, 800] 47 = Drive Gain 48 = Case Temperature [700, 800, CDM] 49 = LPO Amplitude [700,800, CDM] 50 = RPO Amplitude 51 = Board Temperature 53 = Ext. Input Pressure 55 = Ext. Input Temp 56 = ED: Density (Baume) [700, 800] 62 = Gas Std Vol Flow [700, 800] 63 = Gas Std Vol Total [700, 800] 64 = Gat Std Vol Inventory [700, 800] 69 = Live Zero [700, 800] 159 = User Defined Equation [CDM, FDM, FVM]	700 800 CDM FDM FVM

Table A-19: Local display transducer blocks *(continued)*

Index and name	Description	List of values	HW
		161 = Tube-Case Temperature Differential [CDM] 168 = Quality Factor [FVM] 162 = Dynamic Viscosity [FVM] 163 = Kinematic Viscosity [FVM] 164 = Base Viscosity [FVM] 166 = CCAI [FVM] 167 = CII [FVM] 208 = Mass Flow Velocity [CDM] 215 = Time Period (upper 3 db point) [CDM, FDM, FVM] 251 = None (not allowed on LDO_VAR_1_CODE)	
#40 FBUS_UI_ProcVarIndex	Process variable code Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 1.0 (4.0 for R/W)	Same as LDO_VAR_X_CODE	700 800 CDM FDM FVM
#41 UI_NumDecimals	The number of digits displayed to the right of the decimal point for the process variable selected with index 34 Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	0 - 5	700 800 CDM FDM FVM
#42 UI_UpdatePeriodmsec	The period in milliseconds in which the display is updated Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	100 - 10000	700 800 CDM FDM FVM
#43 UI_EnableStatusLedBlinking	Enable/Disable display status LED blinking Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	0 = Disable 1 = Enable	700 800 CDM FDM FVM
#44 UI_EnableAlarmPassword	Enable/Disable display alarm screen password Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	0 = Disable 1 = Enable	700 800 CDM FDM FVM

Table A-19: Local display transducer blocks *(continued)*

Index and name	Description	List of values	HW
#45 LDO_FEATURE_KEY	Enabled features Msg type = STR Data type = BIT STRING (2) Store = Static Access = Read only Available in Release 8.0	0x0000 = standard 0x0800 = Meter verification 0x0008 = Enhanced density 0x0010 = API	700 800 CDM FDM FVM
#46 LDO_SYS_AttachedCoreType	Indicates the attached core type Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	0 = CORE_UNKNOWN, 1 = CORE_700 2 = CORE_ECP 3 = CORE_S 4 = CORE_DENSITY 5 = CORE_DEN_CDM 6 = CORE_DEN_FDM 7 = CORE_DEN_FVM	700 800 CDM FDM FVM

(1) The list within the square bracket contains cores that support this value.

A.7 Petroleum measurement transducer blocks

A.7.1 View list for petroleum measurement transducer block

The following table lists the parameters contained in the transducer block for petroleum measurement parameters.

Four views are defined for the petroleum measurement transducer block. The table also shows the applicable views for each parameter, and the size of the parameter in that view, in bytes.

Index	Name	View			
		1	2	3	4
0	BLOCK_STRUCTURE	—	—	—	—
1	ST_REV	2	2	2	2
2	TAG_DESC	—	—	—	—
3	STRATEGY	—	—	—	2
4	ALERT_KEY	—	—	—	1
5	MODE_BLK	4	—	4	—
6	BLOCK_ERR	2	—	2	—
7	UPDATE_EVT	—	—	—	—
8	BLOCK_ALM	—	—	—	—
9	TRANSDUCER_DIRECTORY	—	—	—	—
10	TRANSDUCER_TYPE	2	2	2	2
11	TRANSDUCER_TYPE_VER	2	2	2	2
12	XD_ERROR	1	—	1	—

Index	Name	View			
		1	2	3	4
13	COLLECTION_DIRECTORY	—	—	—	—
14	API_Corr_Density	5	—	5	—
15	API_Corr_Vol_Flow	5	—	5	—
16	API_Ave_Corr_Density	5	—	5	—
17	API_Ave_Corr_Temp	5	—	5	—
18	API_CTL	5	—	5	—
19	API_Corr_Vol_Total	5	—	5	—
20	API_Corr_Vol_Inv	5	—	5	—
21	API_Reset_Vol_Total	—	2	—	—
22	EN_API	—	—	—	2
23	API_Ref_Temp	—	—	—	4
24	API_TEC	—	—	—	4
25	API_Table_Type	—	—	—	2
26	API_FEATURE_KEY	—	—	—	2
27	SNS_ResetAPIGSVInv	—	2	—	—
28	API_TEMPERATURE_UNITS	2	—	—	—
29	API_DENSITY_UNITS	2	—	—	—
30	API_VOL_FLOW_UNITS	2	—	—	—
31	APIRefPress	4	—	—	—
32	PM_SYS_AttachedCoreType	—	—	—	2
33	API_PressureUnit	2	—	—	—

A.7.2 Standard fieldbus parameters for petroleum measurement transducer blocks

Index and name	Description	List of values
#0 BLOCK_STRUCTURE	The beginning of the transducer block. Msg type = VAR Data type = DS_64 (5) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—

Index and name	Description	List of values
#1 ST_REV	The revision level of the static data associated with the function block. Incremented with each write of static store. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	—
#2 TAG_DESC	The user description of the intended block application. Msg type = STR Data type = OCTET STRING (32) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	Any 32 characters
#3 STRATEGY	Used to identify grouping of blocks. This data is not checked or processed by the block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—
#4 ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Msg type = VAR Data type = Unsigned8 (1) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	1 to 255
#5 MODE_BLK	The actual, target, permitted, and normal modes of the block. Msg type = REC Data type = DS-69 (4) Store = Mixed Access = RW (OOS) or RW (Auto) Available in Release 1.0	See section 2.6 of FF-891
#6 BLOCK_ERR	The error status associated with the hardware or software components associated with a block. Msg type = STR Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	See section 4.8 of FF-903

Index and name	Description	List of values
#7 UPDATE_EVT	Occurs when a static parameter is changed while a block mode is not in out of service (OOS) mode, or when the mode changes from OOS mode and one or more static parameters changed while the block was OOS. Msg type = REC Data type = DS-73 Store = Dynamic Access = RW in any mode Available in Release 1.0	—
#8 BLOCK_ALM	A predefined set of 16 conditions that may occur within a block. Msg type = REC Data type = DS-72 Store = Dynamic Access = RW in any mode Available in Release 9.0	—
#9 TRANSDUCER_ DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#10 TRANSDUCER_ TYPE	Identifies the transducer that follows. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#11 TRANSDUCER_ TYPE_VER	Identifies the version of the transducer block. Format is *XXYY* where *XX* is the major spec revision and *YY* is the manufacturer revision. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#12 XD_ERROR	Used for all config, H/W, connection failure of system problems in the block. Msg type = VAR Data type = Unsigned8 (1) Store = Dynamic Access = RW (OOS) Available in Release 1.0	0 = No Error 18 = Calibration Error 19 = Configuration Error 20 = Electronics Failure 21 = Sensor Failure 26 = Process Error 27 = Calibration in Progress

Index and name	Description	List of values
#13 COLLECTION_ DIRECTORY	Used for all config, H/W, and connection failures of system problems in the block. Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = RW (OOS) Available in Release 9.0	—

A.7.3 Process variables for petroleum measurement transducer blocks

Table A-20: Process variables for petroleum measurement transducer blocks

Index and name	Description	List of values	HW
#14 API_Corr_Density	Temperature-corrected density Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM
#15 API_Corr_Vol_Flow	Temperature-corrected (standard) volume flow Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800
#16 API_Ave_Corr_Density	Batch weighted average density Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM
#17 API_Ave_Corr_Temp	Batch weighted average temperature Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM
#18 API_CTL	CTL Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM

Table A-20: Process variables for petroleum measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#19 API_Corr_Vol_Total	Temperature-corrected (standard) volume total Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800
#20 API_Corr_Vol_Inv	Temperature-corrected (standard) volume inventory Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	700 800
#21 API_Reset_Vol_Total	Reset API reference volume total Msg type = VAR Data type = DS-66 (2) Store = — Access = R/W in any mode Available in Release 3.0	Value part of DS-66 0 = No effect 1 = Reset	700 800

A.7.4 Setup data for petroleum measurement transducer blocks

Table A-21: Setup data for petroleum measurement transducer blocks

Index and name	Description	List of values	HW
#22 EN_API	Enable/Disable petroleum measurement Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 3.0	0 = disabled 1 = enabled	700 800 CDM FDM FVM
#23 API_Ref_Temp	Petroleum measurement reference temperature Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM
#24 API_TEC	Petroleum measurement thermal expansion coeff Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM

Table A-21: Setup data for petroleum measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#25 API_Table_Type	Petroleum measurment 2540 CTL table type Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 3.0	17 = Table 5A 18 = Table 5B 19 = Table 5D 36 = Table 6C 49 = Table 23A 50 = Table 23B 51 = Table 23D 68 = Table 24C 81 = Table 53A 82 = Table 53B 83 = Table 53D 100 = Table 54C 53 = Table 23E [CDM, FDM, FVM](1) 69 = Table 24E [CDM, FDM, FVM]	700 800 CDM FDM FVM
#26 API_FEATURE_KEY	Enabled features Msg type = STR Data type = BIT STRING (2) Store = Static Access = Read only Available in Release 3.0	0x0000 = standard 0x0800 = Meter verification 0x0008 = Enhanced density 0x0010 = API	700 800 CDM FDM FVM
#27 SNS_ResetAPIGSVInv	Reset PM/GSV inventory Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	0 = No effect 1 = Reset	700 800
#28 API_TEMPERATURE_UNITS	Temperature unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 4.0	1000 = K 1001 = Deg C 1002 = Deg F 1003 = Deg R	700 800 CDM FDM FVM
#29 API_DENSITY_UNITS	Density unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = R/W (OOS) Available in Release 4.0	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	700 800 CDM FDM FVM

Table A-21: Setup data for petroleum measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#30 API_VOL_FLOW_UNITS	Standard or special volume flow rate unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 6.0	1347 = m3/s 1348 = m 3/min 1349 = m3/h 1350 = m3/d 1351 = L/s 1352 = L/min 1353 = L/h 1355 = ML/d 1356 = CFS 1357 = CFM 1358 = CFH 1359 = ft3/d 1362 = gal/s 1363 = GPM 1364 = gal/h 1365 = gal/d 1366 = Mgal/d 1367 = ImpGal/s 1368 = ImpGal/m 1369 = ImpGal/h 1370 = Impgal/d 1371 = bbl/s 1372 = bbl/min 1373 = bbl/h 1374 = bbl/d 1631 = barrel(US Beer)/d 1632 = barrel(US Beer)/h 1633 = barrel(US Beer)/min 1634 = barrel(US Beer)/s 253 = Special [700, 800][1]	700 800
#31 APIRefPress	Alternate pressure Msg type = VAR Data type = FLOAT (4) Store = Dynamic Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#32 PM_SYS_AttachedCoreType	Indicates the attached core type Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	0 = CORE_UNKNOWN 1 = CORE_700 2 = CORE_ECP 3 = CORE_S 4 = CORE_DENSITY 5 = CORE_DEN_CDM 6 = CORE_DEN_FDM 7 = CORE_DEN_FVM	700 800 CDM FDM FVM

Table A-21: Setup data for petroleum measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#33 API_PressureUnit	Pressure units Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1148 = inH2O (68°F) 1724 = InH2O@60°F 1156 = inHg (0°C) 1154 = ftH2O (68°F) 1151 = mmH2O (68°F) 1158 = mmHg (0°C) 1141 = psi 1137 = bar 1138 = mbar 1144 = g/cm2 1145 = kg/cm2 1130 = Pa 1132 = MPa 1133 = kPa 1139 = torr 1140 = atm 1147 = inH2O (4°C) 1150 = mmH2O (4°C)	700 800 CDM FDM FVM
#34 API_VOL_TOT_UNITS	Volume flow total unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 8.0	1034 = m3 1036 = cm3 1038 = L 1043 = ft3 1048 = gallon 1049 = ImpGal 1051 = bbl 253 = Special units.	

(1) *The list within the square bracket contains cores that support this value.*

A.8 Concentration measurement transducer blocks

A.8.1 View list for concentration measurement transducer block

The following table lists the parameters contained in the transducer block for concentration measurement parameters.

Four views are defined for the concentration measurement transducer block. The table also shows the applicable views for each parameter, and the size of the parameter in that view, in bytes.

Index	Name	View			
		1	2	3	4
0	BLOCK_STRUCTURE	—	—	—	—
1	ST_REV	2	2	2	2
2	TAG_DESC	—	—	—	—
3	STRATEGY	—	—	—	2
4	ALERT_KEY	—	—	—	1
5	MODE_BLK	4	—	4	—

Index	Name	View			
		1	2	3	4
6	BLOCK_ERR	2	—	2	—
7	UPDATE_EVT	—	—	—	—
8	BLOCK_ALM	—	—	—	—
9	TRANSDUCER_DIRECTORY	—	—	—	—
10	TRANSDUCER_TYPE	2	2	2	2
11	TRANSDUCER_TYPE_VER	2	2	2	2
12	XD_ERROR	1	—	1	—
13	COLLECTION_DIRECTORY	—	—	—	—
14	ED_Ref_Dens	5	—	5	—
15	ED_Spec_Grav	5	—	5	—
16	ED_Std_Vol_Flow	5	—	5	—
17	ED_Net_Mass_Flow	5	—	5	—
18	ED_Net_Vol_Flow	5	—	5	—
19	ED_Conc	5	—	5	—
20	ED_Baume	5	—	5	—
21	ED_Std_Vol_Total	5	—	5	—
22	ED_Std_Vol_Inv	5	—	5	—
23	ED_Net_Mass_Total	5	—	5	—
24	ED_Net_Mass_Inv	5	—	5	—
25	ED_Net_Vol_Total	5	—	5	—
26	ED_Net_Vol_Inv	5	—	5	—
27	ED_Reset_Std_Vol_Total	—	2	—	—
28	ED_Reset_Net_Mass_Total	—	2	—	—
29	ED_Reset_Net_Vol_Total	—	2	—	—
30	EN_ED	—	—	—	2
31	ED_Curve_Lock	—	—	—	2
32	ED_Mode	—	—	—	2
33	ED_Active_Curve	—	—	—	2
34	ED_Curve_Index	—	—	—	2
35	ED_Temp_Index	—	—	—	2
36	ED_Conc_Index	—	—	—	2
37	ED_Temp_ISO	—	—	—	4
38	ED_Dens_At_Temp_ISO	—	—	—	4

Index	Name	View			
		1	2	3	4
39	ED_Dens_At_Temp_Coeff	—	—	—	4
40	ED_Conc_Label_55	—	—	—	4
41	ED_Dens_At_Conc	—	—	—	4
42	ED_Dens_At_Conc_Coeff	—	—	—	4
43	ED_Conc_Label_51	—	—	—	4
44	ED_Ref_Temp	—	—	—	4
45	ED_SG_Water_Ref_Temp	—	—	—	4
46	ED_SG_Water_Ref_Dens	—	—	—	4
47	ED_Slope_Trim	—	—	—	4
48	ED_Slope_Offset	—	—	—	4
49	ED_Extrap_Alarm_Limit	—	—	—	4
50	ED_Curve_Name	—	—	—	12
51	ED_Max_Fit_Order	—	—	—	2
52	ED_Fit_Results	—	—	2	—
53	ED_Conc_Unit_Code	—	2	—	—
54	ED_Expected_Acc	—	4	—	—
55	ED_FEATURE_KEY	—	—	—	2
56	SNS_ResetEDVolInv	—	2	—	—
57	SNS_ResetEDNetMassInv	—	2	—	—
58	SNS_ResetEDNetVolInv	—	2	—	—
59	SNS_ED_ResetFlag	—	2	—	—
60	SNS_ED_EnableDensLowExtrap	—	—	—	2
61	SNS_ED_EnableDensHighExtrap	—	—	—	2
62	SNS_ED_EnableTempLowExtrap	—	—	—	2
63	SNS_ED_EnableTempHighExtrap	—	—	—	2
64	ED_TEMPERATURE_UNITS	2	—	—	—
65	ED_DENSITY_UNITS	2	—	—	—
66	ED_VOL_FLOW_UNITS	2	—	—	—
67	ED_Increment_Curve	—	—	2	—
68	DEN_SelectConcEqn	—	—	—	2
69	DEN_Enable_CMAutoswitch	—	2	—	—
70	ED_SYS_AttachedCoreType	—	2	—	—
71	SNS_ED_ConcUnits_SpecialUnit	—	8	—	—

Index	Name	View			
		1	2	3	4
72	ED_MASSFLOW_UNITS	—	—	2	—
73	ED_VOL_TOT_UNITS	—	—	2	—
74	ED_MASS_TOT_UNITS	—	—	2	—

A.8.2 Standard fieldbus parameters for concentration measurement transducer blocks

Index and name	Description	List of values
#0 BLOCK_STRUCTURE	The beginning of the transducer block. Msg type = VAR Data type = DS_64 (5) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—
#1 ST_REV	The revision level of the static data associated with the function block. Incremented with each write of static store. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	—
#2 TAG_DESC	The user description of the intended block application. Msg type = STR Data type = OCTET STRING (32) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	Any 32 characters
#3 STRATEGY	Used to identify grouping of blocks. This data is not checked or processed by the block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—
#4 ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Msg type = VAR Data type = Unsigned8 (1) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	1 to 255

Index and name	Description	List of values
#5 MODE_BLK	The actual, target, permitted, and normal modes of the block. Msg type = REC Data type = DS-69 (4) Store = Mixed Access = RW (OOS) or RW (Auto) Available in Release 1.0	See section 2.6 of FF-891
#6 BLOCK_ERR	The error status associated with the hardware or software components associated with a block. Msg type = STR Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	See section 4.8 of FF-903
#7 UPDATE_EVT	Occurs when a static parameter is changed while a block mode is not in out of service (OOS) mode, or when the mode changes from OOS mode and one or more static parameters changed while the block was OOS. Msg type = REC Data type = DS-73 Store = Dynamic Access = RW in any mode Available in Release 1.0	—
#8 BLOCK_ALM	A predefined set of 16 conditions that may occur within a block. Msg type = REC Data type = DS-72 Store = Dynamic Access = RW in any mode Available in Release 9.0	—
#9 TRANSDUCER_ DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#10 TRANSDUCER_ TYPE	Identifies the transducer that follows. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—

Index and name	Description	List of values
#11 TRANSDUCER_ TYPE_VER	Identifies the version of the transducer block. Format is *XXYY* where *XX* is the major spec revision and *YY* is the manufacturer revision. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#12 XD_ERROR	Used for all config, H/W, connection failure of system problems in the block. Msg type = VAR Data type = Unsigned8 (1) Store = Dynamic Access = RW (OOS) Available in Release 1.0	0 = No Error 18 = Calibration Error 19 = Configuration Error 20 = Electronics Failure 21 = Sensor Failure 26 = Process Error 27 = Calibration in Progress
#13 COLLECTION_ DIRECTORY	Used for all config, H/W, and connection failures of system problems in the block. Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = RW (OOS) Available in Release 9.0	—

A.8.3 Process variables for concentration measurement transducer blocks

Table A-22: Process variables for concentration measurement transducer blocks

Index and name	Description	List of values	HW
#14 ED_Ref_Dens	Density at reference Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800 CDM FDM FVM
#15 ED_Spec_Grav	Density (fixed special gravity units) Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800 CDM FDM FVM
#16 ED_Std_Vol_Flow	Standard volume flow rate Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800

Table A-22: Process variables for concentration measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#17 ED_Net_Mass_Flow	Net mass flow rate Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800 CDM FDM FVM
#18 ED_Net_Vol_Flow	Net volume flow rate Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800 CDM FDM FVM
#19 ED_Conc	Concentration Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800 CDM FDM FVM
#20 ED_Baume	Density (fixed baume units) Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800

A.8.4 Totals for concentration measurement transducer blocks

Table A-23: Totals for concentration measurement transducer blocks

Index and name	Description	List of values	HW
#21 ED_Std_Vol_Total	Standard volume total Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800
#22 ED_Std_Vol_Inv	Standard volume inventory Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800

Table A-23: Totals for concentration measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#23 ED_Net_Mass_Total	Net mass total Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800
#24 ED_Net_Mass_Inv	Net mass inventory Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800
#25 ED_Net_Vol_Total	Net volume total Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800
#26 ED_Net_Vol_Inv	Net volume inventory Msg type = VAR Data type = DS-65 (5) Store = Dynamic/20 Access = Read only Available in Release 3.0	—	800
#27 ED_Reset_Std_Vol_Total	Reset concentration measurement standard volume total Msg type = VAR Data type = DS-66 (2) Store = — Access = R/W in any mode Available in Release 3.0	Value part of DS-66 1 = Reset	700 800
#28 ED_Reset_Net_Mass_Total	Reset concentration measurement net mass total Msg type = VAR Data type = DS-66 (2) Store = — Access = R/W in any mode Available in Release 3.0	Value part of DS-66 1 = Reset	700 800
#29 ED_Reset_Net_Vol_Total	Reset concentration measurement net volume total Msg type = VAR Data type = DS-66 (2) Store = — Access = R/W in any mode Available in Release 3.0	Value part of DS-66 1 = Reset	700 800

A.8.5 Setup data for concentration measurement transducer blocks

Table A-24: Setup data for concentration measurement transducer blocks

Index and name	Description	List of values	HW
#30 EN_ED	Enable/Disable enhanced density Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 3.0	0 = disabled 1 = enabled	700 800 CDM FDM FVM
#31 ED_Curve_Lock	Lock enhanced density tables Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 3.0	0 = not locked 1 = locked	700
#32 ED_Mode	Enhanced density mode Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 3.0	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)	700 800 CDM FDM FVM
#33 ED_Active_Curve	Active calculation curve Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0 - 5	700 800 CDM FDM FVM
#34 ED_Curve_Index	Curve configuration index (n) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0 - 5	700 800 CDM FDM FVM
#35 ED_Temp_Index	$Curve_n$ temperature isotherm index (x-axis) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0 - 5	700 800 CDM FDM FVM
#36 ED_Conc_Index	$Curve_n$ concentration index (y-axis) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 3.0	0 - 5	700 800 CDM FDM FVM

Table A-24: Setup data for concentration measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#37 ED_Temp_ISO	Curve$_n$ (6x5) temperature isotherm$_x$ value (x-axis) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM
#38 ED_Dens_At_Temp_ISO	Curve$_n$ (6x5) density @ temperature isotherm$_x$, concentration$_Y$ Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM
#39 ED_Dens_At_Temp_Coeff	Curve$_n$ (6x5) Coeff @ temperature isotherm$_X$, concentration$_Y$ Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM
#40 ED_Conc_Label_55	Curve$_n$ (6x5) concentration$_Y$ value (label for y-axis) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM
#41 ED_Dens_At_Conc	Curve$_n$ (5x1) density at concentration$_Y$ (at ref temp) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM
#42 ED_Dens_At_Conc_Coeff	Curve$_n$ (5x1) coeff at concentration$_Y$ (at ref temp) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM

Table A-24: Setup data for concentration measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#43 ED_Conc_Label_51	$Curve_n$ (5x1) $concentration_Y$ value (y-axis) Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM
#44 ED_Ref_Temp	$Curve_n$ reference temperature Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM
#45 ED_SG_Water_Ref_Temp	$Curve_n$ specific gravity water reference temperature Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM
#46 ED_SG_Water_Ref_Dens	$Curve_n$ specific gravity water reference density Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM
#47 ED_Slope_Trim	$Curve_n$ slope trim Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	> 0.8	700 800 CDM FDM FVM
#48 ED_Slope_Offset	$Curve_n$ offset trim Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W (OOS) Available in Release 3.0	—	700 800 CDM FDM FVM
#49 ED_Extrap_Alarm_Limit	$Curve_n$ extrapolation alarm limit: % Msg type = VAR Data type = FLOAT (4) Store = Static Access = R/W in any mode Available in Release 3.0	—	700 800 CDM FDM FVM

Table A-24: Setup data for concentration measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#50 ED_Curve_Name	$Curve_n$ ASCII string – name of curve – 12 characters supported Msg type = VAR Data type = VISIBLE STRING (12) Store = Static Access = R/W in any mode Available in Release 3.0	—	700 800 CDM FDM FVM
#51 ED_Max_Fit_Order	Maximum fit order for 5x5 curve Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 3.0	2, 3, 4, 5 (Accepts only enum values)	700 800 CDM FDM FVM
#52 ED_Fit_Results	$Curve_n$ curve fit results Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 3.0	0 = Good 1 = Poor 2 = Failed 3 = Empty	700 800 CDM FDM FVM
#53 ED_Conc_Unit_Code	$Curve_n$ concentration units code Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 3.0	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 253 = Special Unit 255 = Special Concentration Unit [CDM, FDM, FVM]	700 800 CDM FDM FVM
#54 ED_Expected_Acc	$Curve_n$ curve fit expected accuracy Msg type = VAR Data type = FLOAT (4) Store = Static Access = Read only Available in Release 3.0	—	700 800 CDM FDM FVM
#55 ED_FEATURE_KEY	Enabled features Msg type = STR Data type = BIT STRING (2) Store = Static Access = Read only Available in Release 3.0	0x0000 = standard 0x0800 = Meter verification 0x0008 = Enhanced density 0x0010 = API	700 800 CDM FDM FVM

A.8.6 Other additions for concentration measurement transducer blocks

Table A-25: Other additions for concentration measurement transducer blocks

Index and name	Description	List of values	HW
#56 SNS_ResetEDVolInv	Reset concentration measurement volume inventory Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	0 = No effect 1 = Reset	700 800
#57 SNS_ResetEDNetMassInv	Reset concentration measurement net mass inventory Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	0 = No effect 1 = Reset	700 800
#58 SNS_ResetEDNetVolInv	Reset concentration measurement net volume inventory Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	0 = No effect 1 = Reset	700 800
#59 SNS_ED_ResetFlag	Reset all enhanced density curve information Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 4.0	1 = Reset	800 CDM FDM FVM
#60 SNS_ED_EnableDensLow Extrap	Enable low density extrapolation alarm Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	1 = Enable	800 CDM FDM FVM
#61 SNS_ED_EnableDensHighExtra p	Enable high density extrapolation alarm Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	1 = Enable	800 CDM FDM FVM

Table A-25: Other additions for concentration measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#62 SNS_ED_EnableTempLow Extrap	Enable low temperature extrapolation alarm Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	1 = Enable	800 CDM FDM FVM
#63 SNS_ED_EnableTempHigh Extrap	Enable high temperature extrapolation alarm Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 4.0	1 = Enable	800 CDM FDM FVM
#64 ED_TEMPERATURE_UNITS	Temperature unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 6.0	1000 = K 1001 = Deg C 1002 = Deg F 1003 = Deg R	700 800 CDM FDM FVM
#65 ED_DENSITY_UNITS	Density unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 6.0	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 (not for density and viscosity) 1114 = SGU (not for density and viscosity) 253 = Special [CDM, FDM, FVM]	700 800 CDM FDM FVM

Table A-25: Other additions for concentration measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#66 ED_VOL_FLOW_UNITS	Standard or special volume flow rate unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 6.0	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 / standard cubic ft. per 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 1631 = barrel (US beer) per day 1632 = barrel (US beer) per hour 1633 = barrel (US beer) per minute 1634 =barrel (US Beer) per second 253 = Special units [700, 800]	700 800 CDM
#67 ED_Increment_Curve	Increment the active curve to the next one Msg type = VAR Data type = DS-66 (2) Store = — Access = R/W in any mode Available in Release 7.0	Value part of DS-66 0 = None 1 = Increment	700 800
#68 DEN_SelectConcEqn	Select predefined concentration equations Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W Available in Release 8.0	0 = Concentration Matrix 1 = degreeBaume 2 = degeeTwaddle 3 = degreePlato 4 = degBrix	CDM FDM FVM

Table A-25: Other additions for concentration measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#69 DEN_Enable_CMAutoswitch	Enable concentration measurement curve auto-switching Msg type = VAR Data type = Unsigned16 (2) Store = — Access = R/W Available in Release 8.0	0 = disabled 1 = enabled	CDM FDM FVM
#70 ED_SYS_AttachedCoreType	Indicates the attached core type Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	0 = CORE_UNKNOWN 1 = CORE_700 2 = CORE_ECP 3 = CORE_S 4 = CORE_DENSITY 5 = CORE_DEN_CDM 6 = CORE_DEN_FDM 7 = CORE_DEN_FVM	700 800 CDM FDM FVM
#71 SNS_ED_ConcUnits_SpecialUnit	Curve$_n$ concentration units special unit label Msg type = STR Data type = Visible String Store = Static Access = R/W (OOS) Available in Release 8.0	—	700 800 CDM FDM FVM
#72 ED_MASSFLOW_UNITS	Mass flow unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = R/W (OOS) Available in Release 8.0	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 253 = Special units	800 CDM
#73 ED_VOL_TOT_UNITS	Volume flow total unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 9.0	1034 = m3 1036 = cm3 1038 = L 1043 = ft3 1048 = gallon 1049 = ImpGal 1051 = bbl 253 = Special units.	700 800

Table A-25: Other additions for concentration measurement transducer blocks *(continued)*

Index and name	Description	List of values	HW
#74 ED_MASS_TOT_UNITS	Standard or special mass total and mass inventory unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 9.0	1089 = g 1088 = kg 1092 = t 1094 = lb 1095 = STon 1096 = Lton 253 = Special units	700 800 CDM FDM FVM

A.9 Density viscosity meter transducer blocks

A.9.1 View list for density viscosity meter transducer block

The following table lists the parameters contained in the transducer block for density viscosity meter parameters.

Eight views are defined for the density viscosity meter transducer block. The table also shows the applicable views for each parameter, and the size of the parameter in that view, in bytes.

Index	Name	View							
		1	2	3	4_1	4_2	4_3	4_4	4_5
0	BLOCK_STRUCTURE	—	—	—	—	—	—	—	—
1	ST_REV	2	2	2	2	2	2	2	2
2	TAG_DESC	—	—	—	—	—	—	—	—
3	STRATEGY	—	—	—	2	—	—	—	—
4	ALERT_KEY	—	—	—	1	—	—	—	—
5	MODE_BLK	4	—	4	—	—	—	—	—
6	BLOCK_ERR	2	—	2	—	—	—	—	—
7	UPDATE_EVT	—	—	—	—	—	—	—	—
8	BLOCK_ALM	—	—	—	—	—	—	—	—
9	TRANSDUCER_ DIRECTORY	—	—	—	—	—	—	—	—
10	TRANSDUCER_TYPE	2	2	2	2	—	—	—	—
11	TRANSDUCER_TYPE_ VER	2	2	2	2	—	—	—	—
12	XD_ERROR	1	—	1	—	—	—	—	—
13	COLLECTION_ DIRECTORY	—	—	—	—	—	—	—	—
14	SNS_FlowZeroRestore Previous	—	—	—	—	—	—	—	—
15	DEN_StartHealthCheck	—	—	—	2	—	—	—	—

Index	Name	View							
		1	2	3	4_1	4_2	4_3	4_4	4_5
16	DEN_Compression FilterParameter	—	—	—	—	4	—	—	—
17	DEN_VelocityOOR	2	—	2	—	—	—	—	—
18	DEN_UseUserSensor CheckValue	—	—	—	—	—	—	—	—
19	DEN_StartDensOffset Cal	—	—	—	—	—	—	—	—
20	DEN_TineType	—	—	—	—	—	—	—	—
21	DEN_StartViscScale Cal	—	—	—	—	—	—	—	—
22	SNS_EnableIntExt Temp	—	—	—	—	—	—	—	—
23	DensityOffset	—	—	—	2	—	—	—	—
24	TemperatureOffset	—	—	—	2	—	—	—	—
25	DensityScaleFactor	—	—	—	2	—	—	—	—
26	TemperatureScale Factor	—	—	—	2	—	—	—	—
27	FlowSwitchHysterisis	—	—	—	4	—	—	—	—
28	FlowRateSwitch Threshold	—	—	—	—	—	—	—	—
29	SYS_WtMeasSw Version	—	—	—	—	—	—	—	—
30	DEN_K0	—	4	—	—	—	—	—	—
31	DEN_K1	—	4	—	—	—	—	—	—
32	DEN_K2	—	4	—	—	—	—	—	—
33	DEN_K18	—	4	—	—	—	—	—	—
34	DEN_K19	—	4	—	—	—	—	—	—
35	DEN_KV4	—	4	—	—	—	—	—	—
36	DEN_KV5	—	4	—	—	—	—	—	—
37	DEN_KV6	—	4	—	—	—	—	—	—
38	DEN_CalibrationStatus	—	—	—	1	—	—	—	—
39	DEN_KV_Index	—	—	—	—	—	1	—	—
40	DEN_KV_Crossover	—	—	—	—	—	4	—	—
41	DEN_A1	—	—	—	4	—	—	—	—
42	DEN_A2	—	—	—	4	—	—	—	—
43	DEN_A3	—	—	—	4	—	—	—	—

Index	Name	View							
		1	2	3	4_1	4_2	4_3	4_4	4_5
44	DEN_A4	—	—	—	4	—	—	—	—
45	DEN_A5	—	—	—	4	—	—	—	—
46	DEN_A6	—	—	—	4	—	—	—	—
47	DEN_A7	—	—	—	4	—	—	—	—
48	DEN_A8	—	—	—	4	—	—	—	—
49	DEN_A9	—	—	—	4	—	—	—	—
50	DEN_DensityOffset	—	—	—	4	—	—	—	—
51	DEN_DensityMeter Factor	—	—	—	—	4	—	—	—
52	DEN_Velocity	5	—	5	—	—	—	—	—
53	DEN_FixedVelocity	—	—	—	4	—	—	—	—
54	DEN_VelocityUnits	—	2	—	—	—	—	—	—
55	DEN_VelocityCutoff	—	—	—	—	4	—	—	—
56	DEN_VelocityCutoff	—	—	—	—	4	—	—	—
57	DEN_VelocityLoLim	—	—	—	—	4	—	—	—
58	DEN_VelocitySpan	—	—	—	—	4	—	—	—
59	DEN_VelocityDamping	—	—	—	—	4	—	—	—
60	DEN_TimePeriodB	4	—	4	—	—	—	—	—
61	DEN_TimePeriodA	4	—	4	—	—	—	—	—
62	DEN_SpecialEqnOutput	5	—	5	—	—	—	—	—
63	DEN_ProgrammableConstA	—	—	—	—	4	—	—	—
64	DEN_ProgrammableConstB	—	—	—	—	4	—	—	—
65	DEN_ProgrammableConstC	—	—	—	—	4	—	—	—
66	DEN_ProgrammableConstE	—	—	—	—	4	—	—	—
67	DEN_ProgrammableConstF	—	—	—	—	4	—	—	—
68	DEN_ProgrammableValA	—	—	—	—	4	—	—	—
69	DEN_ProgrammableValB	—	—	—	—	4	—	—	—
70	DEN_ProgrammableValC	—	—	—	—	4	—	—	—
71	DEN_ProgrammableValD	—	—	—	—	4	—	—	—
72	DEN_ProgrammableValE	—	—	—	—	4	—	—	—
73	DEN_ProgrammableValF	—	—	—	—	4	—	—	—
74	DEN_SpecialEqnSlotA	—	—	—	—	2	—	—	—
75	DEN_SpecialEqnSlotB	—	—	—	—	2	—	—	—
76	DEN_SpecialEqnSlotC	—	—	—	—	2	—	—	—

Index	Name	View							
		1	2	3	4_1	4_2	4_3	4_4	4_5
77	DEN_SpecialEqnSlotD	—	—	—	—	2	—	—	—
78	DEN_SpecialEqnSlotE	—	—	—	—	2	—	—	—
79	DEN_SpecialEqnSlotF	—	—	—	—	2	—	—	—
80	DEN_ProgAirWaterDensity	—	4	—	—	—	—	—	—
81	DEN_UserBaseDensity	—	4	—	—	—	—	—	—
82	DEN_SpecialEqnLabel	—	—	—	—	—	8	—	—
83	DEN_DensitySpecUnitLabel	—	—	—	—	—	8	—	—
84	DEN_DensitySpecUnitBaseUnits	—	2	—	—	—	—	—	—
85	DEN_KinViscSpecialUnitBaseUnits	—	2	—	—	—	—	—	—
86	DEN_DensitySpecUnitConvFactor	—	4	—	—	—	—	—	—
87	DEN_QualityFactor	5	—	5	—	—	—	—	—
88	DEN_DynamicViscosity	5	—	5	—	—	—	—	—
89	DEN_KinematicViscosity	5	—	5	—	—	—	—	—
90	DEN_DynamicViscosityUnits	—	2	—	—	—	—	—	—
91	DEN_KinematicViscosityUnits	—	2	—	—	—	—	—	—
92	VISC_RANGE_SEL_INDEX	—	—	—	—	—	2	—	—
93	DEN_V0	—	—	—	—	—	4	—	—
94	DEN_V1	—	—	—	—	—	4	—	—
95	DEN_V2	—	—	—	—	—	4	—	—
96	DEN_ViscRangeScale	—	—	—	—	—	4	—	—
97	ViscRangeSwitchIndex	—	—	—	—	—	2	—	—
98	DEN_ViscRangeLimit	—	—	—	—	—	4	—	—
99	DEN_ViscHysteresis	—	—	—	—	—	4	—	—
100	DEN_ViscosityOffset	—	—	—	—	—	4	—	—
101	DEN_DynViscSpecialUnitLabel	—	—	—	—	—	8	—	—
102	DEN_KinViscSpecialUnitLabel	—	—	—	—	—	8	—	—
103	DEN_DynViscSpecialUnitConvFactor	—	—	—	—	—	4	—	—
104	DEN_KinViscSpecialUnitConvFactor	—	—	—	—	—	4	—	—

Index	Name	View							
		1	2	3	4_1	4_2	4_3	4_4	4_5
105	DEN_DynViscSpecialUnitBaseUnits	—	2	—	—	—	—	—	—
106	DEN_ReferenceViscosity	5	—	5	—	—	—	—	—
107	DEN_CAII	5	—	5	—	—	—	—	—
108	DEN_TubeCaseTempDiff	5	—	5	—	—	—	—	—
109	DEN_AverageTimePeriod	—	—	—	—	—	—	4	—
110	DEN_TimePeriodStablity	—	—	—	—	—	—	4	—
111	DEN_HealthCheckResult	—	—	—	—	—	—	2	—
112	DEN_HealthCheckFailureBits	—	—	—	—	—	—	2	—
113	DEN_LabDensity	—	—	—	—	—	—	4	—
114	DEN_ReferredViscMethod	—	—	—	—	—	—	2	—
115	MBUS_Visc_CurveIndex	—	—	—	—	—	—	2	—
116	MBUS_Visc_TempIndex	—	—	—	—	—	—	2	—
117	DEN_RefVisc_Mat_MaxFitOrder	—	—	—	—	—	—	2	—
118	EN_RefVisc_Mat_TempISO	—	—	—	—	—	—	4	—
119	DEN_RefVisc_Mat_ViscAtTempISO	—	—	—	—	—	—	4	—
120	DEN_RefTemp1	—	—	—	—	—	—	4	—
121	DEN_RefTemp2	—	—	—	—	—	—	4	—
122	DEN_RefVisc_Mat_FitAccuracy	—	—	—	—	—	—	4	—
123	DEN_RefVisc_Mat_FitResults	—	—	—	—	—	—	2	—
124	REF_VISC_INPUT_SOURCE	—	—	—	—	—	—	2	—
125	DEN_RefVisc_ASTM_NumCurves	—	—	—	—	—	—	4	—
126	DEN_RefVisc_ASTM_TempISO	—	—	—	—	—	—	4	—
127	DEN_RefVisc_ASTM_ViscAtTempISO	—	—	—	—	—	—	4	—
128	DEN_BaseDensityForSensorCheck	—	—	—	—	—	—	4	—
129	DEN_ElevationAboveSeaLev	—	—	—	—	—	—	—	2
130	DEN_LabViscosity	—	—	—	—	—	—	—	4
131	DEN_CII	5	—	5	—	—	—	—	—
132	DEN_TemperatureCheckAverage	—	—	—	—	—	—	—	4

Index	Name	View							
		1	2	3	4_1	4_2	4_3	4_4	4_5
133	DEN_DriveGainAverage	—	—	—	—	—	—	—	4
134	DEN_DriveGainStability	—	—	—	—	—	—	—	4
135	DEN_TemperatureCheckStability	—	—	—	—	—	—	—	4
136	DEN_CaseTemperatureAverage	—	—	—	—	—	—	—	4
137	DEN_CaseTemperatureStability	—	—	—	—	—	—	—	4
138	DEN_SpecialEquationType	—	—	—	—	—	2	—	—
139	DEN_Legacy_K0	—	—	—	—	—	—	—	4
140	DEN_Legacy_K1	—	—	—	—	—	—	—	4
141	DEN_Legacy_K2	—	—	—	—	—	—	—	4
142	DEN_Legacy_K18	—	—	—	—	—	—	—	4
143	DEN_Legacy_K19	—	—	—	—	—	—	—	4
144	DEN_Legacy_K20A	—	—	—	—	—	—	—	4
145	DEN_Legacy_K20B	—	—	—	—	—	—	—	4
146	DEN_Legacy_K21A	—	—	—	—	—	—	—	4
147	DEN_Legacy_K21B	—	—	—	—	—	—	—	4
148	DEN_Legacy_K20_K21_Index	—	2	—	—	—	—	—	—
149	DEN_Legacy_K0_K1_K2_Index	—	2	—	—	—	—	—	—
150	DEN_TPA_Microsec	5	—	5	—	—	—	—	—
151	DEN_TPB_Microsec	5	—	5	—	—	—	—	—
152	SNS_EnablePM	—	—	—	—	—	—	—	2
153	SNS_EnableCM	—	—	—	—	—	—	—	2
154	DEN_PressureOffset	—	—	—	—	—	—	—	4
155	DEN_Legacy_K22	—	—	—	—	—	—	—	4
156	DEN_Legacy_K23	—	—	—	—	—	—	—	4
157	DEN_KDV_CalIndex	—	—	—	—	—	—	—	2
158	DEN_TempDiffAverage	—	—	—	—	—	4	—	—
159	DEN_TempDiffStability	—	—	—	—	—	4	—	—
160	DEN_EnableExtTempModulus	—	—	—	—	—	2	—	—
161	DEN_EnableExtTempForVisc	—	—	—	—	—	—	2	—

Index	Name	View							
		1	2	3	4_1	4_2	4_3	4_4	4_5
162	SYS_AttachedCoreType	—	—	—	—	—	—	2	—
163	DEN_SecBaseViscosity	5	—	5	—	—	—	—	—
164	DEN_RefViscUnits	—	2	—	—	—	—	—	—
165	DEN_TEMPERATURE_UNITS	—	—	2	—	—	—	—	—
166	DENSITY_UNITS	—	—	2	—	—	—	—	—
167	PRESSURE_UNITS	—	—	2	—	—	—	—	—
168	DEN_ProductCode	—	—	—	—	—	—	—	—
169	Velocity_Switch_Status	—	—	2	—	—	—	—	—
170	DEN_RefWaterDensity	—	—	—	—	—	—	4	—
171	DEN_RefTemperature	—	—	—	—	—	—	4	—
172	DEN_RefPressure	—	—	—	—	—	—	4	—
173	DEN_Fluid_Option	—	—	—	—	—	2	—	—
174	DEN_StartInlineCal	—	—	—	—	—	2	—	—
175	DEN_CalculatedWaterDens	—	—	—	—	—	—	—	4
176	DEN_InlineCalResult	—	—	—	—	—	—	—	2
177	DEN_InlineCalResultValue	—	—	—	—	—	4	—	—

A.9.2 Standard fieldbus parameters for density viscosity meter transducer blocks

Index and name	Description	List of values
#0 BLOCK_STRUCTURE	The beginning of the transducer block. Msg type = VAR Data type = DS_64 (5) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—
#1 ST_REV	The revision level of the static data associated with the function block. Incremented with each write of static store. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 1.0	—

Index and name	Description	List of values
#2 TAG_DESC	The user description of the intended block application. Msg type = STR Data type = OCTET STRING (32) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	Any 32 characters
#3 STRATEGY	Used to identify grouping of blocks. This data is not checked or processed by the block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	—
#4 ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Msg type = VAR Data type = Unsigned8 (1) Store = Static Access = RW (OOS) or RW (Auto) Available in Release 1.0	1 to 255
#5 MODE_BLK	The actual, target, permitted, and normal modes of the block. Msg type = REC Data type = DS-69 (4) Store = Mixed Access = RW (OOS) or RW (Auto) Available in Release 1.0	See section 2.6 of FF-891
#6 BLOCK_ERR	The error status associated with the hardware or software components associated with a block. Msg type = STR Data type = BIT STRING (2) Store = Dynamic/20 Access = Read only Available in Release 1.0	See section 4.8 of FF-903
#7 UPDATE_EVT	Occurs when a static parameter is changed while a block mode is not in out of service (OOS) mode, or when the mode changes from OOS mode and one or more static parameters changed while the block was OOS. Msg type = REC Data type = DS-73 Store = Dynamic Access = RW in any mode Available in Release 1.0	—

Index and name	Description	List of values
#8 BLOCK_ALM	A predefined set of 16 conditions that may occur within a block. Msg type = REC Data type = DS-72 Store = Dynamic Access = RW in any mode Available in Release 9.0	—
#9 TRANSDUCER_ DIRECTORY	A directory that specifies the number and starting indices of the data collections in the transducer block. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#10 TRANSDUCER_ TYPE	Identifies the transducer that follows. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#11 TRANSDUCER_ TYPE_VER	Identifies the version of the transducer block. Format is *XXYY* where *XX* is the major spec revision and *YY* is the manufacturer revision. Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = RW (OOS) Available in Release 9.0	—
#12 XD_ERROR	Used for all config, H/W, connection failure of system problems in the block. Msg type = VAR Data type = Unsigned8 (1) Store = Dynamic Access = RW (OOS) Available in Release 1.0	0 = No Error 18 = Calibration Error 19 = Configuration Error 20 = Electronics Failure 21 = Sensor Failure 26 = Process Error 27 = Calibration in Progress
#13 COLLECTION_ DIRECTORY	Used for all config, H/W, and connection failures of system problems in the block. Msg type = VAR Data type = Unsigned32 (4) Store = Static Access = RW (OOS) Available in Release 9.0	—

A.9.3 Process variables for density viscosity transducer blocks

Table A-26: Process variables for density viscosity transducer blocks

Index and name	Description	List of values	HW
#14 SNS_FlowZeroRestorePrevious	Restore previous zero Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1 = Restore Previous Zero 0 = None	800 CDM FDM FVM
#15 DEN_StartHealthCheck	Start sensor check Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	0 = Abort 1 = Start	CDM FDM FVM
#16 DEN_CompressionFilter Parameter	Viscosity compression filter parameter Msg type = VAR Data type = Float(4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#17 DEN_VelocityOOR	Velocity out of limit indication Msg type = VAR Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 8.0	1 = Velocity out of limit 0 = Velocity within limit	CDM
#18 DEN_UseUserSensorCheck Value	Curve configuration index (n) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1 = Use user sensor check value 0 = Use factory sensor check value	CDM FDM FVM
#19 DEN_StartDensOffsetCal	Start density offset calibration Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1 = Start density offset calibration 0 = Stop density offset calibration	CDM FDM FVM
#20 DEN_TineType	Fork tine length Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	0 = SHORT_TINE 1 = LONG_TINE	FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#21 DEN_StartViscScaleCal	Start viscosity scale factor Msg type = METHOD Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1 = Start viscosity scale factor 0 = None	FVM
#22 SNS_EnableIntExtTemp	Enable/Disable external temp for modulus comp Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 8.0	0 = Disable 1 = Enable	CDM FDM
#23 DensityOffset	Density offset Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#24 TemperatureOffset	Temperature offset Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#25 DensityScaleFactor	Densisty scale factor Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#26 TemperatureScaleFactor	Temperature scale factor Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#27 FlowSwitchHysterisis	Flow rate switch hysteresis Msg type = VAR Data type = Float(4) Store = Static Access = R/W in any mode Available in Release 8.0	—	CDM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#28 FlowRateSwitchThreshold	Flow rate switch set point Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 8.0	—	800 CDM
#29 SYS_WtMeasSwVersion	Weights & Measures software version Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	—	CDM
#30 DEN_K0	K0, instrument calibration factor Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FDM FVM
#31 DEN_K1	K1, instrument calibration factor Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FDM FVM
#32 DEN_K2	K2, instrument calibration factor Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FDM FVM
#33 DEN_K18	K18, instrument calibration factor Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FDM FVM
#34 DEN_K19	K19, instrument calibration factor Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#35 DEN_KV4	KV4, instrument calibration factor (calibration range indexed by register 4022) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#36 DEN_KV5	KV5, instrument calibration factor (calibration range indexed by register 4022) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#37 DEN_KV6	KV6, instrument calibration factor (calibration range indexed by register 4022) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#38 DEN_CalibrationStatus	Density viscosity calibration status Msg type = VAR Data type = Unsigned8 (1) Store = Static Access = Read only Available in Release 8.0	—	CDM FDM FVM
#39 DEN_KV_Index	KV calibration factor index (0-1) Msg type = ENUM (1) Data type = Unsigned8 (1) Store = Static Access = R/W in any mode Available in Release 8.0	0: Medium 1: High	FVM
#40 DEN_KV_Crossover	KV calibration crossover point (based on quality factor) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#41 DEN_A1	A1, density calibration constant Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#42 DEN_A2	A2, density calibration constant Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#43 DEN_A3	A3, density calibration constant Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#44 DEN_A4	A4, density calibration constant Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#45 DEN_A5	A5, density calibration constant Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#46 DEN_A6	A6, density calibration constant Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#47 DEN_A7	A7, density calibration constant Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#48 DEN_A8	A8, density calibration constant Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#49 DEN_A9	A9, density calibration constant Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#50 DEN_DensityOffset	Density offset Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#51 DEN_DensityMeterFactor	Density meter factor Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#52 DEN_Velocity	Flow velocity Msg type = VAR Data type = DS65 Store = Dynamic/20 Access = Read only Available in Release 8.0	—	CDM
#53 DEN_FixedVelocity	Fixed flow velocity value (m/sec) Msg type = VAR Data type = DS65 Store = Dynamic/20 Access = Read only Available in Release 8.0	—	CDM
#54 DEN_VelocityUnits	Flow velocity units Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1061 = Meters/ Second 1067 = Feet/Second	CDM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#55 DEN_VelocityCutoff	Flow velocity units Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#56 DEN_VelocityHiLim	Flow velocity high limit Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM
#57 DEN_VelocityLoLim	Flow velocity low limit Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM
#58 DEN_VelocitySpan	Flow velocity span Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM
#59 DEN_VelocityDamping	Flow velocity damping Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#60 DEN_TimePeriodB	Time period (u/sec) (upper 3dB point) Msg type = VAR Data type = Float (4) Store = Dynamic/20 Access = Read only Available in Release 8.0	—	CDM FDM FVM
#61 DEN_TimePeriodA	Time period (u/sec) (lower 3dB point) Msg type = VAR Data type = Float (4) Store = Dynamic/20 Access = Read only Available in Release 8.0	—	FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#62 DEN_SpecialEqnOutput	Special equation output Msg type = VAR Data type = DS65 Store = Dynamic/20 Access = Read only Available in Release 8.0	—	CDM FDM FVM
#63 DEN_ProgrammableConstA	Programmable constant A for special equation Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#64 DEN_ProgrammableConstB	Programmable constant B for special equation Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#65 DEN_ProgrammableConstC	Programmable constant C for special equation (X for special equation type I) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#66 DEN_ProgrammableConstE	Programmable constant E for special equation (Y for special equation type I) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#67 DEN_ProgrammableConstF	Programmable constant F for special equation Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#68 DEN_ProgrammableValA	Programmable constant A for special equation - constants available for access using pointers for special equations (registers 4114-4119) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#69 DEN_ProgrammableValB	Programmable constant B for special equation - constants available for access using pointers for special equations (registers 4114-4119) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#70 DEN_ProgrammableValC	Programmable constant C for special equation - constants available for access using pointers for special equations (registers 4114-4119) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#71 DEN_ProgrammableValD	Programmable constant D for special equation - constants available for access using pointers for special equations (registers 4114-4119) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#72 DEN_ProgrammableValE	Programmable constant E for special equation - constants available for access using pointers for special equations (registers 4114-4119) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#73 DEN_ProgrammableValF	Programmable constant F for special equation - constants available for access using pointers for special equations (registers 4114-4119) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#74 DEN_SpecialEqnSlotA	Pointer A for special equation Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1 = Temperature 3 = Density 5 = Volume Flow Rate [CDM](1) 15 = PM: Corr Density 21 = CM: Density At Ref 22 = CM: Density [SGU] 26 = CM: Net Mass Flow Rate [FDM and FVM] 29 = CM: Net Volume Flow Rate [FDM and FVM] 32 = CM: Concentration 47 = Drive Gain 48 = Case Temperature [CDM] 50 = RPO Amplitude [CDM] 51 = Board Temperature 52 = Input Voltage 53 = Ext. Input Pressure 55 = Ext. Input Temp 161 = Tube-Case Temperature Differential [CDM] 162 = Dynamic Viscosity [FVM] 163 = Kinematic Viscosity [FVM] 164 = Base Viscosity [FVM] 168 = Quality Factor [FVM] 208 = Mass Flow Velocity [CDM] 215 = Time Period B (Upper 3db point) 251 = None	CDM FDM FVM
#75 DEN_SpecialEqnSlotB	Pointer B for special equation Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	See #74 DEN_SpecialEqnSlotA	CDM FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#76 DEN_SpecialEqnSlotC	Pointer C for special equation Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	See #74 DEN_SpecialEqnSlotA	CDM FDM FVM
#77 DEN_SpecialEqnSlotD	Pointer D for special equation Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	See #74 DEN_SpecialEqnSlotA	CDM FDM FVM
#78 DEN_SpecialEqnSlotE	Pointer E for special equation Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	See #74 DEN_SpecialEqnSlotA	CDM FDM FVM
#79 DEN_SpecialEqnSlotF	Pointer F for special equation Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	See #74 DEN_SpecialEqnSlotA	CDM FDM FVM
#80 DEN_ProgAirWaterDensity	User-defined water density Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#81 DEN_UserBaseDensity	User-defined base density Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#82 DEN_SpecialEqnLabel	Special equation unit string Msg type = STR Data type = VISIBLE STRING Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#83 DEN_DensitySpecUnitLabel	Special density unit string Msg type = STR Data type = VISIBLE STRING Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#84 DEN_DensitySpecUnitBaseUnits	Base density unit for special density unit Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	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	CDM FDM FVM
#85 DEN_KinViscSpecialUnit BaseUnits	Base kinematic viscosity unit for special kinematic viscosity unit Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1164 = centistokes	FVM
#86 DEN_DensitySpecUnitConvFactor	Special density unit conversion factor Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM
#87 DEN_QualityFactor	Quality factor Msg type = VAR Data type = DS65 Store = Dynamic Access = Read only Available in Release 8.0	—	FVM
#88 DEN_DynamicViscosity	Dynamic viscosity Msg type = VAR Data type = DS65 Store = Dynamic Access = Read only Available in Release 8.0	—	FVM
#89 DEN_KinematicViscosity	Kinematic viscosity Msg type = VAR Data type = DS65 Store = Dynamic Access = Read only Available in Release 8.0	—	FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#90 DEN_DynamicViscosityUnits	Dynamic viscosity unit Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1159 = Pascal second 1162 = Centipoise 253=Special	FVM
#91 DEN_KinematicViscosityUnits	Kinematic viscosity unit Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1164 =Centistokes 253 =Special	FVM
#92 VISC_RANGE_SEL_INDEX	Viscosity value range selection - Index for DEN_V0,DEN_V1,DEN_V2, DEN_ViscRangeScale Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	0 = Ultra low 1 = Ultra low to low 2 = Low to medium 3 = Medium to high 4 = High	FVM
#93 DEN_V0	V0 at the selected range - Array of 4 Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#94 DEN_V1	V1 at the selected range - Array of 4 Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#95 DEN_V2	V2 at the selected range - Array of 4 Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#96 DEN_ViscRangeScale	Range scale at the selected range - Array of 4 Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#97 ViscRangeSwitchIndex	Viscosity range switch setpoint index Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	0 = Ultra low 1 = Ultra low to low 2 = Low to medium 3 = Medium to high 4 = High	FVM
#98 DEN_ViscRangeLimit	Viscosity range switch setpoint (at the index selected by register 4174) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#99 DEN_ViscHysteresis	Viscosity hysteresis Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#100 DEN_ViscosityOffset	Viscosity offset Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#101 DEN_DynViscSpecialUnitLabel	Special dynamic viscosity unit string Msg type = STR Data type = VISIBLE STRING Store = Static Access = R/W (OOS) Available in Release 8.0	Visible string	FVM
#102 DEN_KinViscSpecialUnitLabel	Special kinematic viscosity unit string Msg type = STR Data type = VISIBLE STRING Store = Static Access = R/W (OOS) Available in Release 8.0	Visible string	FVM
#103 DEN_DynViscSpecialUnit ConvFactor	Special dynamic viscosity unit conversion factor Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#104 DEN_KinViscSpecialUnit ConvFactor	Special kinematic viscosity unit conversion factor Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#105 DEN_DynViscSpecialUnit BaseUnits	Base dynamic viscosity unit for special dynamic viscosity unit Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1162 = Centipoise	FVM
#106 DEN_ReferenceViscosity	Primary referred viscosity Msg type = VAR Data type = DS65 Store = Dynamic Access = Read only Available in Release 8.0	—	FVM
#107 DEN_CAII	Ignition Index (CCAI) Msg type = VAR Data type = DS65 Store = Dynamic Access = Read only Available in Release 8.0	—	FVM
#108 DEN_TubeCaseTempDiff	Tube-case temperature differential Msg type = VAR Data type = DS65 Store = Dynamic Access = Read only Available in Release 8.0	—	CDM
#109 DEN_AverageTimePeriod	Average time period on air/vacuum (indexed by DEN_KDV_CalIndex) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM FDM FVM
#110 DEN_TimePeriodStablity	Time period stablity on air/vacuum (sensor check) (indexed by DEN_KDV_CalIndex) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#111 DEN_HealthCheckResult	Check results Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	0 = Good 2 = Fail 3 = Not Run 4 = In Progress 5 = No Factory Cal	CDM FDM FVM
#112 DEN_HealthCheckFailureBits	KDV failure bits Msg type = VAR Data type = BIT STRING Store = Static Access = Read only Available in Release 8.0	Bit #0 - Corrected time period average out of range Bit #1 - Corrected time bit #1 - Period stability out of range Bit #2 - Temperature stability out of range Bit #3 - Drive gain average out of range Bit #4 - Case temperature stability out of range (tube density only)	CDM FDM FVM
#113 DEN_LabDensity	Lab density for density offset calibration Msg type = VAR Data type = Float (4) Store = Static Access = R/W in any mode Available in Release 8.0	—	CDM FDM FVM
#114 DEN_ReferredViscMethod	Referred viscosity calculation method Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	0 = referral matrix 1 = ASTM D341 single curve 2 = ASTM D341 multiple curve	FVM
#115 MBUS_Visc_CurveIndex	Referred viscosity configuration curve index (for matrix method n = 0-5 and for ASTM method n = 0-7) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#116 MBUS_Visc_TempIndex	Referred viscosity temperature isotherm index (for matrix method n = 0-5 and for ASTM method n = 0-1) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#117 DEN_RefVisc_Mat_MaxFitOrder	Referred viscosity maximum fit order for 6x6 matrix (order = 2, 3, 4, 5) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#118 EN_RefVisc_Mat_TempISO	Referred viscosity temperature isothermx value (6x1) (indexed by register MBUS_Visc_TempIndex) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#119 DEN_RefVisc_Mat_ ViscAtTempISO	Referred viscosity (6x6) @ temperature isothermX, curve$_n$ (indexed by MBUS_Visc_CurveIndex and MBUS_Visc_TempIndex) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#120 DEN_RefTemp1	Referred viscosity reference temperature 1 Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#121 DEN_RefTemp2	Referred viscosity reference temperature 2 Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#122 DEN_RefVisc_Mat_ FitAccuracy	Referred viscosity curve fit expected accuracy Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#123 DEN_RefVisc_Mat_ FitResults	Referred viscosity curve fit result Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	0 = Good 1 = Poor 2 = Failed 3 = Empty	FVM
#124 REF_VISC_INPUT_SOURCE	Referred viscosity input source selection (for matrix method only) Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	163 = Kinematic 162 = Dynamic	FVM
#125 DEN_RefVisc_ASTM_NumCurves	Number of ASTM reference curves (n = 2-8) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#126 DEN_RefVisc_ASTM_TempISO	ASTM temperature value (2X8) @ point1 or point2 curve n (n = 0-7) (indexed by MBUS_Visc_CurveIndex and MBUS_Visc_TempIndex) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#127 DEN_RefVisc_ASTM_ ViscAtTempISO	ASTM referral viscosity (2X8) @ temperatureX , curve n (n = 0-7) (indexed by MBUS_Visc_CurveIndex and MBUS_Visc_TempIndex) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#128 DEN_BaseDensityFor SensorCheck	Base density for sensor check Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#129 DEN_ElevationAboveSeaLev	Elevation above sea level for Known Density Verification Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	0 = 0 feet or meters, 1= 1000 feet 2 = 2000 feet 3 = 3000 feet 4 = 4000 feet 5 = 5000 feet 6 = 6000 feet or greater 7 = 500 meters 8 = 1000 meters 9 = 2000 meters or greater	CDM FDM FVM
#130 DEN_LabViscosity	Lab viscosity for viscosity scaling factor calibration Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	FVM
#131 DEN_CII	Ignition index (CII) Msg type = VAR Data type = DS65 Store = Dynamic/20 Access = Read only Available in Release 8.0	—	FVM
#132 DEN_TemperatureCheckAverage	Temperature average (sensor check) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM FDM FVM
#133 DEN_DriveGainAverage	Drive gain average (sensor check) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	FVM
#134 DEN_DriveGainStability	Drive gain stability (sensor check) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#135 DEN_TemperatureCheckStability	Temperature stability (sensor check) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM FDM FVM
#136 DEN_CaseTemperatureAverage	Case temperature average (sensor check) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM
#137 DEN_CaseTemperatureStability	Case temperature stability (sensor check) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM
#138 DEN_SpecialEquationType	Special equation type Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	0 - Type 1 1 - Type 2 2 - Quartic 99 - None	CDM FDM FVM
#139 DEN_Legacy_K0	K0 legacy calibration constant (indexed by DEN_Legacy_K0_K1_K2_Index) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM
#140 DEN_Legacy_K1	K1 legacy calibration constant (indexed by DEN_Legacy_K0_K1_K2_Index) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM
#141 DEN_Legacy_K2	K2 legacy calibration constant (indexed by DEN_Legacy_K0_K1_K2_Index) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#142 DEN_Legacy_K18	K18 legacy calibration constant Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#143 DEN_Legacy_K19	K19 legacy calibration constant Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#144 DEN_Legacy_K20A	K20A constant used to compute K20 (indexed by DEN_Legacy_K20_K21_Index) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#145 DEN_Legacy_K20B	K20B constant used to compute K20 (indexed by DEN_Legacy_K20_K21_Index) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#146 DEN_Legacy_K21A	K21A constant used to compute K21 (indexed by DEN_Legacy_K20_K21_Index) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#147 DEN_Legacy_K21B	K21B constant used to compute K21 (indexed by DEN_Legacy_K20_K21_Index) Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#148 DEN_Legacy_K20_K21_Index	Index for K20A, K20B, K21A, and K21B legacy coefficients (0-3) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#149 DEN_Legacy_K0_K1_K2_Index	Index for K0, K1, and K2 legacy coefficients (0-1) Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#150 DEN_TPA_Microsec	Time period A (in microseconds) Msg type = VAR Data type = DS65 Store = Dynamic Access = Read only Available in Release 8.0	—	FVM
#151 DEN_TPB_Microsec	Time period B (in microseconds) Msg type = VAR Data type = DS65 Store = Dynamic Access = Read only Available in Release 8.0	—	CDM FDM FVM
#152 SNS_EnablePM	User accessible enable PM Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	0 = Disable PM 1 = Enable PM	CDM FDM FVM
#153 SNS_EnablePM	User accessible enable CM Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	0 = Disable CM 1 = Enable CM	CDM FDM FVM
#154 DEN_PressureOffset	Pressure offset Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#155 DEN_Legacy_K22	K22 legacy calibration coefficient Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#156 DEN_Legacy_K23	K23 legacy calibration coefficient Msg type = VAR Data type = Float (4) Store = Static Access = R/W (OOS) Available in Release 8.0	—	CDM
#157 DEN_KDV_CalIndex	Index for KDV results Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	0 = Factory 1 = User	CDM FDM FVM
#158 DEN_TempDiffAverage	Temperature differential average (health check) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM
#159 DEN_TempDiffStability	Temperature differential stability (health check) Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 8.0	—	CDM
#160 DEN_EnableExtTempModulus	Enable external temperature for modulus compensation Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 8.0	0 = Disable 1 = Enable	CDM FDM FVM
#161 DEN_EnableExtTempForVisc	Enable external temperature for reference viscosity Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 8.0	0 = Disable 1 = Enable	FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#162 SYS_AttachedCoreType	Indicates the attached core type Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 8.0	0 = CORE_UNKNOWN 1 = CORE_700 2 = CORE_ECP 3 = CORE_S 4 = CORE_DENSITY 5 = CORE_DEN_CDM 6 = CORE_DEN_FDM 7 = CORE_DEN_FVM	700 800 CDM FDM FVM
#163 DEN_SecBaseViscosity	Secondary referred viscosity Msg type = VAR Data type = DS65 Store = Dynamic Access = Read only Available in Release 8.0	—	FVM
#164 DEN_RefViscUnits	Unit for reference and secondary reference viscosity Msg type = VAR Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1164 = Centistokes 1162 = Centipoise	FVM
#165 DEN_TEMPERATURE_UNITS	Temperature unit Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W (OOS) Available in Release 8.0	1000 = K 1001 = Deg C 1002 = Deg F 1003 = Deg R	700 800 CDM FDM FVM
#166 DENSITY_UNITS	Density unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 8.0	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 253 = Special (only for CDM, FDM, FVM)	700 800 CDM FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#167 PRESSURE_UNITS	Pressure unit Msg type = ENUM Data type = Unsigned16 (2) Store = Dynamic Access = R/W (OOS) Available in Release 8.0	1148 = inch water @ 68F / 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 1132 = Megapascals 1133 = kilopascals 1139 = torr @ 0C 1140 = atmospheres 1147 = Inches water @ 4 degrees Celsius 1150 = Millimeters water @ 4 degrees Celsius	700 800 CDM FDM FVM
#168 DEN_ProductCode	Product code Msg type = STR Data type = VISIBLE STRING (32) Store = Static Access = Read only Available in Release 8.0	—	700 800 CDM FDM FVM
#169 Velocity_Switch_Status	Flow rate switch status Msg type = VAR Data type = Unsigned16 (2) Store = Dynamic Access = Read only Available in Release 9.0	0 = Inactive 1 = Active	CDM
#170 DEN_RefWaterDensity	Reference water density for inline calibration Msg type = VAR Data type = Float (4) Store = Static Access = R/W in any mode Available in Release 9.0	—	CDM FDM FVM
#171 DEN_RefTemperature	Reference temperature for inline calibration Msg type = VAR Data type = Float (4) Store = Static Access = R/W in any mode Available in Release 9.0	—	CDM FDM FVM

Table A-26: Process variables for density viscosity transducer blocks *(continued)*

Index and name	Description	List of values	HW
#172 DEN_RefPressure	Reference pressure for inline calibration Msg type = VAR Data type = Float (4) Store = Static Access = R/W in any mode Available in Release 9.0	—	CDM FDM FVM
#173 DEN_Fluid_Option	Fluid for KDV on user fluid Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 9.0	0 = Water 1 = User Fluid	CDM FDM FVM
#174 DEN_StartInlineCal	Start inline calibration Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = R/W in any mode Available in Release 9.0	0 = No Action, 1 = Start	CDM FDM FVM
#175 DEN_CalculatedWaterDens	Calculated water density after inline calibration Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 9.0	—	CDM FDM FVM
#176 DEN_InlineCalResult	Result of inline calibration Msg type = ENUM Data type = Unsigned16 (2) Store = Static Access = Read only Available in Release 9.0	0 = Fail / Not Run 1 = Pass	CDM FDM FVM
#177 DEN_InlineCalResultValue	Inline calibration check result Msg type = VAR Data type = Float (4) Store = Static Access = Read only Available in Release 9.0	—	CDM FDM FVM

(1) The list within the square bracket contains cores that support this value.

B Fieldbus channel references

Table B-1: Analog input function blocks

Channel number	Channel description	Valid unit code	Core applicability
1	Mass Flow	**Measurement TB → Mass Flow Units**	700 800
2	Temperature	**Measurement TB → Temperature Units**	700 800 CDM FDM FVM
3	Density	**Measurement TB → Density Units**	700 800 CDM FDM FVM
4	Volume Flow	**Measurement TB → Volume Flow Units**	700 800
5	Drive Gain	1342 = %	700 800 CDM FDM FVM
7	API Corr Density	**Measurement TB → Density Units**	700 800 CDM FDM FVM
8	API Corr Vol Flow	**Measurement TB → Volume Flow Units**	700 800
9	API Avg Corr Density	**Measurement TB → Density Units**	700 800
10	API Avg Corr Temp	**Measurement TB → Temperature Units**	700 800
11	API CTL	1588 = No Units	700 800
12	ED Ref Density	**Measurement TB → Density Units**	800 CDM FDM FVM
13	ED Specific Gravity	**Measurement TB → Density Units**	800 CDM FDM FVM
14	ED Std Vol Flow	**Measurement TB → Volume Flow Units**	800

Table B-1: Analog input function blocks *(continued)*

Channel number	Channel description	Valid unit code	Core applicability
15	ED Net Mass Flow	**Measurement TB → Mass Flow Units**	800 CDM FDM FVM
16	ED Net Vol Flow	**Measurement TB → Volume Flow Units**	800 CDM FDM FVM
17	ED Conc	**CM TB → Concentration Units**	800 CDM FDM FVM
18	ED Baume	1111 = Deg Baume (heavy) 1112 = Deg Baume (light)	800
19	Std Gas Volume Flow	**Measurement TB → Gas Std Vol Flow Units**	

Table B-2: Analog output function blocks

Channel number	Channel description	Valid unit code	Core applicability
6	Pressure	**Cal TB → Pressure Units**	700 800 CDM FDM FVM
20	Temperature	**Measurement TB → Temperature Units**	700 800 CDM FDM FVM

Table B-3: Discrete input function blocks

Channel number	Channel description	Core applicability
21	SNS Actual Flow Direction	700 800 CDM
22	SNS ZeroInProgress	700 800 CDM FDM FVM

Table B-3: Discrete input function blocks *(continued)*

Channel number	Channel description	Core applicability
23	SYS AnalogOutputFault	700 800 CDM FDM FVM
24	SNS MVFailed	800

Table B-4: Discrete output function blocks

Channel number	Channel description	Core applicability
25	Start Sensor Zero	700 800 CDM
26	Reset Mass Total	700 800
27	Reset Volume Total	700 800
28	Reset API Reference (Standard) Volume Total	700 800
29	Reset All Process Totals (not Inv)	700 800
30	Reset ED Reference Volume Total	700 800
31	Reset ED Net Mass Total	700 800
32	Reset ED Net Volume Total	700 800
33	Start/Stop All Totals (includes Inv)	700 800
34	Increment ED Curve	700 800
35	Reset Gas Standard Volume Total	800
36	Start Meter Verification in Continuous Measurement Mode	800

Table B-5: AI function blocks

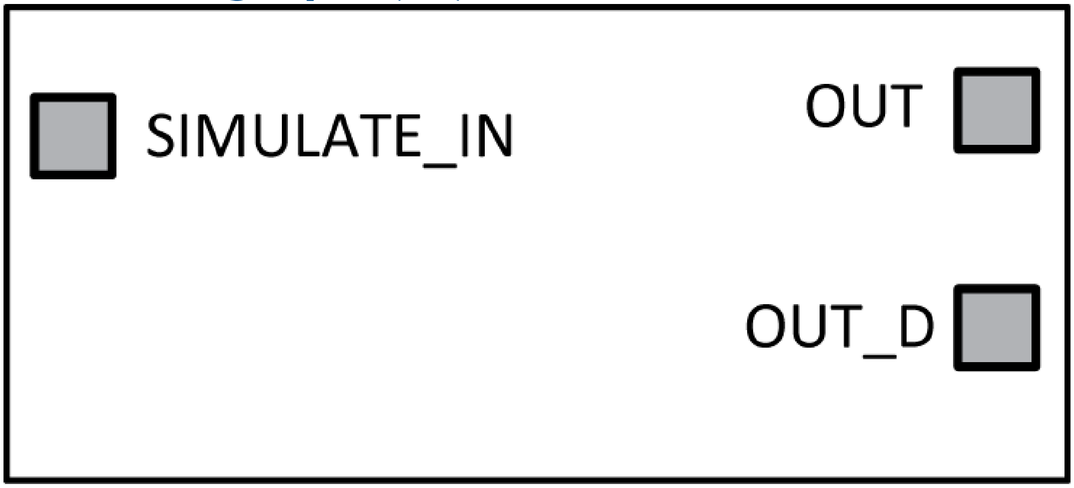
Channel number	Channel description	Valid unit code	Core applicability
37	Special Equation Output	1588 = No Units	CDM FDM FVM
38	Time Period A	1057 - Micro Second	

Table B-5: AI function blocks *(continued)*

Channel number	Channel description	Valid unit code	Core applicability
39	Time Period B	1057 - Micro Second	CDM FDM FVM
40	Tube-case temperature differential	**Measurement TB → Temperature Units**	CDM
41	Dynamic Viscosity	**Orion TB → Dynamic Viscosity Unit**	FVM
42	Kinematic Viscosity	**Orion TB → Kinematic Viscosity Unit**	FVM
43	Base viscosity	**Orion TB → DEN_RefViscUnits**	FVM
44	Quality Factor	1588 = No Units	FVM
45	Flow velocity	**Orion TB → Flow velocity units**	CDM

C FOUNDATION Fieldbus function blocks

C.1 Analog Input (AI) function block



The Analog Input (AI) Function Block processes the measurement from the Transducer Block and makes it available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The AI block supports alarming, signal scaling, signal filtering, signal status calculation, mode control, and simulation. In Automatic mode, the block's output parameter (**OUT**) reflects the process variable (PV) value and status. In Manual mode, **OUT** may be set manually. The Manual mode is reflected on the output status. A discrete output (**OUT_D**) is provided to indicate whether a selected alarm condition is active. Alarm detection is based on the **OUT** value and user specified alarm limits.

C.1.1 AI block configuration parameters

- **CHANNEL**: The **CHANNEL** value is used to select the measurement value. Configure the **CHANNEL** parameter before configuring the **XD_SCALE** parameter.
- **L_TYPE**: Linearization type. Determines whether the field value is used directly (Direct), is converted linearly (Indirect), or is converted with the square root (Indirect Square Root).
- **XD_SCALE**: The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the channel input value. The **XD_SCALE** units code must match the units code of the measurement channel in the transducer block. If the units do not match, the block will not transition to **MAN** or **AUTO**.
- **OUT_SCALE**: The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with **OUT** when **L_TYPE** is not direct.
- **SIMULATE**: A group of data that contains the current transducer value and status, the simulated transducer value and status, and the enable/disable bit.
- **PV_FTIME**: The time constant of the first-order PV filter. It is the time required for a 63% change in the **IN** value.
- **LOW_CUT**: If percentage value of transducer input fails below this, PV = 0.

- **LOW_LIM**: The setting for the alarm limit used to detect the LO alarm condition for process variable in EU of **PV_SCALE**.
- **LO_PRI**: The priority of the **LO** alarm.
- **HI_LIM**: The setting for the alarm limit used to detect the HI alarm condition for process variable in EU of **PV_SCALE**.
- **HI_PRI**: The priority of the HI alarm.
- **ALARM_HYS**: The percent amount the alarm value must return within the alarm limit before the associated active alarm condition clears.

C.1.2 AI block modes

The AI Function Block supports three modes of operation as defined by the MODE_BLK parameter:

- *Manual (Man)*: The block output (**OUT**) may be set manually.
- *Automatic (Auto)*: **OUT** reflects the analog input measurement or the simulated value when simulation is enabled.
- *Out of Service (O/S)*: The block is not processed. **FIELD_VAL** and PV are not updated and the **OUT** status is set to Bad: Out of Service. The **BLOCK_ERR** parameter shows Out of Service. In this mode, you can make changes to all configured parameters. The target mode of a block may be restricted to one or more of the supported modes.

C.1.3 AI block simulation

To support testing, either change the mode of the block to manual and adjust the output value, or enable simulation through the configuration tool and manually enter a value for the measurement value and its status. To enable simulation, the Simulation switch has to be ON. With simulation enabled, the actual measurement value has no impact on the OUT value or the status.

Note
The transmitter has a simulation switch on the display. As a safety measure, the switch has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

C.1.4 AI block configuration

A minimum of four parameters are required to configure the AI Block: **CHANNEL**, **L_TYPE**, **XD_SCALE**, and **OUT_SCALE**.

CHANNEL

Select the channel that corresponds to the desired sensor measurement. The following table provides a list of AI Function block channel numbers and channel applicability depending upon attached core type to transmitter. If a channel is not supported for the given core type, the channel value will not work for the transmitter.

For example, Mass Flow is not a valid assignment for CDM, FDM and FVM core processors attached to the transmitter. The AI Function block will not reject the assignment but the Mass Flow value will not update these core processors.

Table C-1: AI block channel definitions

Channel	Description	700	800	CDM	FDM	FVM
1	Mass flow	X	X			
2	Temperature	X	X	X	X	X
3	Density	X	X	X	X	X
4	Volume flow	X	X	X [(1)]		
5	Drive gain	X	X	X	X	X
7	API Corr Density	X	X	X	X	X
8	API Corr Vol Flow	X	X			
9	API Avg Corr Density	X	X			
10	API Avg Corr Temp	X	X			
11	API CTL	X	X			
12	ED Ref Density	X	X	X	X	X
13	ED Specific Gravity	X	X	X	X	X
14	ED Std Vol Flow	X				
15	ED Net Mass Flow		X		X	X
16	ED Net Vol Flow		X		X	X
17	ED Conc		X	X	X	X
18	ED Baume		X			
19	Std Gas Volume Flow	X	X			
37	Special Equation Output			X	X	X
39	Time Period B			X	X	X
40	Tube-case Temperature Differential			X		
41	Dynamic Viscosity					X
42	Kinematic Viscosity					X
43	Base viscosity					X
44	Quality Factor					X
45	Flow velocity			X		

(1) *This channel assignment is supported only by CDM software revision 2.0 and above.*

L_TYPE

The **L_TYPE** parameter defines the relationship of the sensor measurement to the desired output of the AI block. The relationship can be direct, indirect, or indirect square root.

L_TYPE setting	Reason for selecting
Direct	Select direct when the desired output will be the same as the sensor measurement. This is the most common configuration.
Indirect	Select indirect when the desired output is a calculated measurement based on the sensor measurement. The relationship between the sensor measurement and the calculated measurement will be linear.
Indirect square root	Select indirect square root when the desired output is an inferred measurement based on the sensor measurement and the relationship between the sensor measurement and the inferred measurement is square root.

XD_SCALE and OUT_SCALE

The **XD_SCALE** and **OUT_SCALE** each include three parameters **0%**, **100%**, and **UNITS** (engineering units). Set these based on the **L_TYPE** parameter setting.

L_TYPE setting	Scaling effect
Direct	• **(XD_SCALE) 0%** = 0 • **(XD_SCALE) 100%** = desired upper range value • **(XD_SCALE) UNITS** = desired flow units **Note** **XD_SCALE** units are written to transducer block units.
Indirect	When an inferred measurement is made based on the sensor measurement, set the **XD_SCALE** to represent the operating range that the sensor will see in the process. Determine the inferred measurement values that correspond to the **(XD_SCALE) 0%** and **(XD_SCALE) 100%** points and set these for the **OUT_SCALE**.

C.1.5 AI block filtering

The filtering feature changes the response time of the device to smooth variations in output readings caused by rapid changes in input. Adjust the filter time constant (in seconds) using the **PV_FTIME** parameter. Set the filter time constant to zero to disable the filter feature.

C.1.6 AI block signal conversion

Set the signal conversion type with the Linearization Type (**L_TYPE**) parameter. Choose from direct, indirect, or indirect square root signal conversion with the **L_TYPE** parameter.

- *Direct* signal conversion allows the signal to pass through the accessed channel input value (or the simulated value when simulation is enabled).

$$PV = \text{Channel Value}$$

- *Indirect* signal conversion converts the signal linearly to the accessed channel input value (or the simulated value when simulation is enabled) from its specified range (**XD_SCALE**) to the range and units of the **PV** and **OUT** parameters (**OUT_SCALE**).

$$PV = \frac{(\text{Channel Value})}{100} \times (EU@100\% - EU@0\%) + EU@0\%$$

- *Indirect Square Root* signal conversion takes the square root of the value computed with the indirect signal conversion and scales it to the range and units of the **PV** and **OUT** parameters.

$$PV = \sqrt{\frac{(\text{Channel Value})}{100}} \times (EU@100\% - EU@0\%) + EU@0\%$$

C.1.7 AI block alarm detection

A block alarm will be generated whenever the **BLOCK_ERR** has an error bit set. The types of block error for the AI block are defined above. Process alarm detection is based on the **OUT** value.

Configure the alarm limits of the following standard alarms:

- High (**HI_LIM**)
- High high (**HI_HI_LIM**)
- Low (**LO_LIM**)
- Low low (**LO_LO_LIM**)

To avoid alarm chatter when the variable is oscillating around the alarm limit, an alarm hysteresis in percent of the PV span can be set using the **ALARM_HYS** parameter. The priority of each alarm is set in the following parameters:

- **HI_PRI**
- **HI_HI_PRI**
- **LO_PRI**
- **LO_LO_PRI**

Number	Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts).
3–7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8–15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

C.1.8 AI block status handling

Normally, the status of the **PV** reflects the status of the measurement value, the operating condition of the I/O card, and any active alarm condition. In Auto mode, **OUT** reflects the value and status quality of the **PV**. In Man mode, the **OUT** status constant limit is set to indicate that the value is a constant and the **OUT** status is **Good**. If the sensor limit exceeds the high or low range, **PV** status is set high or low and EU range status is set to uncertain.

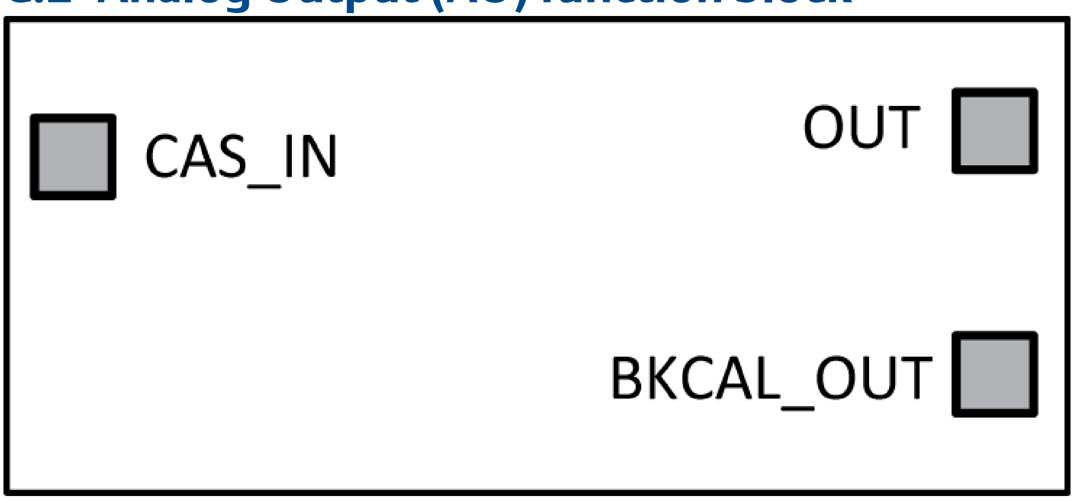
In the **STATUS_OPTS** parameter, select from the following options to control the status handling.

Status handling setting	Effect
Bad if limited	Sets the **OUT** status quality to **Bad** when the value is higher or lower than the sensor limits.
Uncertain if limited	Sets the **OUT** status quality to **Uncertain** when the value is higher or lower than the sensor limits.
Uncertain if in manual mode	Sets the **OUT** status quality to **Uncertain** when the mode is set to Manual.

C.1.9 AI block default configuration

	AI1 (AI_2600_xxxx)	AI2 (AI_2800_xxxx)	AI3 (AI3000_xxxx)	AI4 (AI_3200_xxxx
Channel	**Mass flow (1)**	**Temperature (2)**	**Density (3)**	**Volume flow (4)**
XD_SCALE				
EU_100	100	100	100	100
EU_0	0	0	0	0
Unit_Index	g/s	degC	g/cm³	L/s
Decimal	2	2	2	2
OUT_SCALE				
EU_100	100	100	100	100
EU_0	0	0	0	0
Unit_Index	%	%	%	%
Decimal	0	0	0	0
L_TYPE	Direct	Direct	Direct	Direct

C.2 Analog Output (AO) function block



The AO block converts the FF value to a channel value by using two sets of scaling values. **PV_SCALE** is used to convert the FF value in SP to percent. The **IO_OPT** Increase to Close may be used to reverse the output direction. **XD_SCALE** is used to convert the percent FF value to the value for the channel, which should be given in the device manual. **XD_SCALE** high and low can be reversed to give reverse action, rather than using Increase to Close. There are no nonlinear conversions, at this time. The block output is a copy of the value that is sent to transducer processing via the channel. It may be linked to the input of a controller or control selector to perform valve position control.

C.2.1 AO block configuration parameters

- **CHANNEL**: Defines the output that drives the field device. The block will be forced into OOS mode until a channel number for an analog output is entered. Select the channel that corresponds to the desired sensor measurement.

Table C-2: AO block channel definitions

Channel	Description
28	Pressure
29	Temperature
30	Watercut

- **PV_SCALE**: **PV_SCALE** is used to convert the FF value in SP to percent. The units are usually percent.
- **XD_SCALE**: **XD_SCALE** is used to convert the percent FF value to the value for the channel, which should be given in the device manual. Choose scaling units that are compatible with the transducer block parameter. A configuration alarm is generated if the channel is not an analog output or the scaling limits or units of **XD_SCALE** are not available from the transducer. The block will be forced into OOS mode until the correct entries are made.

C.2.2 AO block modes

The AO function block supports following modes of operation defined by **MODE_BLK** parameter:

- *Out of Service (O/S)*: The AO algorithm of the block is not executed. The last value is issued at **OUT** or the determined value when the Fault State is activated.
- *Manual (MAN)*: The user can directly enter the output value of the AO Block.
- *Automatic (AUTO)*: The set point entered by the user is used over the SP parameter on implementation of the AO Block.
- *Cascade (CAS)*: The AO Function Block receives the set point directly from an upstream function block over the **CAS_IN** parameter to calculate the output value internally. The AO Block is implemented.
- *Remote Cascade (RCAS)*: The AO Function Block receives the set point directly from the host system over the **RCAS_IN** parameter to calculate the output value internally. The AO Block is implemented.

C.2.3 AO block errors

The following conditions are reported in the **BLOCK_ERR** attribute:

- *Block Configuration Error*: The selected channel is incompatible with the engineering units selected in XD_SCALE or the CHANNEL is zero.
- *Link Configuration Error*
- *Simulate Active*: Simulation is enabled and the block is using a simulated value in its execution.

- *Local Override*: The output of the block is not responding to OUT because the resource block has been placed into LO mode or fault state action is active.
- *Device Fault State set*:
- *Output Failure*: May be propagated backward as BAD, Device Failure
- *Readback Check Failed*: May be propagated backward as BAD, Sensor Failure
- *Out-of-Service*: The actual mode is out of service (OOS)

C.2.4 AO block simulation

When simulation is enabled, the last value of **OUT** is maintained and reflected in the field value of the **SIMULATE** attribute. In this case, the **PV** and **READBACK** values and statuses are based on the **SIMULATE** value and the status that you enter.

Note
The transmitter has a simulation Switch on the display. As a safety measure, the switch has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

C.2.5 AO block status handling

Output or readback fault detection are reflected in the status of **PV**, **OUT**, and **BKCAL_OUT**.

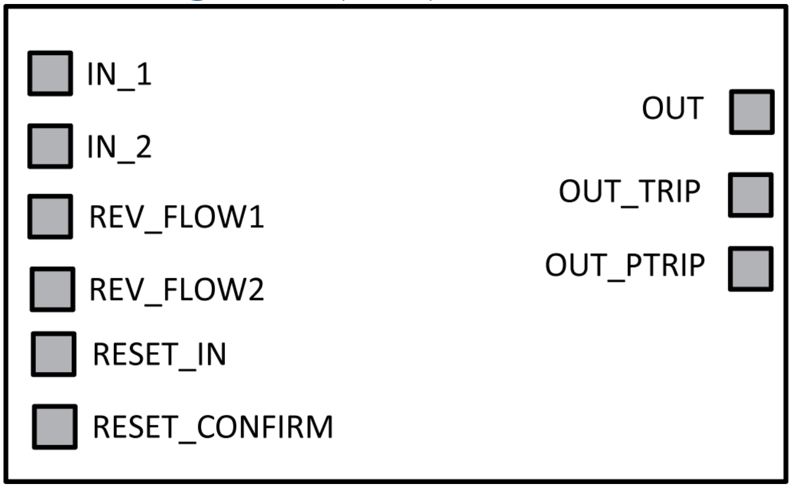
A limited SP condition is reflected in the **BKCAL_OUT** status. When simulation is enabled through the **SIMULATE** attribute, you can set the value and status for **PV** and **READBACK**.

When the block is in Cas mode and the **CAS_IN** input goes bad, the block sheds mode to the next permitted mode.

C.2.6 AO block default configuration

	AO1 (AO_3400_xxxx)	AO2 (AI_3600_xxxx)
Channel	**Pressure (28)**	**Temperature (29)**
XD_SCALE		
EU_100	100	100
EU_0	0	0
Unit_Index	Psi	degC
Decimal	2	2
OUT_SCALE		
EU_100	100	100
EU_0	0	0
Unit_Index	%	%
Decimal	0	0
L_TYPE	Direct	Direct

C.3 Integrator (INT) Function Block



The Integrator (INT) function block integrates one or two variables over time. The block compares the integrated or accumulated value to pre-trip and trip limits and generates discrete output signals when the limits are reached.

The INT integrates one process value. Each input may be an analog value or a pulse count from a Pulse Input block. Two inputs are provided so that a net total can be calculated.

The two inputs are added to produce a result that is used by the integrator. Options may be applied to limit the result to positive or negative flow. The status of the result is the worse of the two inputs.

The integrator calculates three totals that are not visible from Fieldbus. Total is the true integration of the signed value from the adder, regardless of status. Total is visible as the value of OUT. Atotal is the integration of the absolute value from the adder, regardless of status. Rtotal is the integration of the absolute value from the adder with bad status. The ratio of Rtotal to Atotal gives the approximate percent of Total that has good status. This determines the status of OUT.

The integrator may be used in seven ways. It may count until is is reset (standard totalizer) or count until periodically reset, or both. One of the other four ways is selected if the INT block is used as a batch ingredient loader. The amount to be loaded is set in TOTAL_SP. The integrator may count up to TOTAL_SP or count down to zero from TOTAL_SP. OUT_PTRIP turns on as the total approaches the set amount, possibly to reduce flow for fine control of the total. OUT_TRIP turns on when the total equals TOTAL_SP, which may automatically reset the integrator or not. Count up or count down and automatic reset or not are the four ways to use the INT block as a batch ingredient loader.

The totals may be reset by an operator or a discrete input, if permitted. Reset causes data to be stored in 'snapshot' registers, where it can be read until the next reset command. There is an option to disable the reset commands immediately after a successful reset, until the RESET_CONFIRM input is true. This option makes sure that the values at the time of the last reset are not changed by another reset until after the user has read them.

The block has no process alarms, but can generate a reset event.

This block is intended to have measurements that come from a process calculation path. It will work with input from a control path. The block output starts a process calculation path.

The block is unusual because the status of the output has to be calculated. The output status is not directly related to the status of the inputs. The output can be the input to another INT block.

C.3.1 INT block configuration parameters

- **INTEG_TYPE**: The integration type parameter (**INTEG_TYPE**) defines the integrate up, integrate down, and reset characteristics of the block.

INTEG_TYPE setting	Description
UP_AUTO	Integrates from zero to the setpoint and automatically resets when the SP is reached.
UP_DEM	Integrates from zero to the setpoint and resets when **RESET_IN** or the operator command to reset the integrator (**OP_CMT_INT**) transitions to True (1).
DN_AUTO	Integrates from the setpoint to zero and automatically resets when zero is reached.
DN_DEM	Integrates from the setpoint to zero and resets when **RESET_IN** or **OP_CMD_INT** transitions to True.
PERIODIC	Counts upward and resets periodically. The period is set by the **CLOCK_PER** attribute.
DEMAND	Counts upward and is reset when **RESET_IN** or **OP_CMD_INT** transitions to True.
PER&DEM	Counts upward and is reset periodically or by **RESET_IN**.

- **INTEG_OPTS**: The integration options parameter (**INTEG_OPTS**) defines the following options.

INTEG_OPTS setting	Description
Input 1 accumulate	The input value must be pulse count rather than rate. The accumulated pulse count must be for the same block execution time as the Pulse Input block.
Input 2 accumulate	The input value must be pulse count rather than rate. The accumulated pulse count must be for the same block execution time as the Pulse Input block.
Flow forward	The result of adder is limited to zero, when it would be negative.
Flow reverse	The result of adder is limited to zero, when it would be positive.
Use Uncertain	Integrate input even though the status of input is Uncertain.
Use Bad	Integrate input even though the status of input is Bad.
Carry	Carry the excess past the trip point into the next integration cycle as the initial value of the integration.
Add zero if bad	This option ignores Bad value at input. The input with Bad status is not integrated.
Confirm reset	If the Confirm reset is set, the block shall not process subsequent reset at **RESET_IN** until **RESET_CONFIRM** discrete input is **TRUE**.
Input 1 pass through	This is special option only used for Emerson Integrator block to pass internal totals to Integrator block.

- **TIME_UNITn**: The integrator requires units per second, so **TIME_UNITn** is used to convert rate units of minutes, hours and days back to seconds. Minutes divides the input by 60, Hour by 3600, and Day by 86400 so that the result is engineering units per second.
- **TPTAL_SP**: The integrator may count up to **TOTAL_SP** or count down to zero from **TOTAL_SP**, depending upon the **INTEG_TYPE** selection. Same units as **OUT**.
- **UNIT_CONV**: Factor to convert the engineering units of input 2 into the engineering units of input 1. It can be any positive decimal number or fraction. It defaults to 1.
- **PULSE_VALn**: Factor to convert Inn pulses to engineering units to get a total in engineering units.

- **PRE_TRIP**: Adjusts the amount of IN that will set **OUT_PTRIP** when the integration reaches (**TOTAL_SP-PRE_TRIP**) when counting up or **PRE_TRIP** when counting down. Same units as **OUT**. It defaults to 0.

C.3.2 INT block other parameters

- **IN_1**: The main input to this block, normally a rate in units per **TIME_UNIT** of time. **INTEG_OPTS** allows the input to come from a pulse input block or another INT block, using **PULSE_VAL** for scaling.
- **IN_2**: The second input, with the same characteristics as **IN_1**. This input allows for totalizing the difference between (net) of two flows.
- **RESET_IN**: Momentary discrete input that resets the totalizers, if permitted. May not work if the type is **PERIODIC**.
- **RESET_CONFIRM**: Momentary discrete input that enables the next Reset command, if the Confirm option is set.
- **OUT**: The output that contains the value of the total register and a calculated status.
- **OUT_PTRIP**: The pre-trip discrete output.
- **OUT_TRIP**: The trip discrete output.
- **PCT_INCL**: Indicates the percentage of inputs with Good status compared to a total for all inputs.
- **RTOTAL**: Indicates the total of the absolute value of input values with Bad or Uncertain status, as chosen by **INTEG_OPTS**. Same units as **OUT**.
- **STOTAL**: The read-only snapshot of **TOTAL** just before a reset. Same units as **OUT**.
- **SRTOTAL**: The read-only snapshot of **RTOTAL** just before a reset. Same units as **OUT**.
- **N_RESET**: Counts the number of resets. It can not be written or reset.

C.3.3 INT block modes

The Integrator function block supports the following modes:

- *Manual (Man)* – The integration calculations are not performed. **OUT**, **OUT_TRIP**, and **OUT_PTRIP** may be set manually.
- *Automatic (Auto)* – The integration algorithm is performed and the result is written to OUT. Reset actions depend on the integration type attribute (**INTEG_TYPE**) and the inputs.
- *Out of Service (O/S)* – The block does not execute. **OUT** status is set to Bad: Out of Service. The **BLOCK_ERR** attribute shows Out of service.

The integrator initializes with the value in **OUT** when the mode changes from Manual to Automatic. The Manual, Automatic, and Out of Service modes may be configured as permitted modes for operator entry.

C.3.4 INT block errors

The following conditions are reported in the BLOCK_ERR parameter:

- Block Configuration Error: INTEG_TYPE is still zero, TIME_UNITn is still zero.
- Out-of-Service: The actual mode is out of service (OOS).

C.3.5 INT block status handling

The output status calculation is based on the accumulation of input statuses. The calculation includes the accumulations for both input channels when IN_2 is enabled.

Each time the function block executes, the input status is accumulated as Good or Bad as per the input status. The input as uncertain is considered as Bad input.

The output status is determined with the following logic:

- When less than 25% of the input status accumulation is Good, **OUT** status is set to Bad.
- When 25% to less than 50% of the input status accumulation is Good, **OUT** status is set to Uncertain.
- When 50% or more of the input status accumulation is Good, **OUT** status is set to Good.

The input status accumulation is reset when the integrator is reset.

C.3.6 INT block special mode

Enhanced FF host	**Overview → Totalizer Control → Configure Integrator Block**
Fieldbus Host	**Measurement TB → INTEGRATOR_FB_CONFIG (OD Index 50)**

Along with standard operation of integrating the process value at **INn**, the Integrator function block has one special mode of operation: Input 1 pass through. In this special mode of operation, the device internal totals/ inventories are controlled through the Integrator block. The Integrator block passes through the device total/ inventory to output and the device total/inventory is reset by the **RESET_IN** input. To control the integrator block mode there is one additional parameter in the Total-Inventory TB for each INT block. By default the integrator function block operates in standard mode.

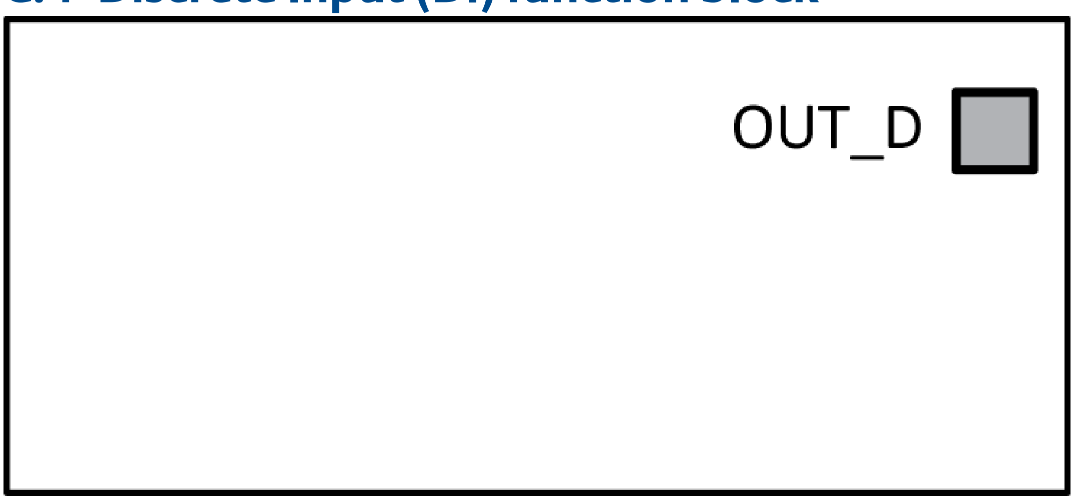
Fieldbus code	Label	Description
0	Standard	Block is working as per configuration of function block parameters.
1	Internal Mass Total	Block outputs internal mass total value and RESET_IN resets internal mass total
2	Internal Volume Total	Block outputs internal volume total value and RESET_IN resets internal volume total
3	Internal Mass Inventory	Block outputs internal mass inventory value and RESET_IN resets internal mass inventory
4	Internal Volume Inventory	Block outputs internal volume inventory value and RESET_IN resets internal volume inventory
5	Internal Gas Standard Volume Total	Block outputs internal gas standard volume total value and RESET_IN resets internal gas standard volume total
6	Internal Gas Standard Volume Inventory	Block outputs internal gas standard volume inventory value and RESET_IN resets gas standard volume inventory and internal API: temp corrected volume inventory
7	Internal API: Temp Corrected Volume Total	Block outputs internal API: temp corrected volume total value and RESET_IN resets internal API: temp corrected volume total

Fieldbus code	Label	Description
8	Internal API: Temp Corrected Volume Inventory	Block outputs internal API: temp corrected volume inventory value and RESET_IN resets gas standard volume inventory and internal API: temp corrected volume inventory
9	Internal ED: Standard Volume Total	Block outputs internal ED: standard volume total value and RESET_IN resets internal ED: standard volume total
10	Internal ED: Standard Volume Inventory	Block outputs internal ED: standard volume inventory value and RESET_IN resets internal ED: standard volume inventory
11	Internal ED: Net Mass Total	Block outputs internal ED: net mass total value and RESET_IN resets internal ED: net mass total
12	Internal ED: Net Mass Inventory	Block outputs internal ED: net mass inventory value and RESET_IN resets internal ED: net mass inventory
13	Internal ED: Net Volume Total	Block outputs internal ED: net volume total value and RESET_IN resets internal ED: net volume total
14	Internal ED: Net Volume Inventory	Block outputs internal ED: net volume inventory value and RESET_IN resets internal ED: net volume inventory

C.3.7 INT block default configuration

	ITB1 (INTEG_4000_6830)	ITB2 (INTEG_4200_6830)
INTEG_TYPE	Uninitialized	Uninitialized
OUT_RANGE		
EU_100	100	100
EU_0	0	0
Unit_Index	%	%

C.4 Discrete Input (DI) function block



The Discrete Input (DI) function block processes a single discrete input from a field device and makes it available to other function blocks. You can configure inversion and alarm detection on the input value. The Discrete Input function block supports mode control, signal status propagation, and simulation.

C.4.1 DI block common configuration parameters

- **CHANNEL**: Defines the I/O input used for the field measurement.

Channel	Description
31	Actual flow direction
32	Zero in progress
33	Analog output fault
34	Meter verification failed

- **IO_OPTS**: allows the option to have the value of **FIELD_VAL_D** be logically inverted before becoming the **PV_D**, if the Invert option is selected.
- **STATUS_OPTS**: allows the option to have the status of **OUT_D** be Uncertain if Man mode. It also allows the option to Propagate Fault Forward.

C.4.2 DI block modes

The DI function block supports following modes:

- *Manual (MAN)*: The output (**OUT_D**) is disconnected from the field.
- *Automatic (AUTO)*: The block algorithm determines **OUT_D**.
- *Out of Service (O/S)*: The block is not processed. The output status is set to Bad: Out of Service. The **BLOCK_ERR** attribute shows Out of Service.

C.4.3 DI block errors

The following conditions are reported in the **BLOCK_ERR** attribute:

- *Simulate Active*: Simulation is enabled and the block is using a simulated value in its execution.
- *Input failure/process variable has Bad status*: The hardware is bad, the configured channel is invalid, or a Bad status is being simulated.
- *Out-of-Service*: The actual mode is out of service (OOS)

C.4.4 DI block simulation

When simulation is enabled, the value of **SIMULATE** is reflected in the field value of the **OUT_D**. With simulation enabled, the actual measurement value has no impact on the **OUT_D** value or the status.

Note
The transmitter has a simulation switch on the display. As a safety measure, the switch has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

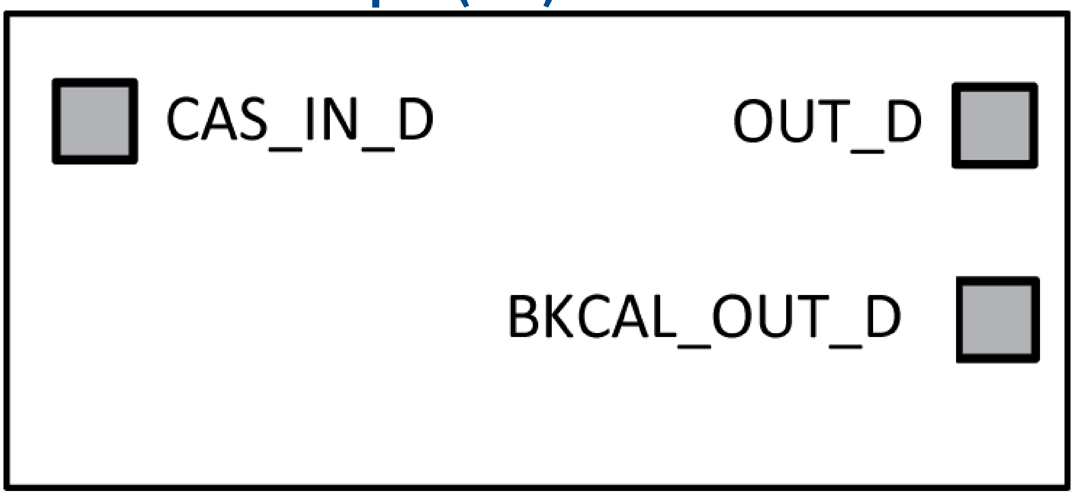
C.4.5 DI block status handling

Under normal conditions, a Good: Non-cascade status is passed through to **OUT_D**. The block also supports Status Action on Failure and Block Error indications.

C.4.6 DI block default configuration

	DI1 (DI_4400_xxxx)
CHANNEL	Analog Output Fault (33)
IO_OPTS	0x0000
STATUS_OPTS	0x0000

C.5 Discrete Output (DO) function block



The Discrete Output (DO) function block processes a discrete setpoint and saves it to a specified channel to produce an output signal. The block supports mode control, output tracking, and simulation. There is no process alarm detection in the block. In operation, the DO function block determines its setpoint, sets the output, and, as an option, checks a feedback signal from the field device to confirm the physical output operation.

C.5.1 DO block configuration

- **CHANNEL**: Selects transducer block input or output.

Channel	**Description**
35	Start Sensor Zero
36	Increment CM Curve
37	Smart Meter Verification in Continuous Measurement Mode
38	Reset All Process Totals
39	Start/Stop All Totals
40	Reset Config Total 1

Channel	Description
41	Reset Config Total 2
42	Reset Config Total 3
43	Reset Config Total 4
44	Reset Config Total 5
45	Reset Config Total 6
46	Reset Config Total 7

- **IO_OPTS**: Options which the user may select to alter input and output block processing.
  - Invert **-** Causes the SP_D value to be inverted before it becomes the output. May be used for normally open solenoid valves and other inverted actuators.
  - SP-PV Track in Man **-** The value of SP is set to the value of PV when the target mode is Man.
  - SP-PV Track in LO or IMan **-** The value of SP is set to the value of PV when the actual mode is LO or IMan.
  - SP Track Retained Target **-** The SP is set to the PV when the actual mode is LO, IMan or Man. This option causes the value of the input selected by the retained target mode to be used instead of PV.
  - Use PV for BKCAL_OUT **-** This only useful if **BKCAL_OUT_D** is connected to something.
  - Fault State to value **-** Set **SP_D** and **OUT_D** to **FSTATE_VAL_D** when the block is in the fault state. If this option is not selected then the output will freeze. The block mode will be LO either way.
  - Use Fault State value on restart **-** Use the value of **FSTATE_VAL_D** for **OUT_D** and **SP_D** if the device is restarted, otherwise use the non-volatile value. This will only be useful if the cascade input is bad at startup.
  - Target to Man if Fault State activated **-** Set the target mode to Man if Fault State is activated. This latches an output block into the Man mode until an operator writes another target mode. Otherwise, the mode is LO while fault state is active, and returns to the target mode when the block state returns to normal.
- **SIMULATE_D**: Enables simulation.
- **FSTATE_TIME**: Time delay before Fault State is declared for this block if there is loss of communications to CAS_IN or there is Good Control, Initiate Fault State status at **CAS_IN** when the target mode is Cas, or there is Good Control, Initiate Fault State status at **RCAS_IN** when the target mode is RCas. Fault State declared by the Resource Block is not delayed.
- **CAS_IN_D**: Connection to this block's discrete SP from another discrete block's output, active only in Cascade mode. Always used for DO blocks.

C.5.2 DO block modes

The DO block supports the following modes:

- *Manual (MAN)*: The block output (**OUT_D**) may be entered manually.
- *Automatic (AUTO)*: The block algorithm uses the local setpoint value (**SP_D**) to determine **OUT_D**.
- *Cascade (CAS)*: The block uses a setpoint supplied by another function block.
- *RemoteCascade (RCAS)*: The block uses a setpoint supplied by a host computer.

- *Out of Service (O/S)*: The block is not processed and the output is not transferred to I/O. The **BLOCK_ERR** attribute shows Out of service.

C.5.3 DO block errors

The following conditions are reported in the **BLOCK_ERR** attribute:

- *Simulate Active*: **SIMULATE_D** is enabled; therefore, **PV_D** is not real.
- *Input failure/process variable has Bad status*: The readback value is bad.
- *Output Failure*: The output hardware or the configured channel is invalid.
- *Readback Failed*: The hardware providing readback is bad.
- *Out-of-Service*: The block is not being processed.

C.5.4 DO block simulation

With **SIMULATE_D** enabled, the specified value and status is reflected in **READBACK_D**. If **SIMULATE_D** is not enabled, and the mode is not Out of Service, the value of **OUT_D** is sent to the hardware

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Note
The transmitter has a simulation Switch on the display. As a safety measure, the switch has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

C.5.5 DO block status handling

Under normal operating conditions, the output statuses (**OUT_D** and **BKCAL_OUT_D**) are Good: Cascade. If the output hardware fails, the status of **BKCAL_OUT_D** is set to Bad: DeviceFail, and the **BLOCK_ERR** attribute shows Output Failure. If the hardware used for output feedback fails, the status of **READBACK_D** and **PV_D** is set to Bad: DeviceFail, and the **BLOCK_ERR** attribute shows Bad PV and Readback Failed.

C.5.6 DO block default configuration

	DO1 (DO_4600_xxxx)
CHANNEL	Start Sensor Zero (35)
IO_OPTS	0x0000

D Using the transmitter display

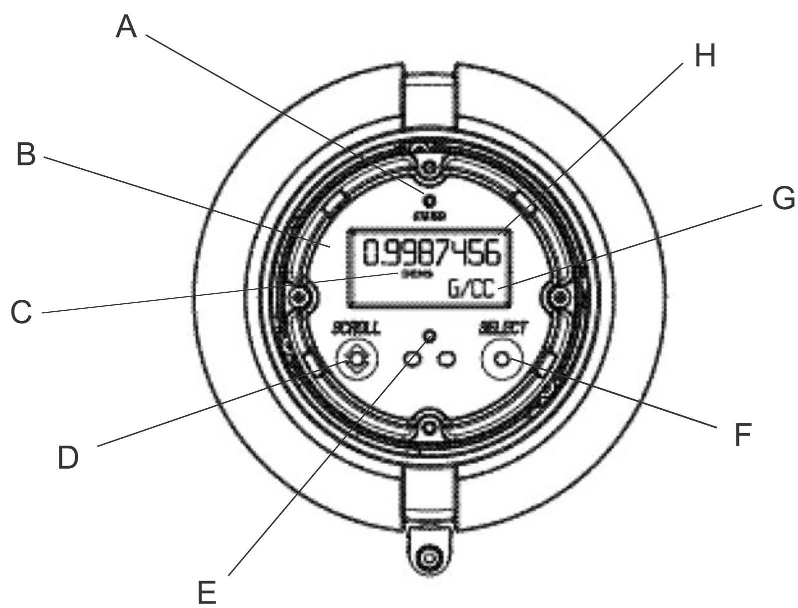
This section explains how to use the 2700 display. Using the display, you can move through the menus, configure the application, monitor and control the application, and perform maintenance and diagnostic tasks.

D.1 Using the display

D.1.1 Components of the transmitter interface

The transmitter interface includes the status LED, the display (LCD panel), and two optical switches.

Figure D-1: Transmitter interface



A. *Status LED*
B. *Display (LCD panel)*
C. *Process variable*
D. ***Scroll** optical switch*
E. *Optical switch indicator*
F. ***Select** optical switch*
G. *Unit of measure for process variable*
H. *Current value of process variable*

Note
Display refers to the display on the remotely mounted transmitter, not directly mounted to the meter. If there is a display directly on the meter, it can only view process variables, and it cannot be used for any other operation.

D.1.2 Use the optical switches

Use the optical switches on the transmitter interface to control the transmitter display. The transmitter has two optical switches: **Scroll** and **Select**.

Note
Display refers to the display on the remotely mounted transmitter, not directly mounted to the meter. If there is a display directly on the meter, it can only view process variables, and it cannot be used for any other operation.

Procedure

To activate an optical switch, block the light by holding your thumb or finger in front of the opening.

Tip
You can activate the optical switch through the lens. Do not remove the transmitter housing cover.

The optical switch indicator lights up when the transmitter senses that an optical switch has been activated.

Table D-1: Optical switch indicator and optical switch states

Optical switch indicator	State of optical switches
Solid red	One optical switch is activated.
Flickering red	Both optical switches are activated.

D.1.3 Access and use the display menu system

The display menu system is used to perform various configuration, administrative, and maintenance tasks.

Prerequisites

To access the display menu system, operator access to either the ***Off-Line*** menu or the ***Alert*** menu must be enabled. To access the complete menu system, operator access must be enabled for both the ***Off-Line*** menu and the ***Alert*** menu.

Tip
The display menu system does not provide complete configuration, administrative, or maintenance functions. For complete transmitter management, you must use another communications tool.

Note
Display refers to the display on the remotely mounted transmitter, not directly mounted to the meter. If there is a display directly on the meter, it can only view process variables, and it cannot be used for any other operation.

Procedure

1. At the transmitter display, activate the**Scroll** and **Select** optical switches simultaneously until the display changes.
   You will enter the ***Off-Line*** menu at any of several locations, depending on several factors.
   - If an alert is active and access to the ***Alert*** menu is enabled, you will see **SEE ALERT**.
   - If no alert is active and Smart Meter Verification is enabled on the transmitter, you will see **ENTER METER VERFY**.

- If no alert is active and Smart Meter Verification is not enabled on the transmitter, you will see **OFF-LINE MAINT**.

2. If **CODE?** appears on the display when you make a choice, enter the value that is configured for **Off-Line Password**.
    a) With the cursor flashing on the first digit, activate **Scroll** until the correct digit is displayed, then activate **Select**.
    b) Repeat this process for the second, third, and fourth digits.

Tip
If you do not know the correct value for **Off-Line Password**, wait 30 seconds. The password screen will time out automatically and you will be returned to the previous screen.

---

3. Use the **Scroll** and **Select** optical switches to navigate to your destination in the display menu system.
    - Use **Scroll** to move through a list of options.
    - Use **Select** to choose the current option.
4. If **Scroll** flashes on the display, activate the **Scroll** optical switch, then the **Select** optical switch, and then the **Scroll** optical switch again.

    The display will prompt you through this sequence. The **Scroll-Select-Scroll** sequence is designed to guard against accidental activation of the off-line menu. It is not designed as a security measure.
5. To exit a display menu and return to a higher-level menu:
    - Activate **Scroll** until the **EXIT** option is displayed, then activate **Select**.
    - If the **EXIT** option is not available, activate **Scroll** and **Select** simultaneously and hold until the screen returns to the previous display.
6. To exit the display menu system, you can use either of the following methods:
    - Exit each menu separately, working your way back to the top of the menu system.
    - Wait two minutes until the display times out and returns to displaying process variable data.

Enter a floating-point value using the display

Certain configuration values (for example, **Lower Range Value** and **Upper Range Value**) are entered as floating-point values. The display supports both decimal notation and exponential notation for floating-point values.

The display allows you to enter a maximum of 8 characters, including the sign. The decimal point is not counted as a character. Exponential notation is used to enter values that require more than 8 characters.

Enter a floating-point value using decimal notation

Decimal notation allows you to enter values between –9999999 and 99999999. You can use the decimal point to enter values with a precision of 0 through 4 (4 characters to the right of the decimal point).

Decimal values entered via the display must meet the following requirements:

- They can contain a maximum of 8 digits, or 7 digits plus a minus sign (−) to indicate a negative number.
- They can contain a decimal point. The decimal point does not count as a digit. The decimal point must be positioned so that the precision of the value does not exceed 4.

When you first enter the configuration screen, the current configuration value is displayed in decimal notation, and the active character is flashing. If the value is positive, no sign is displayed. If the value is negative, a minus sign is displayed.

Note
Display refers to the display on the remotely mounted transmitter, not directly mounted to the meter. If there is a display directly on the meter, it can only view process variables, and it cannot be used for any other operation.

Procedure

- To change the value:
    a) Activate **Select** until the digit you want to change is active (flashing).

       Select moves the cursor one position to the left. From the leftmost position, **Select** moves the cursor to the rightmost digit.
    b) Activate **Scroll** to change the value of the active digit.
    c) Repeat until all digits are set as desired.
- To change the sign of the value:
    - If the current value is negative, activate **Select** until the minus sign is flashing, then activate **Scroll** until the space is blank.
    - If the current value is positive and there is a blank space at the left of the value, activate **Select** until the cursor is flashing under the blank space, then activate **Scroll** until the minus sign appears.
    - If the current value is positive and there is no blank space at the left of the value, activate **Select** until the cursor is flashing under the leftmost digit, then activate **Scroll** until the minus sign appears.
- To move the decimal point:
    a) Activate **Select** until the decimal point is flashing.
    b) Activate **Scroll**.
       The decimal point is removed from its current position.
    c) Activate **Select** and watch the position of the decimal point.

       As the cursor moves to the left, the decimal point will flash between each pair of digits, up to a maximum precision of four (four digits to the right of the decimal point).

       Tip
       If the position is not valid, the decimal point is not displayed. Continue to activate **Select** until the decimal point appears at the right of the displayed value.
    d) When the decimal point is in the desired position, activate **Scroll**.
       The decimal point is inserted at its current position.
- To save the displayed value to transmitter memory, activate **Scroll** and **Select** simultaneously and hold until the display changes.
    - If the displayed value is the same as the value in transmitter memory, you will be returned to the previous screen.
    - If the displayed value is not the same as the value in transmitter memory, **SAVE/YES?** flashes on the display. Activate **Select**.

- To exit the menu without saving the displayed value to transmitter memory, activate **Scroll** and **Select** simultaneously and hold until the display changes.
  - If the displayed value is the same as the value in transmitter memory, you will be returned to the previous screen.
  - If the displayed value is not the same as the value in transmitter memory, **SAVE/YES?** flashes on the display. Activate **Scroll**.

Enter a floating-point value using exponential notation

Exponential notation is used to enter values that are larger than 99999999 or smaller than −9999999.

Exponential values entered via the display must be in the following form: `SX.XXXEYY`. In this string:

- S = Sign. A minus sign (−) indicates a negative number. A blank indicates a positive number.
- X.XXX = The 4-digit mantissa.
- E = The exponent indicator.
- YY = The 2-digit exponent.

Procedure

1. Switch from decimal notation to exponential notation.
   a) Activate **Select** as required until the rightmost digit is flashing.
   b) Activate **Scroll** until `E` is displayed.
   c) Activate **Select**.

   Tip
   If you have modified the value in decimal notation without saving the changes to transmitter memory, the changes will be lost when you switch to exponential notation. Save the decimal value before switching to exponential notation.

2. Enter the exponent.
   The first character may be a minus sign or any digit between 0 and 3. The second character may be any digit between 0 and 9.
   a) Activate **Select** to move the cursor to the rightmost character on the display.
   b) Activate **Scroll** until the desired character is displayed.
   c) Activate **Select** to move the cursor one position to the left.
   d) Activate **Scroll** until the desired character is displayed.

3. Enter the mantissa.
   The mantissa must be a 4-digit value with a precision of 3 (that is, all values between 0.000 and 9.999).
   a) Activate **Select** to move the cursor to the rightmost digit in the mantissa.
   b) Activate **Scroll** until the desired character is displayed.
   c) Activate **Select** to move the cursor one digit to the left.
   d) Activate **Scroll** until the desired character is displayed.
   e) Activate **Select** to move the cursor one digit to the left.

f) Activate **Scroll** until the desired character is displayed.

g) Activate **Select** to move the cursor one digit to the left.

h) Activate **Scroll** until the desired character is displayed.

4. Enter the sign.
   a) Activate **Select** to move the cursor one digit to the left.
   b) Activate **Scroll** until the desired character is displayed.
      For positive numbers, select a blank space.
5. To save the displayed value to transmitter memory, activate **Scroll** and **Select** simultaneously and hold until the display changes.
   - If the displayed value is the same as the value in transmitter memory, you will be returned to the previous screen.
   - If the displayed value is not the same as the value in transmitter memory, **SAVE/YES?** flashes on the display. Activate **Select**.
6. Switch back from exponential notation to decimal notation.
   a) Activate **Select** until the `E` is flashing.
   b) Activate **Select** until `d` is displayed.
   c) Activate **Select**.

D.1.4 Display codes for process variables

Table D-2: Display codes for process variables

Code	Definition	Comment or reference
AVE_D	Average density	Petroleum measurement application only
AVE_T	Average temperature	Petroleum measurement application only
BRD_T	Board temperature	
CONC	Concentration	Concentration measurement application only
DRIVE%	Drive gain	
EXT_P	External pressure	
EXT_T	External temperature	
GSV F	Gas standard volume flow	
GSV I	Gas standard volume inventory	
GSV T	Gas standard volume total	
LPO_A	Left pickoff amplitude	
LVOLI	Volume inventory	
LZERO	Live zero flow	
MASSI	Mass inventory	

Table D-2: Display codes for process variables *(continued)*

Code	Definition	Comment or reference
MTR_T	Case temperature (T-Series sensors only)	
NET M	Net mass flow rate	Concentration measurement application only
NET V	Net volume flow rate	Concentration measurement application only
NETMI	Net mass inventory	Concentration measurement application only
NETVI	Net volume inventory	Concentration measurement application only
PWRIN	Input voltage	Refers to power input to the core processor
RDENS	Density at reference temperature	Concentration measurement application only
RPO_A	Right pickoff amplitude	
SGU	Specific gravity units	
STD V	Standard volume flow rate	Concentration measurement application only
STDVI	Standard volume inventory	Concentration measurement application only
TCDENS	Temperature-corrected density	Petroleum measurement application only
TCORI	Temperature-corrected inventory	Petroleum measurement application only
TCORR	Temperature-corrected total	Petroleum measurement application only
TCVOL	Temperature-corrected volume	Petroleum measurement application only
TUBEF	Raw tube frequency	
WTAVE	Weighted average	

D.1.5 Codes and abbreviations used in display menus

Table D-3: Codes and abbreviations used in display menus

Code or abbreviation	Definition	Comment or reference
ACK ALERT	Acknowledge alert	
ACK ALL	Acknowledge all alerts	
ACT	Action	
ADDR	Address	
AO1	Analog output 1 (primary mA Output)	
AO 1 SRC	Fixed to the process variable assigned to the primary output	
AO2	Analog output 2 (secondary mA Output)	
AUTO SCRLL	Auto Scroll	
BKLT B LIGHT	Backlight	

Table D-3: Codes and abbreviations used in display menus *(continued)*

Code or abbreviation	Definition	Comment or reference
CAL	Calibrate	
CH A	Channel A	
CHANGE PASSW CHANGE CODE	Change password or passcode	Change the password or passcode required for access to display functions
CH B	Channel B	
CH C	Channel C	
CONFG	Configuration	
CORE	Core processor	
CUR Z	Current zero	
DENS	Density	
D EV	Discrete event	Events configured using the enhanced event model
DGAIN, DRIVE %	Drive gain	
DISBL	Disable	**Select** to disable
DO1	Discrete Output 1	
DO2	Discrete Output 2	
DSPLY	Display	
E1OR2	Event 1 or Event 2	Events configured using the basic event model
ENABL	Enable	**Select** to enable
ENABLE ACK	Enable acknowledge all	Enable or disable the ACK ALL function
ENABLE ALERTS	Enable alert menu	Access to alert menu from display
ENABLE AUTO	Enable Auto Scroll	Enable or disable the Auto Scroll function
ENABLE OFFLN	Enable off-line	Access to off-line menu from display
ENABLE PASSW	Enable password	Enable or disable password protection for display functions
ENABLE RESET	Enable totalizer reset	Enable or disable totalizer reset from display
ENABLE START	Enable totalizer start	Enable or disable totalizer start/stop from display
EVNT1	Event 1	Event configured using the basic event model only
EVNT2	Event 2	Event configured using the basic event model only
EXTRN	External	
FAC Z	Factory zero	
FCF	Flow calibration factor	

Table D-3: Codes and abbreviations used in display menus *(continued)*

Code or abbreviation	Definition	Comment or reference
FLDIR	Flow direction	
FL SW FLSWT	Flow switch	
FO	Frequency Output	
FO FREQ	Frequency factor	
FO RATE	Rate factor	
FREQ	Frequency	
FR FL	Frequency=Flow	
GSV	Gas standard volume	
HYSTRSIS	Hysteresis	
INTERN	Internal	
IO	Input/output	
LANG	Language	
LOCK	Write-protect	
LOOP CUR	Loop current	
M_ASC	Modbus® ASCII	
M_RTU	Modbus® RTU	
MAO1	mA Output 1 (primary mA Output)	
MAO2	mA Output 2 (secondary mA Output)	
MASS	Mass flow	
MBUS	Modbus	
MFLOW	Mass flow	
MSMT	Measurement	
MTR F	Meter factor	
OFF-LINE MAINT	Off-line maintenance	
OFFLN	Off-line	
P/UNT	Pulses/unit	
POLAR	Polarity	
PRESS	Pressure	
QUAD	Quadrature	
r.	Revision	
SCALE	Scaling method	

Table D-3: Codes and abbreviations used in display menus *(continued)*

Code or abbreviation	Definition	Comment or reference
SIM	Simulation	Used for loop testing, not simulation mode. Simulation mode is not accessible through the display.
SPECL	Special	
SRC	Source	Variable assignment
TEMP, TEMPR	Temperature	
UNT/P	Units/pulse	
VAR 1	Display Variable 1	
VER	Version	
VERFY	Verify	
VFLOW	Volume flow	
VOL	Volume, volume flow	
XMTR	Transmitter	

E Using ProLink III with the transmitter

E.1 Basic information about ProLink III

ProLink III is a configuration and service tool available from Micro Motion. ProLink III runs on a Windows platform and provides complete access to transmitter functions and data.

Version requirements

Use the latest version of ProLink III and the device firmware to support all features. For details about ProLink III device support, refer to the `ProLink III ChangeLog.txt` file.

ProLink III requirements

To install ProLink III, you must have:

- The ProLink III installation media
- The ProLink III installation kit for your connection type:

To obtain ProLink III and the appropriate installation kit, contact customer support.

ProLink III documentation

Most of the instructions in this manual assume that you are already familiar with ProLink III or that you have a general familiarity with Windows programs. If you need more information than this manual provides, see the *Micro Motion ProLink III with ProcessViz Software User Manual*.

In most ProLink III installations, the manual is installed with the ProLink III program. Additionally, the ProLink III manual is available on the documentation CD or at Emerson.com.

ProLink III features and functions

ProLink III offers complete transmitter configuration and operation functions. ProLink III also offers a number of additional features and functions, including:

- A Professional version with expanded features not available on the Basic version
- The ability to save the transmitter configuration set to a file on the PC, and reload it or propagate it to other transmitters
- The ability to log specific types of data to a file on the PC
- The ability to view performance trends for various types of data on the PC
- The ability to connect to and view information for more than one device
- A guided connection wizard

These features are documented in the *Micro Motion ProLink III with ProcessViz Software User Manual*. ProLink III features are not documented in this manual.

ProLink III messages

As you use ProLink III with a Micro Motion transmitter, you will see a number of messages and notes. This manual does not document all of these messages and notes.

Important
The user is responsible for responding to messages and notes and complying with all safety messages.

F Using a field communicator with the transmitter

F.1 Basic information about field communicators

A field communicator is a handheld configuration and management tool that can be used with a variety of devices, including Micro Motion transmitters. It provides complete access to transmitter functions and data.

Field communicator documentation

Most of the instructions in this manual assume that you are already familiar with field communicators and can perform the following tasks:

- Turn on the field communicator
- Navigate the field communicator menus
- Establish communication with HART®-compatible devices
- Send configuration data to the device
- Use the alpha keys to enter information

Field communicator menus and messages

Many of the menus in this manual start with the *On-Line* menu. Ensure that you are able to navigate to the *On-Line* menu.

As you use a field communicator with a Micro Motion transmitter, you will see a number of messages and notes. This manual does not document all of these messages and notes.

Important
The user is responsible for responding to messages and notes and complying with all safety messages.

F.2 Connect with the FF host

A connection from the FOUNDATION Fieldbus host to your transmitter allows you to read process data, configure the transmitter, and perform maintenance and troubleshooting tasks.

G Default values and ranges

G.1 Default values and ranges

The default values and ranges represent the typical factory transmitter configuration. Depending on how the transmitter was ordered, certain values may have been configured at the factory and are not represented in the default values and ranges.

Table G-1: Transmitter default values and ranges

Type	Parameter	Default	Range	Comments
Flow	Flow direction	Forward		
	Flow damping	0.8 sec(1)	0.0 – 51.2 sec	User-entered value is corrected to the nearest valid value in list of preset values.In Special mode, the preset values are 1/5 normal. For gas applications, a minimum value of 2.56 is recommended. The 2.56 value will be automatically rounded up to 3.2 seconds.
	Flow calibration factor	1.00005.13		For sensors, this value represents the FCF and FT factors concatenated.
	Mass flow units	g/s		
	Mass flow cutoff	Sensor-specific value set at factory		For most sensors, the typical setting is 0.05% to 0.10% of the sensor's rated maximum flow rate. For some sensors, the setting may be higher.
	Volume flow type	Liquid		
	Volume flow units	L/s		
	Volume flow cutoff	0/0 L/s	0.0 – x L/s	x is obtained by multiplying the flow calibration factor by 0.2, using units of L/s.
Meter factors	Mass factor	1		
	Density factor	1		
	Volume factor	1		
Density	Density damping	1.6 sec	0.0 – 51.2 sec	User-entered value is corrected to nearest valid value in a list of preset values.
	Density units	g/cm^3		
	Density cutoff	0.2 g/cm^3	0.0 – 0.5 g/cm^3	
	D1	0 g/cm^3		
	D2	1 g/cm^3		

Table G-1: Transmitter default values and ranges *(continued)*

Type	Parameter	Default	Range	Comments
	K1	1000 µsec	1000 – 50,000 µsec	
	K2	50,000 µsec	1000 – 50,000 µsec	
	FD	0		
	Temp Coefficient	4.44		
Two-phase flow	Two-phase flow low limit	0.0 g/cm^3	0.0 – 10.0 g/cm^3	
	Two-phase flow high limit	5.0 g/cm^3	0. 0 – 10.0 g/cm^3	
	Two-phase duration	0.0 sec	0.0 – 60.0 sec	
Temperature	Temperature damping	4.8 sec	0.0 – 38.4 sec	User-entered value is corrected to nearest valid value in a list of preset values.
	Temperature units	Deg C		
	Temperature calibration factor	1.00000T0.0000		
Pressure	Pressure units	PSI		
	Flow factor	0		
	Density factor	0		
	Cal pressure	0		
Special units	Base mass unit	g		
	Base mass time	sec		
	Mass flow conversion factor	1		
	Base volume unit	L		
	Base volume time	sec		
	Volume flow conversion factor	1		
LRV	Mass flow rate	−200.000 g/s		
	Volume flow rate	−0.200 L/s		
	Density	0.000 g/cm^3		
	Temperature	−240.000 °C		
	Drive gain	0.000%		
	Gas standard volume flow rate	−423.78SCFM		
	External temperature	−240.000 °C		
	External pressure	0.000 psi		
URV	Mass flow rate	200.000 g/s		

Table G-1: Transmitter default values and ranges *(continued)*

Type	Parameter	Default	Range	Comments
	Volume flow rate	0.200 L/s		
	Density	10.000 g/cm^3		
	Temperature	450.000 °C		
	Drive gain	100.000%		
	Gas standard volume flow rate	423.78 SCFM		
	External temperature	450.000 °C		
	External pressure	100.000 psi		
Display	Backlight on/off	On		
	Refresh rate	200 milliseconds	100 – 10,000 milliseconds	
	Variable 1	Mass flow rate		
	Variable 2	Mass total		
	Variable 3	Volume flow rate		
	Variable 4	Volume total		
	Variable 5	Density		
	Variable 6	Temperature		
	Variable 7	Drive gain		
	Variable 8–15	None		
	Display totalizer start/stop	Disabled		
	Display totalizer reset	Disabled		
	Display auto scroll	Disabled		
	Display offline menu	Enabled		
	Display offline password	Disabled		
	Display alarm menu	Enabled		
	Display acknowledge all alarms	Enabled		
	Offline password	1234		
	Auto scroll rate	10 sec		

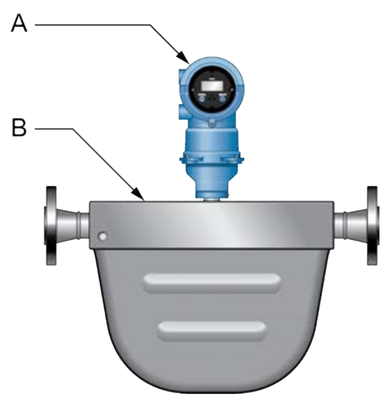
(1) *In Special mode, the default value is 0.64 sec.*

H Transmitter components and installation wiring

H.1 Installation types

The transmitter was ordered and shipped to be installed in one of several possible configurations.

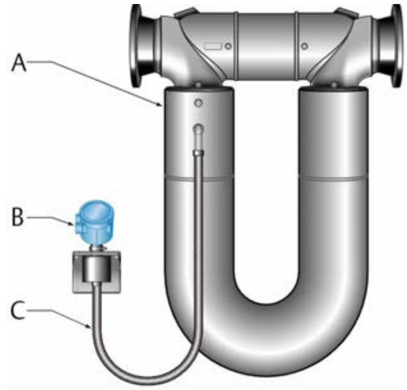
Figure H-1: Integral installation



The transmitter is mounted directly to the sensor. Integral installations do not require separate transmitter installation. Power supply must be field wired to the transmitter.

A. Transmitter
B. Sensor

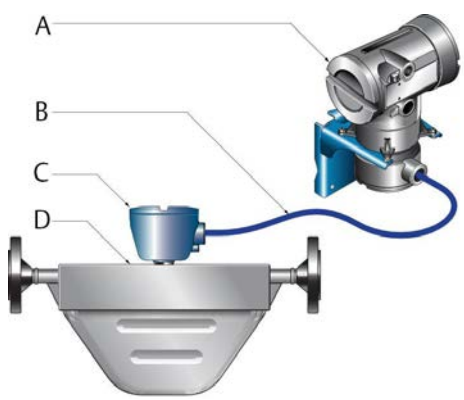
Figure H-2: High-temperature meters with factory connection



The transmitter is shipped with a flexible connection factory installed between the sensor and the transmitter. The transmitter must be dismounted from its shipping location (spot-welded to the sensor case) and then mounted separately. Power supply must be field wired to the transmitter.

A. Sensor
B. Transmitter or core processor
C. Factory-installed flexible connection

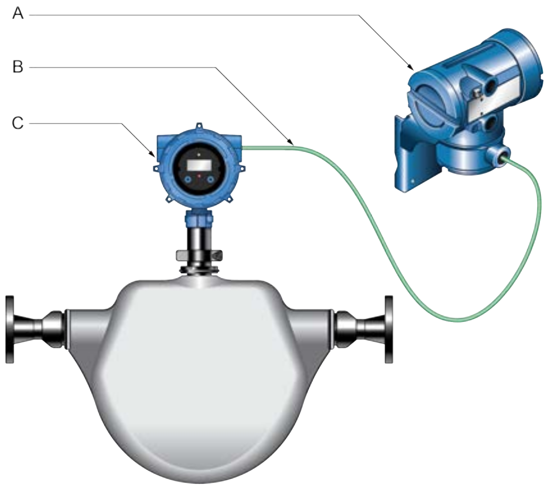
Figure H-3: 4-wire remote installation for Coriolis meters



The transmitter is installed remotely from the sensor. The 4-wire connection between the sensor and transmitter must be field wired. Power supply must be field wired to the transmitter.

A. Transmitter
B. Field-wired 4-wire connection
C. Core processor
D. Sensor

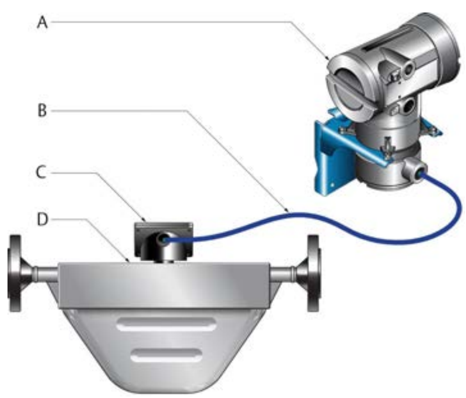
Figure H-4: 4-wire remote installation for density and viscosity meters (CDM, FDM, or FVM with fieldbus only)



The transmitter is installed remotely from the Compact Density Meter (CDM), Fork Density Meter (FDM), or Fork Viscosity Meter (FVM). The 4-wire connection between the sensor and transmitter must be field wired. Power supply must be field wired to the transmitter.

A. Transmitter
B. Field-wired 4-wire connection
C. Meter electronics

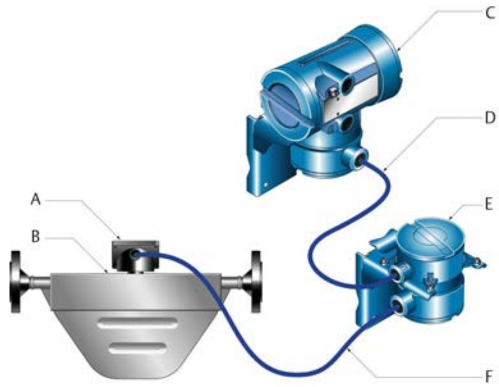
Figure H-5: 9-wire remote installation



The transmitter and core processor are combined in a single unit that is installed remotely from the sensor. The 9-wire connection between the transmitter/core processor and the sensor must be field wired. The power supply must be field wired to the transmitter.

A. Transmitter
B. Field-wired 9-wire connection
C. Junction box
D. Sensor

Figure H-6: Remote core processor with remote sensor installation

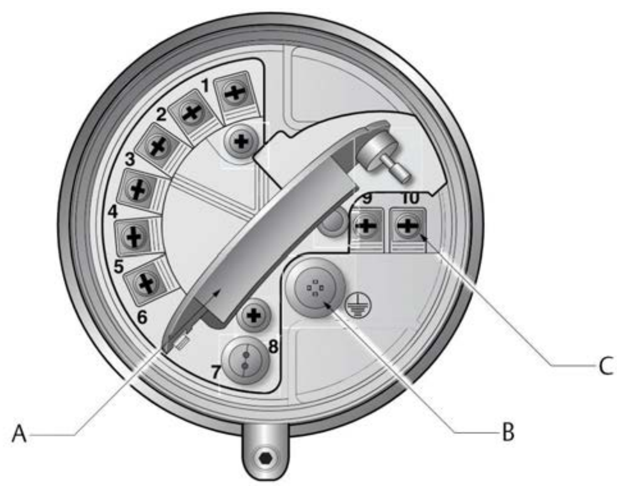


The transmitter, core processor, and sensor are all mounted separately. The 4-wire connection between the transmitter and core processor must be field wired. The 9-wire connection between the core processor and the sensor must be field wired. The power supply must be field wired to the transmitter. This configuration is sometimes called double-hop.

A. *Junction box*
B. *Sensor*
C. *Transmitter*
D. *Field-wired 4-wire connection*
E. *Core processor*
F. *Field-wired 9-wire connection*

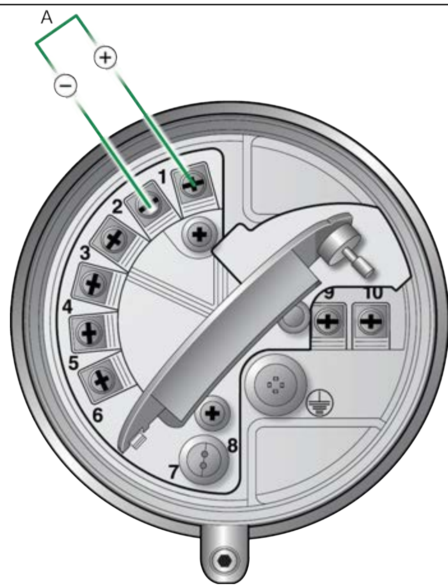
H.2 Power supply terminals and ground

Figure H-7: Power supply wiring terminals



A. *Warning flap*
B. *Equipment ground*
C. *Power supply wiring terminals (9 and 10)*

H.3 Fieldbus wiring terminals



A. FOUNDATION Fieldbus

I NE53 history

Operating instructions within this document are English versions. Instructions in other languages have different part numbers but matching revision letters.

<table>
<tr><th>Date</th><th>Version</th><th>Type</th><th>Change</th><th>Operating instruction</th></tr>
<tr><td>09/2000</td><td>1.0</td><td>Initial Product Release</td><td>N/A</td><td>3600326 A</td></tr>
<tr><td rowspan="3">06/2001</td><td rowspan="3">2.0</td><td>Feature</td><td>Feature additions:
Backlink active scheduler (LAS)
PID function block
Analog output function block for pressure compensation
Support for pressure compensation to the transducer block (TB)
Drive gain as a selectable channel for AI blocks
Ability to enable fieldbus siulate mode through the service port</td><td rowspan="3">3600326 B</td></tr>
<tr><td>Expansion</td><td>Support to configure the process variable units for mass flow, volume flow, density, and temperature from the display</td></tr>
<tr><td>Adjustment</td><td>Clarified the interaction of the digital fault setting and the last measured value timeout</td></tr>
<tr><td rowspan="2">02/2002</td><td rowspan="2">2.2</td><td>Feature</td><td>Added protections against low power conditions</td><td rowspan="2">3600326 C</td></tr>
<tr><td>Adjustment</td><td>Improved handling of RS-485 communication through the service port
Improved display</td></tr>
<tr><td>07/2004</td><td>3.x</td><td>Feature</td><td>Feature additions:
Petroleum measurement application
Gas standard volume functionality
Enhanced density application
Support for enabling fieldbus simulation mode through the display
Support for 32-character tagnames configurable through Modbus
Supoort for Analog Input Block configurable through Modbus</td><td>3600326 D</td></tr>
</table>

Date	Version	Type	Change	Operating instruction
		Expansion	• Software version information available either through the display or through Modbus • Totalizers can be disabled, in addition to starting and stopping • Doubled the number of virtual communication relationshups (VCRs)	
		Adjustment	• Improved handling of AI block status when slug flow is detected • Some fieldbus parameters made persistent across power resets • Introduced finer-grained control over operator access to display functions	
06/2007	4.0	Feature	Feature additions: • Configurable alarm severity • Additional support for gas standard volume functionality • Meter verification as an option • Multiple display language selections • PlantWeb Alerts II • Ability to enable simulate mode through the Device Information TB • Default value for AI1 block: mass flow in g/s • Default value for AI2 block: temperature in °C • Default value for AI3 block: density in g/cm^3 • Default value for AI4 block: volume flow in l/s	3600326 D
		Expansion	• Added Temperature and density units to API TB • Added additional configuration ability for the display	
01/2008	5.0	Feature	Feature additions: • Support for Meter Verification AMS Snap-On • Extra security for local display off-line menu access	3600326 EA
		Adjustment	• Improved handling of Gas Standard Volume cutoffs • Improved local display functionality for API and concentration measurement variables	
03/2009	5.1	Adjustment	Resolved non-volatile memory(NVM) reliability issue present in version 4.0 and version 5.0.	3600326 EA

Date	Version	Type	Change	Operating instruction
06/2010	6.0	Adjustment	• Smart Meter Verification • Improved representation of gas volume on local display • Harmonized behavior of gas volume density parameter with other gas • Standard volume parameters	3600326 EA
07/2012	7.0	Adjustment	• Added DI channels to increment the Concentration Mass Curve • Added Special units support for both Mass Flow and Volume Flow • Moved mass flow, volume flow, and density limit parameters from the Device Info TB to the Measurement TB • Added alarms A6, A22, A23, and A24 to alarm status information	3600326 EB
02/2015	8.0	Feature	• Added Density Viscosity core support • Added Density Viscosity core-related AI channels • Made units local to respective TBs to avoid cross-block communication	3600326 EC
05/2017	9.0	Adjustment	Density Viscosity phase 2 changes: • Restricted Velocity unit codes to ft/sec and m/sec • Decoupled API referred density unit from Density units • Added Pressure input type selection for Density Viscosity cores • Abbreviated parameter labels for DD4	3600326 ED
08/2022	10.0	Adjustment	Updated SMV documentation to add or clarify the following sections: • SMV test preparation • Smart Meter Verification capabilities • Interpreting Smart Meter Verification results • Resolving a failed Smart Meter Verification test Added Transducer blocks and views overview topic to Appendix A.	3600326 EE

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