Micro Motion® Compact Density Meters (CDM) with Foundation™ Fieldbus

Configuration and Use Manual

Micro Motion®

EMERSON™
Process Management

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.

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1 Before you begin

Topics covered in this chapter:

- *About this manual*
- *Model codes and device types*
- *Communications tools and protocols*
- *Additional documentation and resources*

1.1 About this manual

This manual provides information to help you configure, commission, use, maintain, and troubleshoot the Micro Motion Compact Density Meter (CDM).

The following version of the CDM is documented in this manual: Compact Density Meter with Foundation Fieldbus.

See *Micro Motion® Compact Density Meters: Configuration and Use Manual* for the following versions of the CDM:

- Compact Density Meter with Analog Outputs
- Compact Density Meter with Analog Output and Discrete Output
- Compact Density Meter with Time Period Signal Output

Important

This manual assumes that your meter has been installed correctly and completely, according to the instructions in the installation manual, and that the installation complies with all applicable safety requirements.

1.2 Model codes and device types

Your device can be identified by the model code on the device tag.

Table 1-1:   Model codes and device types

Model code	Device nickname	I/O	Electronics mounting
CDM100M****C	CDM mA	• Two mA outputs • RS-485 terminals	Integral
CDM100M****D	CDM DO	• One mA output • One discrete output • RS-485 terminals	Integral

Table 1-1: Model codes and device types *(continued)*

Model code	Device nickname	I/O	Electronics mounting
CDM100M****B	CDM TPS	• One mA output • One Time Period Signal output • RS-485 terminals	Integral
CDM100M****A	CDM FF	• Foundation fieldbus	4-wire remote transmitter

Restriction

The CDM mA, CDM DO, and CDM FF meters support a complete set of application and configuration options. The CDM TPS meter supports a subset of configuration options. Refer to the product data sheet for details.

1.3   Communications tools and protocols

You can use several different communications tools and protocols to interface with the device. You may use different tools in different locations or for different tasks.

Table 1-2: Communications tools, protocols, and related information

Communications tool	Supported protocols	Scope	In this manual	For more information
Display	Not applicable	Basic configuration and commissioning	Complete user information. See *Appendix B*.	Not applicable
ProLink III	Service port	Complete configuration and commissioning	Basic user information. See *Appendix C*.	User manual • Installed with software • On Micro Motion user documentation CD • On Micro Motion web site (*www.micromotion.com*)
Fieldbus host	Foundation fieldbus	Complete configuration and commissioning	Resource block, transducer blocks and information about the function blocks related to user tasks. See *Appendix D*.	Foundation fieldbus documentation

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Tip

You may be able to use other communications tools from Emerson Process Management, such as AMS Suite: Intelligent Device Manager, or the Smart Wireless THUM™ Adapter. Use of AMS or the Smart Wireless THUM Adapter is not discussed in this manual. For more information on the Smart Wireless THUM Adapter, refer to the documentation available at *www.micromotion.com*.

1.4   Additional documentation and resources

Micro Motion provides additional documentation to support the installation and operation of the transmitter.

Table 1-3:   Additional documentation and resources

Topic	Document
Device installation	*Micro Motion Compact Density Meters (CDM): Installation Manual*
	Micro Motion Model 1700 and Model 2700 Transmitters: Installation Manual
Product data sheet	*Micro Motion Compact Density Meters: Product Data Sheet*
	Micro Motion Model 1700 and Model 2700 Transmitters: Product Data Sheet

All documentation resources are available on the Micro Motion web site at *www.micromotion.com* or on the Micro Motion user documentation DVD.

2   Quick start

Topics covered in this chapter:

*   *Power up the transmitter*
*   *Check meter status*
*   *Make a startup connection to the transmitter*
*   *Zero the meter*

2.1   Power up the transmitter

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

1.   Ensure that all transmitter and sensor covers and seals are closed.

> ⚠ **CAUTION!**
>
> **To prevent ignition of flammable or combustible atmospheres, ensure that all covers and seals are tightly closed. For hazardous area installations, applying power while housing covers are removed or loose can cause an explosion.**

2.   Turn on the electrical power at the power supply.

The transmitter will automatically perform diagnostic routines. During this period, Alert 009 is active. The diagnostic routines should complete in approximately 30 seconds.

Postrequisites

Although the sensor is ready to receive process fluid shortly after power-up, the electronics can take up to 10 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 10 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.

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.

Table 2-1: Transmitter status reported by status LED

LED state	Description	Recommendation
Green	No alerts are active.	Continue with configuration or process measurement.
Flashing green	No alerts are active. One or more previously active alerts have not been acknowledged.	Continue with configuration or process measurement. If you choose, you can acknowledge the alerts.
Yellow	One or more low-severity alerts are active, and have been acknowledged.	A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement. If you choose, you can identify and resolve the alert condition.
Flashing yellow	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. If you choose, you can identify and resolve the alert condition. You may also acknowledge the alert.
Red	One or more high-severity alerts are active, and have been acknowledged.	A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing.
Flashing red	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. You may also acknowledge the alert.

Related information

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

2.3 Make a startup connection to the transmitter

Identify the connection type to use, and follow the instructions for that connection type in the appropriate appendix.

2.4 Zero the meter

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

- *Zero the meter using the display*   (Section 2.4.1)
- *Zero the meter using ProLink III*   (Section 2.4.2)
- *Zero the meter using a Fieldbus host*   (Section 2.4.3)

2.4.1   Zero the meter using the display

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

Important

In most cases, the default value (0) is adequate for flow indication. Do not zero the meter unless the velocity switch is being triggered incorrectly and you need to apply an offset to the velocity measurement.

Restriction

You cannot change the Zero Time setting from the display. The current setting of Zero Time will be applied to the zero procedure. The default value is 20 seconds. If you need to change Zero Time, you must make a connection to the transmitter from a communications tool such as ProLink III.

Prerequisites

Important

Do not zero the meter if a high-severity alert is active. Correct the problem, then zero the meter. You may zero the meter if a low-severity alert is active.

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. Prepare the meter:

    a. Stop flow through the sensor by shutting the downstream valve, and then the upstream valve if available.

    b. Verify that the sensor is blocked in, that flow has stopped, and that the sensor is completely full of process fluid.

    c. Verify that the process fluid is not flashing or condensing, and that it does not contain particles that can settle out.

    d. Remove or reduce sources of electromechanical noise if appropriate.

2. Start the zero process.

    a. Navigate to the Zero menu: OFFLINE MAINT > OFFLINE CALIB > VEL ZERO.

    b. Scroll to CAL VEL/ZERO and activate Select, then select CAL/YES?.

        The status LED changes to flashing yellow while the zero is in progress.

3. Read the zero result on the display.

   The display reports CAL PASS if the zero was successful, or CAL FAIL if it was not.

Postrequisites

Restore normal flow through the sensor by opening the valves.

Need help? If the zero fails:

- Ensure 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 Micro Motion.
- If you want to return the meter to operation using a previous zero value, choose OFFLINE MAINT > CAL > RESTORE VEL/ZERO.

2.4.2 Zero the meter using ProLink III

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

Important
In most cases, the default value (0) is adequate for flow indication. Do not zero the meter unless the velocity switch is being triggered incorrectly and you need to apply an offset to the velocity measurement.

Prerequisites

Important
Do not zero the meter if a high-severity alert is active. Correct the problem, then zero the meter. You may zero the meter if a low-severity alert is active.

Procedure

1. Prepare the meter:

   a. Stop flow through the sensor by shutting the downstream valve, and then the upstream valve if available.

   b. Verify that the sensor is blocked in, that flow has stopped, and that the sensor is completely full of process fluid.

   c. Verify that the process fluid is not flashing or condensing, and that it does not contain particles that can settle out.

   d. Remove or reduce sources of electromechanical noise if appropriate.

2. Choose Device Tools > Calibration > Zero Velocity.

3. Modify Zero Time, if desired.

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.

4. Click Calibrate Zero.

The Calibration in Progress message is displayed. When the calibration is complete:

- If the zero procedure was successful, a Calibration Success message and a new zero value are displayed.
- If the zero procedure failed, a Calibration Failed message is displayed.

Postrequisites

Restore normal flow through the sensor by opening the valves.

Need help? If the zero fails:

- Remove or reduce sources of electromechanical noise, then retry.
- If the zero continues to fail, contact Micro Motion.
- If you want to return the meter to operation using a previous zero value, choose Device Tools > Calibration > Zero Velocity > Restore Prior Zero . Restore Prior Zero is available only while the Zero Velocity window is open. If you close the Zero Velocity window, you will no longer be able to restore the prior zero.

2.4.3 Zero the meter using a Fieldbus host

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

Important

In most cases, the default value (0) is adequate for flow indication. Do not zero the meter unless the velocity switch is being triggered incorrectly and you need to apply an offset to the velocity measurement.

Prerequisites

Important

Do not zero the meter if a high-severity alert is active. Correct the problem, then zero the meter. You may zero the meter if a low-severity alert is active.

Procedure

1. Prepare the meter:

   a. Stop flow through the sensor by shutting the downstream valve, and then the upstream valve if available.

   b. Verify that the sensor is blocked in, that flow has stopped, and that the sensor is completely full of process fluid.

   c. Verify that the process fluid is not flashing or condensing, and that it does not contain particles that can settle out.

    d. Remove or reduce sources of electromechanical noise if appropriate.

2. Apply the Zero Calibration method parameter (Calibration TB > ZERO_CAL).

3. Acknowledge Set flow to zero when prompted to confirm that flow is completely stopped.

4. Adjust the zero time when prompted, if desired.

   The Calibration in Progress message is displayed. When the calibration is complete:

   - If the zero procedure was successful, a Calibration Success message and a new zero value are displayed.
   - If the zero procedure failed, a Calibration Failed message is displayed.

Postrequisites

Restore normal flow through the sensor by opening the valves.

Need help? If the zero fails:

- Remove or reduce sources of electromechanical noise, then retry.
- If the zero continues to fail, contact Micro Motion.

Part II
Configuration and commissioning

Chapters covered in this part:

- *Introduction to configuration and commissioning*
- *Integrate the meter with the network*
- *Configure process measurement*
- *Configure device options and preferences*
- *Completing the configuration*

3 Introduction to configuration and commissioning

Topics covered in this chapter:

- *Default values*
- *Enable access to the off-line menu of the display*
- *Place function blocks in Out of Service mode*
- *Restore the factory configuration*

3.1 Default values

Default values for your meter are configured at the factory. The specific values are determined by the options that were specified on the purchase order. These are provided on the configuration sheet that was shipped with your meter.

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

Display	*Not available*
ProLink III	Device Tools > Configuration > Transmitter Display > Display Security
Fieldbus host	Local Display TB > Offline Menu (OD Index 011)

Overview

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.

3.3 Place function blocks in Out of Service mode

Display	*Not available*
ProLink III	*Not applicable*
Fieldbus host	(block name) > MODE_BLOCK (OD Index Number 005)

Overview

Before you modify parameters on the fieldbus function blocks, you must place the function blocks in Out of Service (O/S) mode. Before you return the device to operation, you must place them back in service (Auto mode). If you are using ProLink III to modify parameters, ProLink III handles this automatically.

3.4 Restore the factory configuration

Display	*Not available*
ProLink III	Device Tools > Configuration Transfer > Restore Factory Configuration
Fieldbus host	Diagnostic TB > Restore Factory Config (OD Index 050)

Overview

Restoring the factory configuration returns the transmitter to a known operational configuration. This may be useful if you experience problems during configuration.

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

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4   Integrate the meter with the network

Topics covered in this chapter:

- *Assign function block channels to transducer block channels*
- *Configure AI Linearization*
- *Configure process alert limits for the AI blocks*
- *Configure the timeout for Field Diagnostic alerts*

4.1   Assign function block channels to transducer block channels

Fieldbus host	AI or AO function block > CHANNEL
	AI or AO function block > XD_SCALE (OD Index 10)
	AI or AO function block > OUT_SCALE (OD Index 11)

Overview

Each of the four AI function blocks and the AO function block can be assigned to a transducer block channel. Each transducer block channel is used for a single process variable. The AI function blocks are used for input data (data sent from the transmitter to the host). The AO function block is used for output data (data sent from the host to the transmitter).

Figure 4-1: Channel assignment for the function blocks
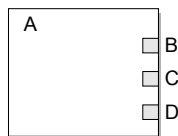
A.   *AO function block or AI function block*
B.   *AI channel or AO channel (CHANNEL)*
C.   *Transducer scale: units index (XD_SCALE)*
D.   *Output scale: units index (OUT_SCALE)*

Note

Perform these steps for each AI function block channel (1–4) and the AO function block channel, as needed.

Procedure

1. Set the (AI or AO) function block channel to the transducer block channel this block should report.

2. Make sure the transducer scale is set to the correct units, and change it if necessary.

3. Make sure the output scale units matches the transducer scale units, and change it if necessary.

4.2　**Configure** AI Linearization

Fieldbus host	AI function block > L_TYPE (OD Index 16)

Overview

AI Linearization is used to rescale a process variable. It can also be used to change the measurement units. The default setting (Direct) is appropriate for most applications.

Procedure

1. Set AI Linearization as desired.

Option	Description
Direct	The AI block reports process variables directly from the Measurement transducer block.
Indirect	The value from the Measurement transducer block is rescaled as specified by the Transducer Scale parameters and the Output Scale parameters. The AI block reports the inverse of the result.
Indirect Square Root	The value from the Measurement transducer block is rescaled as specified by the Transducer Scale parameters and the Output Scale parameters. The AI block reports the square root of the result. This setting is not applicable to most Micro Motion meters.

Important

AI linearization affects only the process variable reported by the AI block. It has no effect on the Measurement block. Therefore:

- If you set AI Linearization to Indirect or Indirect Square Root, the process variable reported by the AI block will be different from the process variable read directly from the Measurement block. Both the display and ProLink III read data directly from the Measurement block.

- Measurement parameters such as Density Damping and Density Cutoff are processed by the Measurement block, and the result is passed through AI linearization. Using Ai linearization to implement damping or cutoff processing may not be possible, and is not recommended.

2. If you selected Indirect or Indirect Square Root, set the Transducer Scale and Output Scale parameters:

a. Set Transducer Scale: EU at 0% to the value of the process variable when the transducer block reports 0%.

b. Set Transducer Scale: EU at 100% to the value of the process variable when the transducer block reports 100%.

c. Set Output Scale: EU at 0% to the value of the process variable when the AI block reports 0%.

d. Set Output Scale: EU at 100% to the value of the process variable when the AI block reports 100%.

Specify the two transducer scale parameters in the measurement unit configured for the transducer block. Specify the two output scale parameters in the measurement unit configured for the AI block. In most cases, the transducer block and the AI block use the same measurement unit.

Example: Using scaling to change the measurement unit

The transducer block is configured to measure density in g/cm^3. You want the AI block to report density in oz/in^3.

Your lowest expected density value is 0.5 g/cm^3. This is equivalent to 0.289 oz/in^3.

Your highest expected density value is 0.85 g/cm^3. This is equivalent to 0.491 oz/in^3.

Set parameters as follows:
- AI Linearization = Indirect
- Transducer Scale: EU at 0% = 0.5
- Transducer Scale: EU at 100% = 0.85
- Output Scale: EU at 0% = 0.289
- Output Scale: EU at 100% = 0.491

Result: As line density varies between 0.5 g/cm^3 and 0.85 g/cm^3:
- The transducer block varies between 0% and 100%.
- The Measurement block converts this value to a value between 0.5 g/cm^3 and 0.85 g/cm^3. The result is reported on the display and set to the AI block.
- The AI block applies AI linearization, and reports a value between 0.289 oz/in^3 and 0.85 oz/in^3.

4.3 Configure process alert limits for the AI blocks

Fieldbus host	AI function block > HI_HI_LIM (OD Index 26)
	AI function block > HI_HI_PRI (OD Index 25)
	AI function block > HI_LIM (OD Index 28)
	AI function block > HI_PRI (OD Index 27)
	AI function block > LO_LIM (OD Index 30)
	AI function block > LO_PRI (OD Index 29)
	AI function block > LO_LO_LIM (OD Index 32)
	AI function block > LO_LO_PRI (OD Index 31)
	AI function block > ALARM_HYS (OD Index 24)

Overview

Process alerts are used to indicate that a process variable is outside the specified limits. Each AI block has four alert limits: High-High, High, Low, and Low-Low. In general, the range between High and Low represents the normal process range.

Process alerts are reported only by the affected AI block. They are not shown on the display or reported by ProLink III.

Prerequisites

Before setting process alert limits, ensure that the four AI blocks are configured for the appropriate transducer channel (process variable) and measurement unit.

Procedure

1. Select AI Block 1.

2. Set process alert limits:

   a. Set the High-High alert to the value of the process variable that will cause the transmitter to post a High-High alert for this AI block.

   b. Set the High alert to the value of the process variable that will cause the transmitter to post a High alert for this AI block.

   c. Set the Low alert to the value of the process variable that will cause the transmitter to post a Low alert for this AI block.

   d. Set the Low-Low alert to the value of the process variable that will cause the transmitter to post a Low-Low alert for this AI block.

3. For each process alert limit, set the alert priority.

   The alert priority is a value between 0 and 15. Higher numbers represent higher priorities. These values are used for fieldbus network management. They do not affect transmitter operation: The transmitter will post the alert as soon as the condition is detected.

4. Repeat for all other AI blocks.

5. Set the alert hysteresis.

The alert hysteresis defines a range around the alert limit that operates as a deadband. The range is defined in terms of % of the output scale. Alert hysteresis is used to suppress repetitive alerts when the process variable is hovering around the alert limit.

- A higher value suppresses alerts across a wider range.
- A lower value suppresses alerts across a narrower range. Therefore, alerts may be posted more frequently.

Important

The alert hysteresis applies to all AI blocks and to all process alert limits.

Example:

AI Block 1 is configured to report line density. The High alert is set at 1.0 g/cm³. The alert hysteresis is set at 5%.

If line density goes above 1.05 g/cm³, the transmitter posts a High alert. The High alert remains active until density goes below 0.95 g/cm³.

4.4 Configure the timeout for Field Diagnostic alerts

Fieldbus host	DiagnosticsTB > Alert Index (OD Index 017)
	Diagnostic TB > Alert timeout (OD Index 083)

Overview

Each Field Diagnostic alert has an individual Timeout parameter. If the alert occurs, it is not sent to the host until the timeout has expired. Additionally, any associated AI blocks do not go into fault until the timeout has expired. In other words, the process quality for the AI block is reported as Good until the timeout expires.

Procedure

1. Set the alert index to the alert you want to configure.
2. Set the timeout as desired:

   - Default: 0 seconds
   - Range: 0 to 300 seconds

5 Configure process measurement

Topics covered in this chapter:

- *Verify the calibration factors*
- *Configure line density measurement*
- *Configure temperature measurement*
- *Configure the pressure input*
- *Configure velocity measurement*
- *Set up the API referral application*
- *Set up concentration measurement*

5.1 Verify the calibration factors

Display	*Not available*
ProLink III	Device Tools > Calibration Data
Fieldbus host	Density Viscosity Meter TB > DEN_A1 (OD Index 035)
	Density Viscosity Meter TB > DEN_A2 (OD Index 036)
	Density Viscosity Meter TB > DEN_A3 (OD Index 037)
	Density Viscosity Meter TB > DEN_A4 (OD Index 038)
	Density Viscosity Meter TB > DEN_A5 (OD Index 039)
	Density Viscosity Meter TB > DEN_A6 (OD Index 040)
	Density Viscosity Meter TB > DEN_A7 (OD Index 041)
	Density Viscosity Meter TB > DEN_A8 (OD Index 042)
	Density Viscosity Meter TB > DEN_A9 (OD Index 043)

Overview

The calibration factors are used to adjust measurement for the unique traits of the sensor. Your device was calibrated at the factory. However, you should verify that the calibration factors that are configured in your device match the factory values.

Prerequisites

You will need the factory values for the calibration factors. These are provided in two locations:

- The calibration certificate shipped with your meter
- The label inside the transmitter's end-cap

Important
If the transmitter is not the original component, do not use the values from the transmitter label.

Procedure

1. View the calibration factors that are stored in the device.

2. Compare them to the factory values.

    - If the values match, no action is required.
    - If the values do not match, contact Micro Motion customer service.

Related information

Sample calibration certificates

5.1.1 Calibration factors

The original calibration factors are obtained from factory calibration, and are unique to each device. They are used to adjust measurements for the specific physical properties of the device.

Contents of the calibration certificate

The calibration certificate contains several sets of factors:

Density calibration coefficients	Define the relationship between density and the response of your sensor
Temperature compensation coefficients	Adjust density measurement for the effect of temperature on sensor response
Pressure compensation coefficients	Adjust density measurement for the effect of pressure on sensor response
Flow compensation coefficient	Adjusts density measurement for the effect of flow on sensor response

The calibration certificate also provides the results of the Known Density Verification procedure that was performed at the factory.

For each calibration performed at the factory, the calibration certificate contains the data used to calculate the calibration coefficients.

CDM format and legacy format (A factors and K factors)

The calibration factors are provided on three calibration certificates:

- The first certificate provides the calibration factors in the CDM format, A_n, in SI units. These are obtained from factory calibration of your device.

- The second certificate provides the calibration factors in the legacy format, K_n, in SI units. These factors represent the current calibration factors converted to the format used by the 7835 and 7845 meters.

- The third certificate provides the calibration factors in the legacy format, K_n, in imperial units. These factors represent the current calibration factors converted to the format used by the 7835 and 7845 meters, and then converted to imperial units.

If you have existing programs that use the K factors, update your programs with the new K values in the appropriate units. In all other situations, use the A-format calibration factors.

Related information

Sample calibration certificates

5.2 Configure line density measurement

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

- *Configure Density Measurement Unit* (Section 5.2.1)
- *Configure Density Damping* (Section 5.2.2)
- *Configure Density Cutoff* (Section 5.2.3)
- *Configure two-phase flow parameters* (Section 5.2.4)

5.2.1 Configure Density Measurement Unit

Display	OFF-LINE MAINT > OFF-LINE CONFG > UNITS > DENS
ProLink III	Device Tools > Configuration > Process Measurement > Line Density > Density Unit
Fieldbus host	Measurement TB > Density Unit (OD Index 017)

Overview

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

Restriction

If the API referral application is enabled, you cannot change the density measurement unit here. The density measurement unit is controlled by the API table selection.

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

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).

Related information

Set up the API referral application

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.

Table 5-1:   Options for Density Measurement Unit

Unit description	Label		Code
	Display	ProLink III	Fieldbus host
Specific gravity[1]	SGU	SGU	1114
Grams per cubic centimeter	G/CM3	g/cm3	1100
Grams per liter	G/L	g/l	1105
Grams per milliliter	G/mL	g/ml	1104
Kilograms per liter	KG/L	kg/l	1103
Kilograms per cubic meter	KG/M3	kg/m3	1097
Pounds per U.S. gallon	LB/GAL	lbs/Usgal	1108
Pounds per cubic foot	LB/CUF	lbs/ft3	1107
Pounds per cubic inch	LB/CUI	lbs/in3	1106
Short ton per cubic yard	ST/CUY	sT/yd3	1109
Degrees API	D API	degAPI	1113
Special unit	SPECL	special	253

(1)   *Non-standard calculation. This value represents line density divided by the density of water at 60 °F.*

Define a special measurement unit for density

Display	*Not available*
ProLink III	Device Tools > Configuration > Process Measurement > Line Density > Special Units
Fieldbus host	Density Viscosity Meter TB > Base Unit (OD Index 081) Density Viscosity Meter TB > Conversion Factor (OD Index 083) Density Viscosity Meter TB > Label (OD Index 080)

Procedure

1.   Specify Density Special Unit Base.

Density Special Unit Base is the existing density unit that the special unit will be based on.

2.   Calculate Density Special Unit Conversion Factor as follows:

a.   x base units = y special units

b.   Density Special Unit Conversion Factor = x/y

3. Enter Density Special Unit Conversion Factor.

4. Set User-Defined Label to the name you want to use for the density 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 density

You want to measure density in ounces per cubic inch.

1. Set Density Special Unit Base to g/cm3.

2. Calculate Density Special Unit Conversion Factor: 1 g/cm3 = 0.578 oz/in3

3. Set Density Special Unit Conversion Factor to 0.578.

4. Set User-Defined Label to oz/in3.

5.2.2   Configure Density Damping

Display	*Not available*
ProLink III	Device Tools > Configuration > Process Measurement > Line Density > Density Damping
Fieldbus host	Measurement TB > Density_Damping (OD Index 028)

Overview

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 value you want to use.

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

5.2.3   Configure Density Cutoff

Display	*Not available*
ProLink III	Device Tools > Configuration > Process Measurement > Line Density > Density Cutoff Low
Fieldbus host	Measurement TB > Density_Low_Cutoff (OD Index 034))

Procedure

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

The default value is 0.2 g/cm³. The range is 0.0 g/cm³ to 0.5 g/cm³.

5.2.4   Configure two-phase flow parameters

Display	*Not available*
ProLink III	Device Tools > Configuration > Process Measurement > Line Density
Fieldbus host	Diagnostic TB > Two-Phase Flow Low Limit (OD Index 009)
	Diagnostic TB > Two-Phase Flow High Limit (OD Index 010)
	Diagnostic TB > Two-Phase Flow Timeout (OD Index 008)

Overview

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 sometimes 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/cm³, even if you configured another unit for density measurement.

The default value for Two-Phase Flow Low Limit is 0.0 g/cm³. The range is 0.0 to 3.0 g/cm³.

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

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

Tip

To reduce the occurrence of two-phase flow alerts that are not significant to your process, set Two-Phase Flow High Limit slightly above your expected highest process density.

You must enter Two-Phase Flow High Limit in g/cm³, even if you configured another unit for density measurement.

The default value for Two-Phase Flow Low Limit is 3.0 g/cm³. The range is 0.0 to 3.0 g/cm³.

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.

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.

Tip

To decrease the occurrence of two-phase flow alerts, lower Two-Phase Flow Low Limit or raise Two-Phase Flow High Limit.

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.
- Line density is held at its 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:

- Line density reverts to actual process density.
- 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, line density reverts to actual process density, but the two-phase flow alert remains active.

If Two-Phase Flow Timeout is set to 0.0 seconds, two-phase flow will cause a two-phase flow alert but will have no effect on how the meter measures or reports line density.

5.3 Configure temperature measurement

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

- *Configure Temperature Measurement Unit*   (Section 5.3.1)
- *Configure Temperature Damping*   (Section 5.3.2)
- *Configure Temperature Input*   (Section 5.3.3)

5.3.1 Configure Temperature Measurement Unit

Display	OFF-LINE MAINT > OFF-LINE CONFG > UNITS > TEMP
ProLink III	Device Tools > Configuration > Process Measurement > Line Temperature > Temperature Unit
Fieldbus host	Measurement TB > Temperature Units (OD Index 015)

Overview

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

Restriction

If the API referral application is enabled, the API table selection automatically sets the temperature measurement unit. Configure the API referral application first, then change the temperature measurement unit if desired.

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

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

The default setting is Degrees Celsius.

Related information

Set up the API referral application

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.

5.3.2 Configure Temperature Damping

Display	*Not available*
ProLink III	Device Tools > Configuration > Process Measurement > Line Temperature > Temperature Damping
Fieldbus host	Measurement TB > Temperature Tamping (OD Index 027)

Overview

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.

Tips

- 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 down to the nearest valid value.

5.3.3 Configure Temperature Input

Temperature data from the on-board temperature sensor (RTD) is always available. You can set up an external temperature device and use external temperature data if you want to.

- *Configure Temperature Input using a fieldbus host*

Configure Temperature Input using a fieldbus host

Fieldbus host	Temperature device: AI function block > Output
	Transmitter: AO function block > Cascade Input

Overview

Temperature data from the on-board temperature sensor (RTD) is always available. You can set up an external temperature device and use external temperature data if you want to.

Tip
Use an external device only if it is more accurate than the internal RTD.

Important
Line temperature data is used in several different measurements and calculations. It is possible to use the internal RTD temperature in some areas and an external temperature in others. The transmitter stores the internal RTD temperature and the external temperature separately. However, the transmitter stores only one alternate temperature value, which may be either the external temperature or the configured fixed value. Accordingly, if you choose a fixed temperature for some uses, and an external temperature for others, the external temperature will overwrite the fixed value.

Prerequisites

You must enable external temperature compensation before you can set the fixed temperature value.

Procedure

- To use an external temperature value:

  1. Set up the AO function block as a temperature source.
  2. Connect the AI block of the temperature measurement device to the AO block of the transmitter.

Figure 5-1: External temperature source
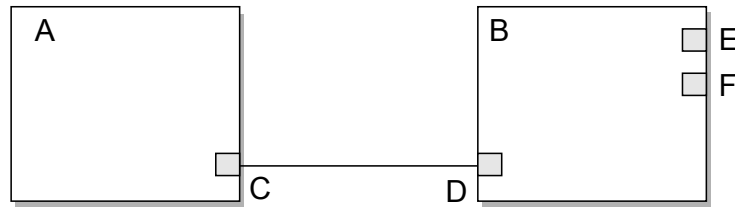
A. AI function block (in the temperature measurement device)
B. AO function block (in the transmitter)
C. Output
D. Cascade Input
E. AO Channel – Set to External Temperature (value = 20)
F. Process Value Scale: Units Index – Change the units to match the temperature sensing device

- To use a fixed temperature value:

  1. Set up the Calibration block.

Figure 5-2: Fixed temperature setting in the Calibration block
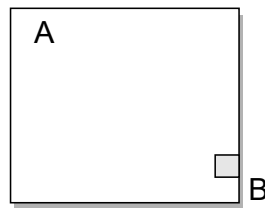
A. Calibration block
B. External Temperature: Value – Set to the appropriate fixed temperature value

5.4 Configure the pressure input

Pressure data is required for several different measurements. The meter does not measure pressure. There are several different methods to obtain pressure data.

- *Configure the pressure input using a fieldbus host*   (Section 5.4.1)

5.4.1 Configure the pressure input using a fieldbus host

Fieldbus host	Pressure device AI function block > Output
	Transmitter AO function block > Cascade Input

Overview

Pressure data is required for several different measurements.

Tip

A fixed pressure value is not recommended. A fixed pressure value may produce inaccurate process data.

Procedure

1. Set up the AO function block as a pressure source.

2. Connect the AI block of the temperature measurement device to the AO block of the transmitter.

Figure 5-3: External pressure source

A. *AI function block (in the pressure measurement device)*
B. *AO function block (in the transmitter)*
C. *Output*
D. *Cascade Input*
E. *AO Channel – If changed from the default, reset to Pressure (value = 6)*
F. *Process Value Scale: Units Index – Change the units to match the pressure measurement device*

Note

Restriction: If the API referral application is enabled, the API table selection automatically sets the pressure measurement unit. Configure the API referral application first, then change the pressure measurement unit if necessary.

Related information

Set up the API referral application

5.4.2 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.

Table 5-2: Options for Pressure Measurement Unit

	Label		Code
Unit description	**Display**	**ProLink III**	**Fieldbus host**
Feet water @ 68 °F	FTH2O	Ft Water @ 68°F	1154
Inches water @ 4 °C	INW4C	In Water @ 4°C	1147

Table 5-2: Options for Pressure Measurement Unit *(continued)*

| Unit description | Label | | Code |
	Display	ProLink III	Fieldbus host
Inches water @ 60 °F	INW60	In Water @ 60°F	1148
Inches water @ 68 °F	INH2O	In Water @ 68°F	1148
Millimeters water @ 4 °C	mmW4C	mm Water @ 4°C	1150
Millimeters water @ 68 °F	mmH2O	mm Water @ 68°F	1151
Millimeters mercury @ 0 °C	mmHG	mm Mercury @ 0°C	1158
Inches mercury @ 0 °C	INHG	In Mercury @ 0°C	1156
Pounds per square inch	PSI	PSI	1141
Bar	BAR	bar	1137
Millibar	mBAR	millibar	1138
Grams per square centimeter	G/SCM	g/cm2	1144
Kilograms per square centimeter	KG/SCM	kg/cm2	1145
Pascals	PA	pascals	1130
Kilopascals	KPA	Kilopascals	1133
Megapascals	MPA	Megapascals	1132
Torr @ 0 °C	TORR	Torr @ 0°C	1139
Atmospheres	ATM	atms	1140

5.5   Configure velocity measurement

The meter provides a basic velocity measurement. The velocity measurement is typically used as an flow indicator.

Velocity is calculated from the measured volume flow rate and the cross-section of the meter tube. If the calculated velocity is greater than the maximum velocity limit of the sensor, Alert A005 is posted.

- *Configure Velocity Measurement Unit*   (Section 5.5.1)
- *Configure Velocity Damping*   (Section 5.5.2)
- *Configure Flow Direction*   (Section 5.5.3)
- *Configure Velocity Cutoff*   (Section 5.5.4)
- *Configure Velocity Switch Setpoint*   (Section 5.5.5)

5.5.1   Configure Velocity Measurement Unit

Display	OFF-LINE MAINT > OFF-LINE CONFG > UNITS > VEL
ProLink III	Device Tools > Configuration > Process Measurement > Velocity > Velocity Unit
Fieldbus host	Density Viscosity Meter TB > Flow Velocity Units (OD Index 048)

Overview

Velocity Measurement Unit controls the measurement unit used to report velocity.

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

Set Velocity Measurement Unit to the desired unit.

The default setting is m/sec.

Options for Velocity Measurement Unit

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

Table 5-3:   Options for Velocity Measurement Unit

Unit description	Label		Code
	Display	ProLink III	Fieldbus host
Feet per minute	FT/M	ft/min	1070
Feet per second	FT/S	ft/sec	1067
Inches per minute	IN/M	in/min	1069
Inches per second	IN/S	in/sec	1066
Meters per hour	M/H	m/hr	1063
Meters per second	M/S	m/sec	1061

5.5.2 Configure Velocity Damping

Display	*Not available*
ProLink III	Device Tools > Configuration > Process Measurement > Velocity > Velocity Damping
Fieldbus host	Density Viscosity Meter TB > Velocity Damping (OD Index 053)

Overview

Velocity Damping controls the amount of damping that is applied to the velocity measurement.

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 Velocity Damping to the value you want to use.

The default value is 0.8 seconds. The range is 0.0–51.2 seconds.

The value is automatically rounded down to the nearest valid value. Valid values are as follows: 0, 0.2, 0.4, 0.8, ... 51.2.

5.5.3 Configure Flow Direction

Display	*Not available*
ProLink III	Device Tools > Configuration > Process Measurement > Velocity > Flow Direction
Fieldbus host	Measurement TB > Flow Direction (OD Index 035))

Overview

Flow Direction controls how forward flow and reverse flow affect velocity 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.

The default setting is Forward.

Options for Flow Direction

Table 5-4:   Options for Flow Direction

Flow Direction **setting**		Relationship to Flow Direction arrow on sensor	Effect on velocity measurement
Setting	**Code**		
Forward	0	Appropriate when the Flow Direction arrow is in the same direction as the majority of flow.	No effect
Reverse	1	Appropriate when the Flow Direction arrow is in the opposite direction from the majority of flow.	No effect
Absolute value	3	Flow Direction arrow is not relevant.	The absolute value of the process variable is used.
Bidirectional	2	Appropriate when both forward and reverse flow are expected, and forward flow will dominate, but the amount of reverse flow will be significant.	No effect
Negate/Forward only	4	Appropriate when the Flow Direction arrow is in the opposite direction from the majority of flow.	The sign of the process variable is reversed.
Negate/Bidirectional	5	Appropriate when both forward and reverse flow are expected, and reverse flow will dominate, but the amount of forward flow will be significant.	The sign of the process variable is reversed.

Effect of Flow Direction on digital communications

Table 5-5:

	Actual flow direction		
Flow Direction **setting**	**Forward**	**Zero flow**	**Reverse**
Forward	Positive	0	Negative
Bidirectional	Positive	0	Negative
Negate Forward	Negative	0	Positive
Negate Bidirectional	Negative	0	Positive

5.5.4 Configure Velocity Cutoff

Display	*Not available*
ProLink III	Device Tools > Configuration > Process Measurement > Velocity > Velocity Cutoff
Fieldbus host	Density Viscosity Meter TB > Velocity Cutoff (OD Index 049)

Overview

Velocity Cutoff defines the point below which velocity will be reported as 0.

Procedure

Enter the desired value for Velocity Cutoff.

The default is 0.0. There are no limits on the range.

5.5.5 Configure Velocity Switch Setpoint

Display	OFF-LINE MAINT > OFF-LINE CONFG > IO > CH B DO > CONFIG DO > CONFIG VELSW
ProLink III	Device Tools > Configuration > Process Measurement > Velocity > Velocity Switch Setpoint
Fieldbus host	Density Visocity Meter TB > Velocity Switch Setpoint (OD Index 022)

Overview

The velocity switch is used to indicate that the velocity has moved past the configured setpoint, in either direction. If the velocity is below the setpoint, the velocity switch is ON. If the velocity is above the setpoint, the velocity switch is OFF.

The velocity switch is based on the absolute value of the velocity, so it is not affected by flow direction.

The velocity switch is implemented with a 5% hysteresis. *Hysteresis* defines a range around the setpoint within which the velocity switch will not change.

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.

Prerequisites

Depending on the communications tool you are using, you may need to configure Channel B to operate as a discrete output, then set Discrete Output Source to Velocity Switch before you can configure Velocity Switch Setpoint.

Procedure

Set Velocity Switch Setpoint to the value at which the velocity switch will be triggered (after the 5% hysteresis is applied).

- If the velocity is below the setpoint, the velocity switch is ON.
- If the velocity is above the setpoint, the velocity switch is OFF.

The default value is 0.0. At this value, the velocity switch will never be ON. Velocity Switch Setpoint can be set to 0.0 or any positive number.

Example: Velocity switch in operation

If Velocity Switch Setpoint = 5 m/sec and the first measured velocity is above 5 m/sec, the velocity switch is OFF. 1If will remain OFF unless the velocity drops below 4.75 m/sec. If this happens, the velocity switch will turn ON, and remain ON until the velocity rises above 5.25 m/sec. At this point it turns OFF and will remain OFF until the velocity drops below 4.75 m/sec.

Postrequisites

You can report the status of the velocity switch in the following ways:

- Setting Discrete Output Source to Velocity Switch
- Querying the device using digital communications

5.6 Set up the API referral application

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

- *Set up the API referral application using ProLink III*   (Section 5.6.1)
- *Set up the API referral application using a fieldbus host*   (Section 5.6.2)

5.6.1 Set up the API referral application using ProLink III

This section guides you through the tasks required to set up and implement the API referral application.

1. *Enable the API referral application using ProLink III*
2. *Configure API referral using ProLink III*
3. *Set up temperature and pressure data for API referral using ProLink III*

Enable the API referral application using ProLink III

The API referral application must be enabled before you can perform any setup. If the API referral application was enabled at the factory, you do not need to enable it now.

1. Choose Device Tools > Configuration > Transmitter Options.

2. If the concentration measurement application is enabled, disable it and click Apply.

    The concentration measurement application and the API referral application cannot be enabled simultaneously.

3. Enable API Referral and click Apply.

Configure API referral using ProLink III

The API referral 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 and reference pressure that you want to use.

Procedure

1. Choose Device Tools > Configuration > Process Measurement > Petroleum Measurement.
2. Specify the API table to use.

    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
E tables	NGL (Natural Gas Liquids) and LPG (Liquid Petroleum Gas)

Note

The API referral application is not appropriate for the following process fluids: ethanol, butadiene and butadiene mixes, isopentane, LNG, ethylene, propylene, cyclohexane, aeromatics, asphalts, and road tars.

    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. 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.

Restriction
Not all combinations are supported by the API referral 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.

       If your process fluid goes outside any of these limits, the meter will post a status alert and will report line density instead of referred density until the process fluid goes back within range.

    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.

6. Set Reference Pressure to the pressure to which density will be corrected in referred density calculations.

API tables supported by the API referral application

The API tables listed here are supported by the API referral application.

Table 5-6: API tables, process fluids, measurement units, and default reference values

Process fluid	API table	Referred density (API)	Default reference temperature	Default reference pressure
Generalized crude and JP4	5A	Unit: °API Range: 0 to 100 °API	60 °F	0 psi (g)
	23A	Unit: SGU Range: 0.6110 to 1.0760 SGU	60 °F	0 psi (g)
	53A	Unit: kg/m^3 Range: 610 to 1075 kg/m^3	15 °C	0 kPa (g)
Generalized products (gasoline, jet fuel, aviation fuel, kerosene, heating oils, fuel oils, diesel, gas oil)	5B	Unit: °API Range: 0 to 85 °API	60 °F	0 psi (g)
	23B	Unit: SGU Range: 0.6535 to 1.0760 SGU	60 °F	0 psi (g)

Table 5-6:   API tables, process fluids, measurement units, and default reference values *(continued)*

Process fluid	API table	Referred density (API)	Default reference temperature	Default reference pressure
	53B	Unit: kg/m³ Range: 653 to 1075 kg/m³	15 °C	0 kPa (g)
Liquids with a constant density base or known thermal expansion coefficient	6C	Unit: °API	60 °F	0 psi (g)
	24C	Unit: SGU	60 °F	0 psi (g)
	54C	Unit: kg/m³	15 °C	0 kPa (g)
Lubricating oils	5D	Unit: °API Range: −10 to +40 °API	60 °F	0 psi (g)
	23D	Unit: SGU Range: 0.8520 to 1.1640 SGU	60 °F	0 psi (g)
	53D	Unit: kg/m³ Range: 825 to 1164 kg/m³	15 °C	0 kPa (g)
NGL (natural gas liquids)	23E	Unit: SGU	60 °F	0 psi (g)
LPG (liquid petroleum gas)	24E	Unit: SGU	60 °F	0 psi (g)

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, ethylene, propylene, cyclohexane, aeromatics, asphalts, and road tars.

Set up temperature and pressure data for API referral using ProLink III

The API referral application uses temperature and pressure data in its calculations. You must decide how to provide this data, then perform the required configuration and setup.

Tip

Fixed values for temperature or pressure are not recommended. Using a fixed temperature or pressure value may produce inaccurate process data.

Important

Line temperature data is used in several different measurements and calculations. It is possible to use the internal RTD temperature in some areas and an external temperature in others. The transmitter stores the internal RTD temperature and the external temperature separately. However, the transmitter stores only one alternate temperature value, which may be either the external temperature or the configured fixed value. Accordingly, if you choose a fixed temperature for some uses, and an external temperature for others, the external temperature will overwrite the fixed value.

Important

Line pressure data is used in several different measurements and calculations. The transmitter stores only one pressure value, which may be either the external pressure or the configured fixed value. Accordingly, if you choose a fixed pressure for some uses, and an external pressure for others, the external pressure will overwrite the fixed value.

Prerequisites

You must be using gauge pressure.

The pressure device must use the pressure unit that is configured in the transmitter.

If you are using an external temperature device, it must use the temperature unit that is configured in the transmitter.

Procedure

1. Choose Device Tools > Configuration > Process Measurement > API Referral.

2. Choose the method to be used to supply temperature data, and perform the required setup.

Option	Description	Setup
Internal RTD temperature data	Temperature data from the on-board temperature sensor (RTD) is used.	a. Write 0 to Density Viscosity Meter TB TB > DEN_EnableExtTempForVis.
Fieldbus AO function block	Temperature from an external device is used, supplied via the AO function block.	a. Write 1 to Density Viscosity Meter TB TB > DEN_EnableExtTempForVis. b. Ensure that the AO function block is set up as a temperature source. c. Connect the AO function block of the transmitter to the AI function block of the external temperature device.

3. Set up the pressure input.

    a. Ensure that the AO function block is set up as a pressure source.

    b. Connect the AO function block of the transmitter to the AI function block of the external pressure device.

Postrequisites

If you are using external temperature data, verify the external temperature value displayed in the Inputs group on the ProLink III main window .

The current pressure value is displayed in the External Pressure field. Verify that the value is correct.

Need help? If the value is not correct:

- Ensure that the external device and the meter are using the same measurement unit.
- For digital communications:

- Verify that the host has access to the required data.
- Verify that the output variable is being correctly received and processed by the transmitter.

• If necessary, apply an offset.

5.6.2 Set up the API referral application using a fieldbus host

This section guides you through the tasks required to set up and implement the API referral application.

1. *Enable the API referral application using a fieldbus host*
2. *Configure API referral using a fieldbus host*
3. *Set up temperature and pressure data for API referral using a fieldbus host*

Enable the API referral application using a fieldbus host

The API referral application must be enabled before you can perform any setup. If the API referral application was enabled at the factory, you do not need to enable it now.

1. If necessary, disable the concentration measurement application: Write 0 to Density Viscosity Meter TB TB > SNS_EnableCM (OD Index 147).

   The concentration measurement application and the API referral application cannot be enabled simultaneously.

2. Enable the API referral application: Write 1 to Density Viscosity Meter TB TB > SNS_EnablePM (OD Index 146).

Configure API referral using a fieldbus host

The API referral 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 and reference pressure that you want to use.

Procedure

1. Specify the API table to use: API Referral TB > API Table Type (OD Index 019).

   Each API table is associated with a specific set of equations. Your choice also determines the measurement unit to be used for temperature and pressure, and the default values for reference temperature and reference pressure.

Table 5-7: API tables, process fluids, measurement units, and default reference values

Process fluid	API table	Referred density (API)	Default reference temperature	Default reference pressure	Fieldbus code
Generalized crude and JP4	5A	Unit: °API Range: 0 to 100 °API	60 °F	0 psi (g)	17
	23A	Unit: SGU Range: 0.6110 to 1.0760 SGU	60 °F	0 psi (g)	49
	53A	Unit: kg/m³ Range: 610 to 1075 kg/m³	15 °C	0 kPa (g)	81
Generalized products (gasoline, jet fuel, aviation fuel, kerosene, heating oils, fuel oils, diesel, gas oil)	5B	Unit: °API Range: 0 to 85 °API	60 °F	0 psi (g)	18
	23B	Unit: SGU Range: 0.6535 to 1.0760 SGU	60 °F	0 psi (g)	50
	53B	Unit: kg/m³ Range: 653 to 1075 kg/m³	15 °C	0 kPa (g)	82
Liquids with a constant density base or known thermal expansion coefficient	6C	Unit: °API	60 °F	0 psi (g)	36
	24C	Unit: SGU	60 °F	0 psi (g)	68
	54C	Unit: kg/m³	15 °C	0 kPa (g)	100
Lubricating oils	5D	Unit: °API Range: −10 to +40 °API	60 °F	0 psi (g)	19
	23D	Unit: SGU Range: 0.8520 to 1.1640 SGU	60 °F	0 psi (g)	51
	53D	Unit: kg/m³ Range: 825 to 1164 kg/m³	15 °C	0 kPa (g)	83
NGL (natural gas liquids)	23E	Unit: SGU	60 °F	0 psi (g)	53
LPG (liquid petroleum gas)	24E	Unit: SGU	60 °F	0 psi (g)	69

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.

The meter automatically changes the density unit, temperature unit, pressure unit, and reference pressure to match the API table.

2.   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.

       If your process fluid goes outside any of these limits, the meter will post a status alert and will report line density instead of referred density until the process fluid goes back within range.

   b. Verify that the referred density range of the selected table is adequate for your application.

3.   If you chose a C table, enter the Thermal Expansion Coefficient (TEC) for your process fluid: API Referral TB > API_TEC (OD Index 017).

4.   If required, set the temperature to which density will be corrected in referred density calculations: API Referral TB > API Reference Temp (OD Index 017).

   The default reference temperature is determined by the selected API table.

5.   If required, set the temperature to which density will be corrected in referred density calculations: API Referral TB > API Reference Temp (OD Index 017).

   The default reference temperature is determined by the selected API table.

Set up temperature and pressure data for API referral using a fieldbus host

The API referral application uses line temperature and line pressure data in its calculations. You must decide how to provide this data, then perform the required configuration and setup.

Tip

Fixed values for temperature or pressure are not recommended. Using a fixed temperature or pressure value may produce inaccurate process data.

Important

Line temperature data is used in several different measurements and calculations. It is possible to use the internal RTD temperature in some areas and an external temperature in others. The transmitter stores the internal RTD temperature and the external temperature separately. However, the transmitter stores only one alternate temperature value, which may be either the external temperature or the configured fixed value. Accordingly, if you choose a fixed temperature for some uses, and an external temperature for others, the external temperature will overwrite the fixed value.

Important

Line pressure data is used in several different measurements and calculations. The transmitter stores only one pressure value, which may be either the external pressure or the configured fixed value. Accordingly, if you choose a fixed pressure for some uses, and an external pressure for others, the external pressure will overwrite the fixed value.

Prerequisites

You must be using gauge pressure.

The pressure device must use the pressure unit that is configured in the transmitter.

If you are using an external temperature device, it must use the temperature unit that is configured in the transmitter.

Procedure

1. Choose the method to be used to supply temperature data, and perform the required setup.

Option	Description	Setup
Internal RTD temperature data	Temperature data from the on-board temperature sensor (RTD) is used.	a. Write 0 to Density Viscosity Meter TB TB > DEN_EnableExtTempForVis.
Fieldbus AO function block	Temperature from an external device is used, supplied via the AO function block.	a. Write 1 to Density Viscosity Meter TB TB > DEN_EnableExtTempForVis. b. Ensure that the AO function block is set up as a temperature source. c. Connect the AO function block of the transmitter to the AI function block of the external temperature device.

2. Set up the pressure input.

    a. Ensure that the AO function block is set up as a pressure source.

    b. Connect the AO function block of the transmitter to the AI function block of the external pressure device.

5.7   Set up concentration measurement

The concentration measurement application calculates concentration from line density and line temperature.

*   *Preparing to set up concentration measurement*   (Section 5.7.1)
*   *Set up concentration measurement using ProLink III*   (Section 5.7.2)

5.7.1   Preparing to set up concentration measurement

The procedure for setting up concentration measurement application depends on how your device was ordered and how you want to use the application. Review this information before you begin.

Requirements for concentration measurement

To use the concentration measurement application, the following conditions must be met:

- The concentration measurement application must be enabled.
- One or more concentration matrices must be stored in your transmitter.

Tip

In most cases, the concentration matrix that you ordered was loaded at the factory. If you need to add concentration matrices and you are using ProLink III, you can load concentration matrices from a file or you can build a custom matrix. If you are using the Field Communicator, you can build a custom matrix but you cannot load a matrix from a file. This manual does not discuss building a custom matrix. For information on building a custom matrix, see *Micro Motion Enhanced Density Application: Theory, Configuration, and Use*.

- If your concentration matrices use Specific Gravity as the derived variable, the reference temperature values must be set.
- Temperature Source must be configured and set up.
- One matrix must be selected as the active matrix (the matrix used for measurement).

Optional tasks in setting up concentration measurement

The following tasks are optional:

- Modifying names and labels
- Configuring operational parameters
    - Extrapolation alerts
    - Calculation method (matrix or equation)
    - Matrix switching

5.7.2   Set up concentration measurement using ProLink III

This section guides you through the tasks required to set up, configure, and implement concentration measurement.

1. *Enable the concentration measurement application using ProLink III*
2. *Load a concentration matrix using ProLink III*
3. *Set reference temperature values for specific gravity using ProLink III*
4. *Set up temperature data for concentration measurement using ProLink III*
5. *Modify matrix names and labels using ProLink III*
6. *Modify operational parameters for concentration measurement using ProLink III*
7. *Select the active concentration matrix using ProLink III*

Enable the concentration measurement application using ProLink III

The concentration measurement application must be enabled before you can perform any setup. If the concentration measurement application was enabled at the factory, you do not need to enable it now.

1. Choose Device Tools > Configuration > Transmitter Options.

2. If the API referral application is enabled, disable it and click Apply.

The concentration measurement application and the API referral application cannot be enabled simultaneously.

3. Set Concentration Measurement to Enabled and click Apply.

Load a concentration matrix using ProLink III

At least one concentration matrix must be loaded onto your transmitter. You can load up to six.

Tip

In many cases, concentration matrices were ordered with the device and loaded at the factory. You may not need to load any matrices.

Prerequisites

> *Standard matrices for the concentration measurement application*
> *Concentration measurement matrices available by order*

The concentration measurement application must be enabled on your device.

For each concentration matrix that you want to load, you need a file containing the matrix data. The ProLink III installation includes a set of standard concentration matrices. Other matrices are available from Micro Motion.

Tips

- If you have a custom matrix on another device, you can save it to a file, then load it to the current device.
- If you have a matrix file in ProLink II format, you can load it using ProLink III.

You must know the following information for your matrix:

- The derived variable that the matrix is designed to calculate
- The density unit that the matrix was built with
- The temperature unit that the matrix was built with

Important

- All concentration matrices on your transmitter must use the same derived variable.
- 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.
- If you want the meter to calculate Net Mass Flow Rate, the derived variable must be set to Mass Concentration (Density). If your matrix is not set up for Mass Concentration (Density), contact Micro Motion for assistance or for a custom matrix.
- If you want the meter to calculate Net Volume Flow Rate, the derived variable must be set to Volume Concentration (Density). If your matrix is not set up for Volume Concentration (Density), contact Micro Motion for assistance or for a custom matrix.

If you plan to use matrix switching, you must identify the two matrices to be used for switching and load them into Slot 1 and Slot 2.

Procedure

1. Choose Device Tools > Configuration > Process Measurement > Line Density and set Density Unit to the density unit used by your matrix.

    Important
    When you load a matrix, if the density unit is not correct, concentration data will be incorrect. The density units must match at the time of loading. You can change the density unit after the matrix is loaded.

    ---

2. Choose Device Tools > Configuration > Process Measurement > Line Temperature and set Temperature Unit to the temperature unit used by your matrix.

    Important
    When you load a matrix, if the temperature unit is not correct, concentration data will be incorrect. The temperature units must match at the time of loading. You can change the temperature unit after the matrix is loaded.

    ---

3. Choose Device Tools > Configuration > Process Measurement > Concentration Measurement.

    The Concentration Measurement window is displayed. It is organized into steps that allow you to perform several different setup and configuration tasks. For this task, you will not use all the steps.

4. In Step 1, ensure that the setting of Derived Variable matches the derived variable used by your matrix. If it does not, change it as required and click Apply.

    Important
    If you change the setting of Derived Variable, all existing concentration matrices will be deleted from transmitter memory. Verify the setting of Derived Variable before continuing.

    ---

5. Load one or more matrices.

    a. In Step 2, set Matrix Being Configured to the location (slot) 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. (Optional) Set the density and temperature units to the units you want to use for measurement.

Related information

Matrix switching
Derived variables and calculated process variables
Configure Density Measurement Unit
Configure Temperature Measurement Unit

Set reference temperature values for specific gravity using ProLink III

When Derived Variable is set to Specific Gravity, you must set the reference temperature to be used for density measurement and the reference temperature of water, and then verify the density of water at the configured reference temperature. The two reference temperature values affect specific gravity measurement.

Additionally, the two reference temperature values affect any concentration process variable that is calculated by equation, rather than by matrix, because the equations are based on specific gravity.

Typically, the two reference temperature values are the same, but this is not required.

Restriction

If Derived Variable is not set to Specific Gravity, do not change any of these values. These are set by the active concentration matrix.

Procedure

1. Choose Device Tools > Configuration > Process Measurement > Concentration Measurement.

   The Concentration Measurement window is displayed. It is organized into steps that allow you to perform several different setup and configuration tasks. For this task, you will not use all the steps.

2. Scroll to Step 2, set Matrix Being Configured to the matrix you want to modify, and click Change Matrix.

3. Scroll to Step 3, then perform the following actions:

   a. Set Reference Temperature for Referred Density to the temperature to which line density will be corrected for use in the specific gravity calculation.

   b. Set Reference Temperature for Water to the water temperature that will be used in the specific gravity calculation.

   c. Set Water Density at Reference Temperature to the density of water at the specified reference temperature.

      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. Click the Apply button at the bottom of Step 3.

Related information

Using equations to calculate specific gravity, °Baumé, °Brix, °Plato, and °Twaddell

Set up temperature data for concentration measurement using ProLink III

The concentration measurement application uses line temperature data in its calculations. You must decide how to provide this data, then perform the required configuration and setup. Temperature data from the on-board temperature sensor (RTD) is always available. You can set up an external temperature device and use external temperature data if you want to.

The temperature setup that you establish here will be used for all concentration measurement matrices on this meter.

Important

Line temperature data is used in several different measurements and calculations. It is possible to use the internal RTD temperature in some areas and an external temperature in others. The transmitter stores the internal RTD temperature and the external temperature separately. However, the transmitter stores only one alternate temperature value, which may be either the external temperature or the configured fixed value. Accordingly, if you choose a fixed temperature for some uses, and an external temperature for others, the external temperature will overwrite the fixed value.

Prerequisites

If you plan to poll an external device, the primary mA output must be wired to support HART communications.

Procedure

1. Choose Device Tools > Configuration > Process Measurement > Concentration Measurement.

    The Concentration Measurement window is displayed. It is organized into steps that allow you to perform several different setup and configuration tasks. For this task, you will not use all the steps.

2. Scroll to Step 4.

3. Choose the method to be used to supply temperature data, and perform the required setup.

Option	Description	Setup
Internal RTD temperature data	Temperature data from the on-board temperature sensor (RTD) is used.	a. Write 0 to Density Viscosity Meter TB TB > DEN_EnableExtTempForVis.
Fieldbus AO function block	Temperature from an external device is used, supplied via the AO function block.	a. Write 1 to Density Viscosity Meter TB TB > DEN_EnableExtTempForVis. b. Ensure that the AO function block is set up as a temperature source. c. Connect the AO function block of the transmitter to the AI function block of the external temperature device.

Postrequisites

If you are using external temperature data, verify the external temperature value displayed in the Inputs group on the ProLink III main window .

Need help? If the value is not correct:

- Ensure that the external device and the meter are using the same measurement unit.
- For digital communications:
  - Verify that the host has access to the required data.
  - Verify that the output variable is being correctly received and processed by the transmitter.
- If necessary, apply an offset.

Modify matrix names and labels using ProLink III

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

1. Choose Device Tools > Configuration > Process Measurement > Concentration Measurement.

    The Concentration Measurement window is displayed. It is organized into steps that allow you to perform several different setup and configuration tasks. For this task, you will not use all the steps.

2. Scroll to Step 2, set Matrix Being Configured to the matrix you want to modify, and click Change Matrix.

3. Scroll to Step 3, then perform the following actions:

    a. Set Concentration Units Label to the label that will be used for the concentration unit.

    b. If you set Concentration Units Label to Special, enter the custom label in User-Defined Label.

    c. In Matrix Name, enter the name to be used for the matrix.

4. Click the Apply button at the bottom of Step 3.

Modify operational parameters for concentration measurement using ProLink III

You can enable and disable extrapolation alerts, set extrapolation alert limits, and control matrix switching. These parameters control the behavior of the concentration measurement application but do not affect measurement directly. Additionally, for certain types of concentration measurement, you can select the calculation method to be used.

1. Choose Device Tools > Configuration > Process Measurement > Concentration Measurement.

    The Concentration Measurement window is displayed. It is organized into steps that allow you to perform several different setup and configuration tasks. For this task, you will not use all the steps.

2. Scroll to Step 2, set Matrix Being Configured to the matrix you want to modify, and click Change Matrix.

3. Scroll to Step 4.

4. Set up extrapolation alerts.

   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, and can also be used to initiate matrix switching. Each concentration matrix has its own extrapolation alert settings.

   a. Set Extrapolation Alert Limit to the point, in percent, at which an extrapolation alert will be posted.

   b. Enable or disable the high and low limit alerts for temperature and density, as desired, and click Apply.

   Important
   If you plan to use matrix switching, you must enable the appropriate extrapolation alerts.

   Example: If Extrapolation Alert Limit is set to 5%, High Extrapolation Limit (Temperature) is enabled, and the matrix is built for a temperature range of 40 °F to 80 °F, an extrapolation alert will be posted if line temperature goes above 82 °F.

5. If applicable, use the Equation Selection parameter to specify the type of calculation to be used, and click Apply.

   This option is available only when Derived Variable is set to Specific Gravity.

Option	Description
Specific Gravity	Referred density is calculated from the matrix. The result is used in the specific gravity equation. The output is specific gravity.
Baume	Specific gravity is calculated as described above, and the result is used in the °Baumé equation. The output is specific gravity and °Baumé (light or heavy).
Brix	Specific gravity is calculated as described above and the result is used in the °Brix equation. The output is specific gravity and °Brix.
Plato	Specific gravity is calculated as described above, and the result is used n the °Plato equation. The output is specific gravity and °Plato.
Twaddell	Specific gravity is calculated as described above, and the result is used in the °Twaddell equation. The output is specific gravity and °Twaddell.

6. Enable or disable Matrix Switching as desired, and click Apply.

   When matrix switching is enabled and an extrapolation alert occurs, the transmitter automatically switches from the matrix in Slot 1 to the matrix in Slot 2, or vice versa. This occurs only if no extrapolation alert would be generated by the other matrix. Matrix switching is not applicable to any other slots.

Related information

Using equations to calculate specific gravity, °Baumé, °Brix, °Plato, and °Twaddell

Select the active concentration matrix using ProLink III

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.

1. Choose Device Tools > Configuration > Process Measurement > Concentration Measurement.

    The Concentration Measurement window is displayed. It is organized into steps that allow you to perform several different setup and configuration tasks. For this task, you will not use all the steps.

2. Scroll to Step 2, set Active Matrix to the matrix you want to use and click Change Matrix.

    Note
    To support matrix switching, you must select the matrix in Slot 1 or the matrix in Slot 2.

5.7.3 Using equations to calculate specific gravity, °Baumé, °Brix, °Plato, and °Twaddell

Whenever the derived variable is set to Specific Gravity, you have the option of using equations to calculate °Baumé, °Brix, °Plato, and °Twaddell, instead of matrix referral. Whenever the equation method is used, the active matrix is used to measure referred density. This value is used to calculate specific gravity. The result of the specific gravity calculation is then used in the equations used to calculate °Baumé, °Brix, °Plato, or °Twaddell.

Specific gravity is always calculated using the two reference temperatures that are specified during concentration measurement configuration.

If you are measuring in °Baumé, the meter will automatically select the appropriate equation according to the specific gravity of the process fluid, and will switch equations when specific gravity crosses 1.0.

Table 5-8: Equations used for specific gravity, °Baumé, °Brix, °Plato, and °Twaddell

Equation	Current value of specific gravity	Equation
Specific Gravity	N/A	$SG = \dfrac{\rho_{\text{RefTemp}}}{\rho_{\text{WaterRefTemp}}}$
°Baumé	1.0 or greater (°Baumé heavy)	$°\text{Baumé} = 145 - \dfrac{145}{SG}$
	Less than 1.0 (°Baumé light)	$°\text{Baumé} = \dfrac{140}{SG} - 130$

Table 5-8: Equations used for specific gravity, °Baumé, °Brix, °Plato, and °Twaddell *(continued)*

Equation	Current value of specific gravity	Equation
°Brix	N/A	$°\text{Brix} = 318.906 - \left(\frac{384.341}{\text{SG}}\right) + \left(\frac{66.1086}{\text{SG}^2}\right)$
°Plato	N/A	$°\text{Plato} = (668.72 \times \text{SG}) - 463.37 - \left(205.347 \times \text{SG}^2\right)$
°Twaddell	N/A	$°\text{Twaddell} = 200 \times (\text{SG} - 1)$

SG	Specific gravity of process fluid
ρ_{RefTemp}	Density of process fluid at Reference Temperature for Referred Density, as measured using the active concentration matrix
$\rho_{\text{WaterRefTemp}}$	Density of water at Reference Temperature for Water

Related information

Set reference temperature values for specific gravity using ProLink III

5.7.4 Matrix switching

Matrix switching can be used to measure different process fluids without resetting the active matrix manually. Matrix switching can also be used to increase measurement accuracy.

When matrix switching is enabled, the meter automatically switches between the matrices in Slot 1 and Slot 2 whenever an extrapolation alert is present for the active matrix but would not be generated by the other matrix. For example:

- The matrix in Slot 2 is active, the high-density extrapolation alert is enabled, and matrix switching is enabled. Line density goes above the range of the matrix plus the extrapolation limit. The meter posts an alert, then checks the range of the matrix in Slot 1. No extrapolation alert would be posted, so the meter automatically switches to the matrix in Slot 1.

- The matrix in Slot 2 is active, the high-density extrapolation alert is enabled, and matrix switching is enabled. Line density goes above the range of the matrix plus the extrapolation limit. The meter posts an alert, then checks the range of the matrix in Slot 1. The current line density would also generate an extrapolation alert for this matrix, so the meter does not switch.

You can control the conditions that trigger matrix switching by enabling or disabling specific extrapolation alerts. For example, if the low-density and high-density extrapolation alerts are enabled, but the low-temperature and high-temperature extrapolation alerts are disabled, matrix switching will be triggered only by changes in line density. Changes in line temperature will not trigger matrix switching.

Depending on your application, you may need to set up your matrices and extrapolation limits so that there is no overlap in density and/or temperature, or so that there is slight overlap.

Example: Using matrix switching to measure different process fluids

The line may contain either of two process fluids, depending on the current product. The matrix in Slot 1 is appropriate for the first process fluid. The matrix in Slot 2 is appropriate for the second process fluid. Whenever the line is switched, an extrapolation alert is posted for the current matrix, and the meter automatically switches to use the other matrix.

To ensure that the correct matrix is used, there can be no overlap between the ranges of the two matrices. In other words:

- If you are using density to trigger matrix switching, there can be no density values that are within the ranges of both matrices, after the extrapolation limits are applied.

- If you are using temperature to trigger matrix switching, there can be no temperature values that are within the ranges of both matrices, after the extrapolation limits are applied.

- If you are using both density and temperature to trigger matrix switching, there can be no density or temperature values that are within the ranges of both matrices, after the extrapolation limits are applied.

Example: Using matrix switching to increase measurement accuracy

For some process fluids, measurement accuracy is increased when the matrix has a narrower temperature or density range. By using two matrices with adjacent or slightly overlapping ranges, increased accuracy is available over a wider range of process variation.

To ensure continuous process measurement, there should be no gap between the ranges, after the extrapolation limits are applied.

6 Configure device options and preferences

Topics covered in this chapter:

- *Configure the transmitter display*
- *Enable or disable operator actions from the display*
- *Configure security for the display menus*
- *Configure alert handling*
- *Configure informational parameters*

6.1 Configure the transmitter display

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

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.

- *Configure the language used for the display* (Section 6.1.1)
- *Configure the process variables and diagnostic variables shown on the display* (Section 6.1.2)
- *Configure the number of decimal places (precision) shown on the display* (Section 6.1.3)
- *Configure the refresh rate of data shown on the display* (Section 6.1.4)
- *Enable or disable automatic scrolling through the display variables* (Section 6.1.5)

6.1.1 Configure the language used for the display

Display	OFF-LINE MAINT > OFF-LINE CONFG > DISPLAY > LANG
ProLink III	Device Tools > Configuration > Transmitter Display > General
Fieldbus host	Local Display TB > Language (OD Index 018)

Overview

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

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

Select the language you want to use.

The languages available depend on your transmitter model and version.

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

Display	*Not available*
ProLink III	Device Tools > Configuration > Transmitter Display > Display Variables
Fieldbus host	Local Display TB > Display Variable *x* (OD Index 019–033)

Overview

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

You cannot set Display Variable 1 to None or to a diagnostic variable. Display Variable 1 must be set to a 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.

Procedure

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

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

Display	*Not available*
ProLink III	Device Tools > Configuration > Transmitter Display > Display Variables
Fieldbus host	Local Display TB > Process Variable (OD Index 034)
	Local Display TB > Number of Decimals (OD Index 035)

Overview

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.

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. 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.

6.1.4   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
Fieldbus host	Local Display TB > Refresh Rate (OD Index 036)

Overview

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

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

Set Refresh Rate to the desired value.

The default value is 1000 milliseconds. The range is 100 milliseconds to 10,000 milliseconds (10 seconds).

6.1.5   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
Fieldbus host	Local Display TB > Auto Scroll (OD Index 010)
	Local Display TB > Scroll Time (OD Index 016)

Overview

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.

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.   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 (de-fault)	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.

6.2 Enable or disable operator actions from the display

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

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.

- *Enable or disable the Acknowledge All Alerts display command* (Section 6.2.1)

6.2.1 Enable or disable the Acknowledge All Alerts display command

Display	OFF-LINE MAINT > OFF-LINE CONFG > DISPLAY > ACK
ProLink III	Device Tools > Configuration > Transmitter Display > Ack All
Fieldbus host	Local Display TB > Acknowledge All Alerts (OD Index 014)

Overview

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

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. 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.

6.3 Configure security for the display menus

Display	OFF-LINE MAINT > OFF-LINE CONFG > DISPLAY
ProLink III	Device Tools > Configuration > Transmitter Display > Display Security
Fieldbus host	Local Display TB > Offline Menu (OD Index 011)
	Local Display TB > Offline Menu Passcode Required (OD Index 012)
	Local Display TB > Alert Menu (OD Index 013)

Overview

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

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

Option	Description
Enabled **(default)**	Operator can access the maintenance section of the off-line menu. This access is required for configuration and calibration, including Known Density Verification.
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 Known Density Verification, configuration, or calibration.

Option	Description
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 off-line menu, enable or disable Off-Line Password.

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

4. Set Off-Line Password to the desired value.

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

Tip

Record your password for future reference.

6.4 Configure alert handling

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

- *Configure Fault Timeout* (Section 6.4.1)
- *Configure Status Alert Severity* (Section 6.4.2)

6.4.1 Configure Fault Timeout

Display	*Not available*
ProLink III	Device Tools > Configuration > Fault Processing
Fieldbus host	Diagnostic TB > Fault Timeout Value (OD Index 016)

Overview

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. 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.

6.4.2   Configure Status Alert Severity

Display	*Not available*
ProLink III	Device Tools > Configuration > Alert Severity
Fieldbus host	DiagnosticsTB > Alert Index (OD Index 017)
	DiagnosticsTB > Alert Severity (OD Index 018)

Overview

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

Restrictions

- 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

Micro Motion recommends using 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 returns to green.
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 returns to green.

Status alerts and options for Status Alert Severity

Table 6-1: Status alerts and Status Alert Severity

Alert number	Alert title	Default severity	User can reset severity
A001	EEPROM Error	Fault	No
A002	RAM Error	Fault	No
A003	No Sensor Response	Fault	Yes
A004	Temperature Overrange	Fault	No
A005	Velocity Overrange	Fault	Yes
A006	Characterization Required	Fault	Yes
A008	Density Overrange	Fault	Yes
A009	Transmitter Initializing/Warming Up	Ignore	Yes
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 Temperature (RTD) Failure	Fault	Yes

Table 6-1: Status alerts and Status Alert Severity *(continued)*

Alert number	Alert title	Default severity	User can reset severity
A017	Sensor Case Temperature (RTD) Failure	Informational	Yes
A018	EEPROM Error (Transmitter)	[please verify] Informational	[please verify] Yes
A019	RAM Error (Transmitter)	[please verify] Informational	[please verify] Yes
A020	Calibration Factors Missing	Fault	Yes
A021	Transmitter/Sensor/Software Mismatch	Fault	No
A026	Sensor/Transmitter Communications Failure	[please verify] Informational	[please verify] Yes
A029	Internal Electronics Failure	Fault	No
A030	Incorrect Board Type	Fault	No
A033	Insufficient Pickoff Signal	Fault	Yes
A037	Sensor Check Failed	Fault	Yes
A102	Drive Overrange	Informational	Yes
A104	Calibration in Progress	Informational	To Informational or Ignore only
A105	Two-Phase Flow	Informational	Yes
A107	Power Reset Occurred	Informational	Yes
A115	No External Input or Polled Data	Informational	Yes
A116	Temperature Overrange (API Referral)	Informational	Yes
A117	Density Overrange (API Referral)	Informational	Yes
A120	Curve Fit Failure (Concentration)	Informational	No
A121	Extrapolation Alert (Concentration)	Informational	Yes
A122	Pressure Overrange (API Referral)	Informational	Yes
A133	EEPROM Error (Display)	Informational	Yes
A134	Tube-Case Temperature Difference Overrange	Informational	Yes
A136	Incorrect Display Type	Informational	Yes

6.5   Configure informational parameters

Display	*Not available*
ProLink III	Device Tools > Configuration > Meter Information
Fieldbus host	Device Info TB

Overview

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

Procedure

Enter data as desired.

Parameter	Description
Meter Serial Number	The serial number of the device. Enter the value from the device tag.
Message	A message to be stored in device memory. The message can contain up to 32 characters.
Descriptor	A description of this device. The description can contain up to 16 characters.
Date	A static date (not updated by the meter). Enter the date in the form mm/dd/yyyy.
Flange Type	The sensor flange type for this device. Obtain the value from the documents shipped with the device or from a code in the model number.

Tips

- The Field Communicator does not support all informational parameters. If you need to configure all of the informational parameters, use ProLink III.

- The Field Communicator allows you to configure HART Tag and HART Long Tag from this location. These parameters are replicated from Configure > Manual Setup > HART > Communications. These parameters are used in HART communications.

7   Completing the configuration

Topics covered in this chapter:

- *Back up transmitter configuration*
- *Return function blocks to In Service (Auto) mode*

7.1   Back up transmitter configuration

ProLink II and ProLink III provide 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. It is also a convenient way to replicate a configuration across multiple devices.

Restriction

This function is not available with any other communications tools.

Procedure

To back up the transmitter configuration using ProLink III:

1. Choose Device Tools > Configuration Transfer > Save or Load Configuration Data.

2. In the Configuration groupbox, select the configuration data you want to save.

3. Click Save, then specify a file name and location on your computer.

4. 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.

7.2   Return function blocks to In Service (Auto) mode

Display	*Not available*
ProLink III	*Not applicable*
Fieldbus host	All TBs > MODE_BLOCK (OD Index Number 005)

Overview

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

Part III

Operations, maintenance, and troubleshooting

Chapters covered in this part:

- *Transmitter operation*
- *Measurement support*
- *Troubleshooting*

8   Transmitter operation

Topics covered in this chapter:

- *Record the process variables*
- *View process variables*
- *View and acknowledge status alerts*

8.1   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.

Variable	Measurement		
	Typical average	**Typical high**	**Typical low**
Density, Concentration, or °API			
Velocity			
Line Temperature			
Tube-Case Temperature Difference			
Sensor Time Period			
Input Voltage			
Drive Gain			

8.2   View 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.

- *View process variables using the display*   (Section 8.2.1)
- *View process variables and other data using ProLink III*   (Section 8.2.2)

8.2.1 View process variables using the display

View the desired process variable(s).

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/CM3).

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.

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.

Figure 8-1: Transmitter display features
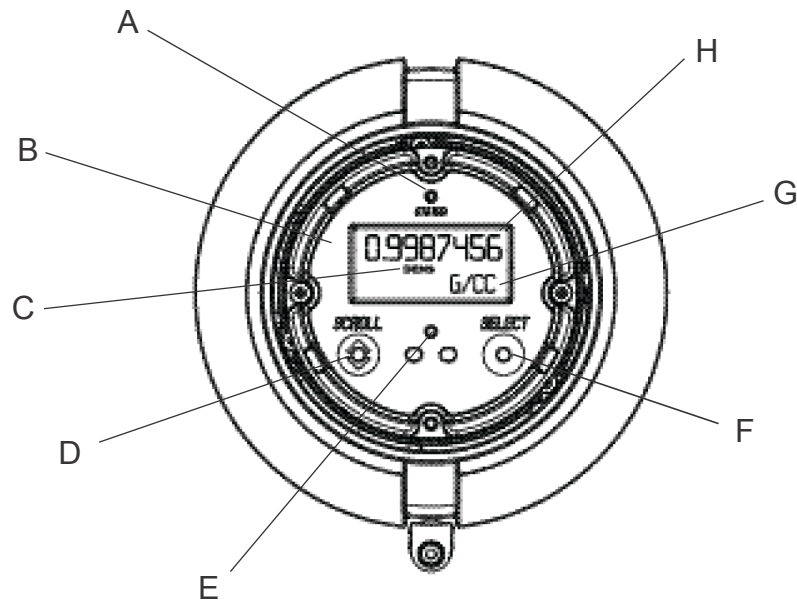
A. Status LED
B. Display (LCD panel)
C. Process variable
D. Scroll optical switch
E. Optical switch indicator: turns red when either Scroll or Select is activated
F. Select optical switch
G. Unit of measure for process variable
H. Current value of process variable

8.2.2   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.

8.3   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.

- *View and acknowledge alerts using the display*   (Section 8.3.1)
- *View and acknowledge alerts using ProLink III*   (Section 8.3.2)
- *View alerts using a fieldbus host*   (Section 8.3.3)

8.3.1   View and acknowledge alerts using the display

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

Note

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

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.

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.

Procedure

See *Figure 8-2*.

Figure 8-2: Using the display to view and acknowledge the status alerts
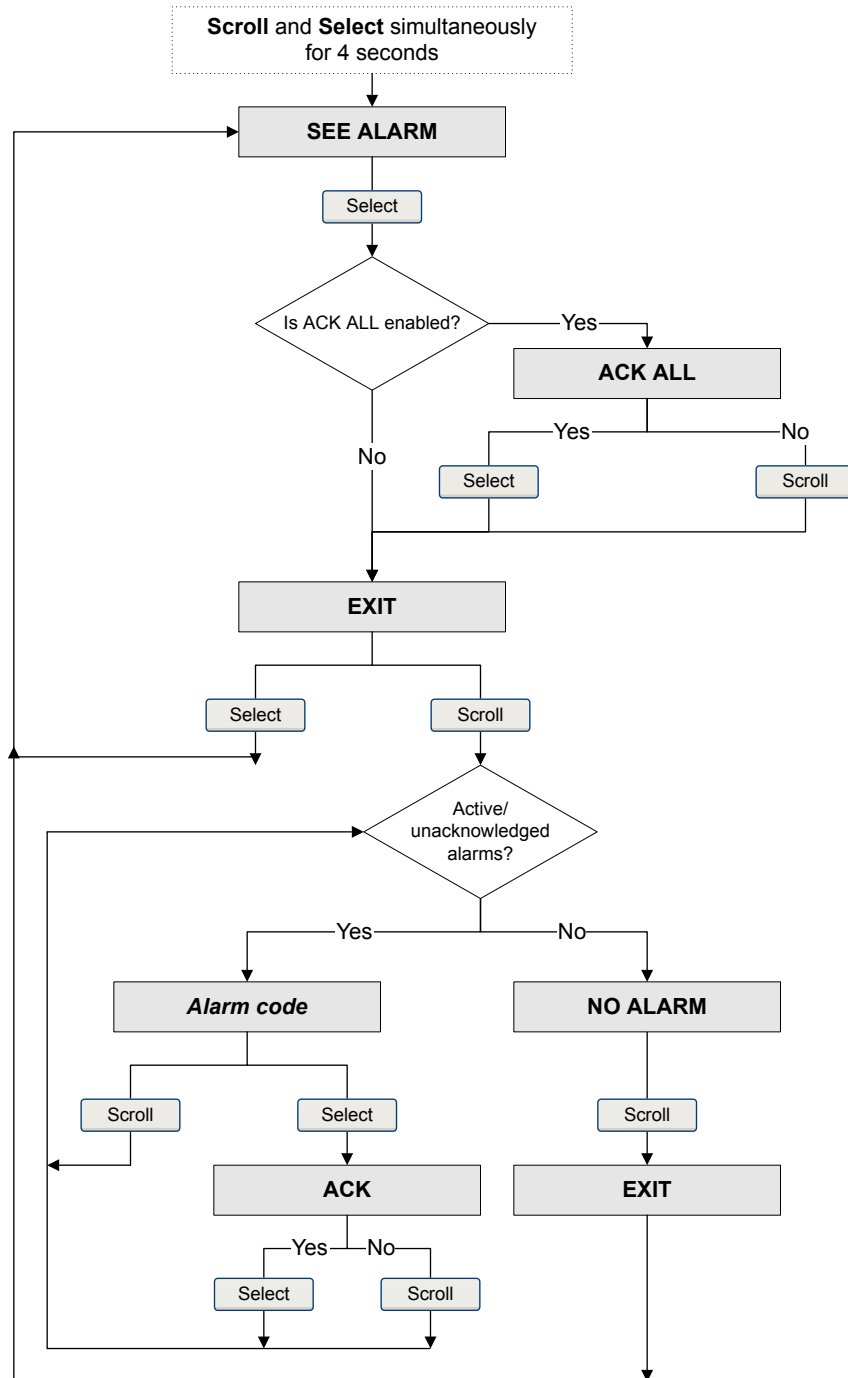
Postrequisites

- To clear the following alerts, you must correct the problem, acknowledge the alert, then power-cycle the transmitter: .

- 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

8.3.2 View and acknowledge alerts using ProLink III

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

1. View alerts on the ProLink III main screen under Alerts.

    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: .

- 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

8.3.3 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.

- 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:

  1. 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)

  2. For each active alert, obtain the alert detail by reading the status words (OD Index 11, 12, 13, 14, 114) from the Diagnostic transducer block.

Related information

Alert data in transmitter memory
Resource block
Diagnostic transducer block and related information

8.3.4 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

Table 8-1: Alert data in transmitter memory

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

Table 8-1: Alert data in transmitter memory *(continued)*

Alert data structure	Transmitter action if condition occurs	
	Contents	**Clearing**
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

9 Measurement support

Topics covered in this chapter:

- *Perform the Known Density Verification procedure*
- *Adjust density measurement with Density Offset or Density Meter Factor*
- *Perform density offset calibration*
- *Adjust temperature measurement with Temperature Offset*
- *Adjust concentration measurement with Trim Offset*
- *Adjust concentration measurement with Trim Offset and Trim Slope*
- *Set up user-defined calculations*

9.1 Perform the Known Density Verification procedure

The Known Density Verification procedure is used to verify that the meter's current operation matches the factory baseline. If the meter passes the test, the meter does not have any physical problems such as denting, bending, twisting, erosion, or corrosion.

- *Perform the Known Density Verification procedure using the display*   (Section 9.1.1)
- *Perform the Known Density Verification procedure using ProLink III*   (Section 9.1.2)
- *Perform the Known Density Verification procedure using a fieldbus host* (Section 9.1.3)

9.1.1 Perform the Known Density Verification procedure using the display

The Known Density Verification procedure is used to verify that the meter's current operation matches the factory baseline. If the meter passes the test, the meter does not have any physical problems such as denting, bending, twisting, erosion, or corrosion.

> **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.

Prerequisites

Power down the meter, remove the meter from the process, and place it in a protected stable environment.

Ensure that the sensor tubes are clean and dry.

Minimize variation in ambient temperature.

Eliminate or minimize vibration.

Power up the meter.

Procedure

1. Enter the Off-Line Maintenance menu and scroll to RUN KDV.

2. Set Alt to the value that is closest to the altitude of your meter, measured from sea level.

    a. Activate SCROLL to move through the list of options.

        The options are 0000, 1000 feet, 2000 feet, 3000 feet, 4000 feet, 5000 feet, 6000 feet, 500 meters, 1000 meters, and 2000 meters.

    b. When the correct value appears, activate SELECT and save the value to the meter.

3. When START KDV appears, activate SELECT.

4. Wait while the meter collects and analyzes process data.

    This step should be complete in approximately 20 seconds.

5. Check the results in the Results data display.

    - If all process variables passed the tests, no action is required. Click Close to exit the wizard.

    - If one or more process variables failed the test:

        - For problems with Line Temperature, Case Temperature, or Tube-Case Temperature Difference, verify that the ambient temperature of the meter is stable, and that the meter temperature has stabilized in the test location. Then retry the Known Density Verification procedure.

        - For problems with Verification Time Period Signal or Drive Gain, ensure that the meter is clean and dry. Then retry the Known Density Verification procedure.

        - If the Known Density Verification procedure continues to fail, contact Micro Motion customer service.

9.1.2 Perform the Known Density Verification procedure using ProLink III

The Known Density Verification procedure is used to verify that the meter's current operation matches the factory baseline. If the meter passes the test, the meter does not have any physical problems such as denting, bending, twisting, erosion, or corrosion.

Prerequisites

Power down the meter, remove the meter from the process, and place it in a protected stable environment.

Ensure that the sensor tubes are clean and dry.

Minimize variation in ambient temperature.

Eliminate or minimize vibration.

Power up the meter.

Procedure

1. Choose Device Tools > Diagnostics > Known Density Verification.
2. (Optional) Enter identification data.
3. Set Altitude to the value that is closest to the altitude of your meter, measured from sea level.

    Valid values are 0000 to 6000 feet, and 0000 to 2000 meters.
4. Click Start, then wait while the meter collects and analyzes process data.

    This step should be complete in approximately 20 seconds.
5. Check the results in the Results data display.

    - If all process variables passed the tests, no action is required. Click Close to exit the wizard.
    - If one or more process variables failed the test:
        - For problems with Line Temperature, Case Temperature, or Tube-Case Temperature Difference, verify that the ambient temperature of the meter is stable, and that the meter temperature has stabilized in the test location. Then retry the Known Density Verification procedure.
        - For problems with Verification Time Period Signal or Drive Gain, ensure that the meter is clean and dry. Then retry the Known Density Verification procedure.
        - If the Known Density Verification procedure continues to fail, contact Micro Motion customer service.

9.1.3 Perform the Known Density Verification procedure using a fieldbus host

The Known Density Verification procedure is used to verify that the meter's current operation matches the factory baseline. If the meter passes the test, the meter does not have any physical problems such as denting, bending, twisting, erosion, or corrosion.

Prerequisites

Power down the meter, remove the meter from the process, and place it in a protected stable environment.

Ensure that the sensor tubes are clean and dry.

Minimize variation in ambient temperature.

Eliminate or minimize vibration.

Power up the meter.

Procedure

1. Set KDV Altitude to the value that is closest to the altitude of your meter, measured from sea level: Density Viscosity Meter TB TB > DEN_ElevationAboveSeaLev (OD Index 123).

Code in decimal	Description
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

2. Write 1 to Density Viscosity Meter TB TB > DEN_StartHealthCheck (OD Index 9) to start the method, then wait while the meter collects and analyzes process data.

   This step should be complete in approximately 20 seconds.

3. Read the results in Density Viscosity Meter TB TB > DEN_HealthCheckResult (OD Index 105).

Code in decimal	Description
0	Good
2	Failed
3	Not run
4	In progress
5	No factory calibration

9.2 Adjust density measurement with Density Offset or Density Meter Factor

You can adjust the reported density measurement by modifying the value for Density Offset or Density Meter Factor. The measured density value is always multiplied by the density meter factor. The density offset is always added to the result.

The default value for Density Meter Factor is 1.0. The default value for Density Offset is 0. Accordingly, the default values have no effect on the reported density value.

Important

Density Offset and Density Meter Factor improve measurement accuracy only when the line temperature and line pressure of the sample are close to the line temperature and line pressure of the process.

Tip

If the density offset calibration procedure is available, use it to calculate a density offset value that is corrected to reference temperature and reference pressure. Density offset calibration is the preferred method to adjust density measurement.

Restriction

You cannot enter a density offset from the display. If you want to change the density offset manually, you must use ProLink III or the Field Communicator.

Prerequisites

You will need an external density measurement method that is highly accurate.

Ensure that your process is stable during the sampling procedure. Minimize variation in density, temperature, flow rate, and fluid composition. Minimize aeration.

Procedure

1. Take a density reading from the device.

   a. Ensure that line temperature and line pressure are at typical operating levels.

   b. Record the line temperature and line pressure.

   c. Record the measured density.

2. Immediately after the previous step, take a sample from a location as close to the device as possible.

3. Using the external measurement method, measure the density of the sample at line temperature and line pressure.

4. Use the following equation to calculate an appropriate value for Density Offset or Density Meter Factor.

$$\rho_{\text{Lab}} = \left(\rho_{\text{Line}} \times \text{DensityMeterFactor}\right) + \text{DensityOffset}$$

Tip

In most cases, you will calculate and set only one parameter. Follow the guidelines established for your site.

---

5. If you are using the offset to adjust density measurement, set Density Offset to the calculated value.

   • Using the display: Not available

   • Using ProLink III: Device Tools > Configuration > Process Measurement > Line Density > Density Offset

   • Using Foundation fieldbus: Density Viscosity Meter TB TB > DEN_DensityOffset (OD Index 44)

The default value for Density Offset is 0. The range is unlimited.

6. If you are using the meter factor to adjust density measurement, set Density Meter Factor to the calculated value.

- Using the display: OFF-LINE MAINT > OFF-LINE CAL > DENS MTR F
- Using ProLink III: Device Tools > Configuration > Process Measurement > Line Density > Density Meter Factor
- Using Foundation fieldbus: Density Viscosity Meter TB TB > DEN_DensityMeterFactor (OD Index 45)

The default value for Density Meter Factor is 1.0. The recommended range is 0.8 to 1.2. If your calculated meter factor is outside this range, contact Micro Motion customer service.

9.3 Perform density offset calibration

Density offset calibration is used to verify or adjust the value of Density Offset. Density Offset is always added to the measured density value after the density meter factor is applied, and before other processing is performed.

- *Perform density offset calibration using the display* (Section 9.3.1)
- *Perform density offset calibration using ProLink III* (Section 9.3.2)
- *Perform density offset calibration using a fieldbus host* (Section 9.3.3)

9.3.1 Perform density offset calibration using the display

Density offset calibration is used to verify or adjust the value of Density Offset. Density Offset is always added to the measured density value after the density meter factor is applied, and before other processing is performed.

The default value of Density Offset is 0.

Restriction

Density offset calibration is available only when API referral or concentration measurement is enabled on your meter. If neither of these is enabled, Density Offset must be entered manually.

Tip

Density offset calibration is the preferred method for calculating a density offset, because the procedure automatically corrects the data to reference temperature and reference pressure. If this procedure is available on your device, use it and do not set Density Offset manually.

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.

Prerequisites

Ensure that your process is stable during the calibration procedure. Minimize variation in density, temperature, flow rate, and fluid composition. Minimize aeration.

If concentration measurement is enabled on your meter, ensure that Active Matrix is set to the matrix that you want to calibrate.

Following the procedures defined in ASTM 1298 or API 555, obtain a laboratory reference value for the density of your process fluid at reference temperature and reference pressure.

Procedure

1. Navigate to the Density Offset Calibration wizard: OFF-LINE MAINT > OFF-LINE CAL > DENS CAL OFFSET and activate Select.

   If concentration measurement is enabled, the active matrix is displayed. Activate Scroll to continue. The current reference temperature is displayed.

2. Activate Scroll to move to the next step.

3. Enter the laboratory reference density and save it to the transmitter.

4. Activate Select to apply the offset, and wait for a few seconds while the calibration process is performed.

   If the calibration succeeded, the calculated density offset is displayed.

   If the calibration failed, Density Offset is reset to the original value.
   - Verify your laboratory reference value.
   - Ensure that your process was stable during the entire procedure.
   - Repeat the calibration.

5. Activate Scroll to view the referred density value.

   - For concentration measurement, Referred Density (Concentration) is displayed.
   - For API referral, Referred Density (API) is displayed.

6. To exit the calibration, activate Scroll, then activate Select.

9.3.2 Perform density offset calibration using ProLink III

Density offset calibration is used to verify or adjust the value of Density Offset. Density Offset is always added to the measured density value after the density meter factor is applied, and before other processing is performed.

The default value of Density Offset is 0.

Restriction

Density offset calibration is available only when API referral or concentration measurement is enabled on your meter. If neither of these is enabled, Density Offset must be entered manually.

Tip

Density offset calibration is the preferred method for calculating a density offset, because the procedure automatically corrects the data to reference temperature and reference pressure. If this procedure is available on your device, use it and do not set Density Offset manually.

Prerequisites

Ensure that your process is stable during the calibration procedure. Minimize variation in density, temperature, flow rate, and fluid composition. Minimize aeration.

If concentration measurement is enabled on your meter, ensure that Active Matrix is set to the matrix that you want to calibrate.

Following the procedures defined in ASTM 1298 or API 555, obtain a laboratory reference value for the density of your process fluid at reference temperature and reference pressure.

Procedure

1.   Navigate to the Density Offset Calibration wizard: Device Tools > Calibration > Density Offset > Density Offset Calibration.

2.   Enter the laboratory reference value for density.

3.   Click Apply Offset and wait for a few seconds while the calibration process is performed.

4.   For API referral: Check the values displayed in the Density Offset and Referred Density (API) fields.

     If the calibration succeeded:

     •   Density Offset displays the updated value for this parameter.

     •   Referred Density (API) shows this process variable with the new density offset applied. This value should match the laboratory reference value.

     If the calibration failed, Density Offset is reset to the original value.

     •   Verify your laboratory reference value.

     •   Ensure that your process was stable during the entire procedure.

     •   Repeat the calibration.

5.   For concentration measurement: Check the values displayed in the Density Offset and Referred Density (Concentration) fields.

     If the calibration succeeded:

     •   Density Offset displays the updated value for this parameter.

     •   Referred Density (Concentration) shows this process variable with the new density offset applied. This value should match the laboratory reference value.

     If the calibration failed, Density Offset is reset to the original value.

     •   Verify your laboratory reference value.

     •   Ensure that your process was stable during the entire procedure.

- Ensure that the active concentration matrix is valid.
- Repeat the calibration.

9.3.3 Perform density offset calibration using a fieldbus host

Density offset calibration is used to verify or adjust the value of Density Offset. Density Offset is always added to the measured density value after the density meter factor is applied, and before other processing is performed.

The default value of Density Offset is 0.

Restriction

Density offset calibration is available only when API referral or concentration measurement is enabled on your meter. If neither of these is enabled, Density Offset must be entered manually.

Tip

Density offset calibration is the preferred method for calculating a density offset, because the procedure automatically corrects the data to reference temperature and reference pressure. If this procedure is available on your device, use it and do not set Density Offset manually.

Prerequisites

Ensure that your process is stable during the calibration procedure. Minimize variation in density, temperature, flow rate, and fluid composition. Minimize aeration.

If concentration measurement is enabled on your meter, ensure that Active Matrix is set to the matrix that you want to calibrate.

Following the procedures defined in ASTM 1298 or API 555, obtain a laboratory reference value for the density of your process fluid at reference temperature and reference pressure.

Procedure

1. Enter the laboratory reference value: Density Viscosity Meter TB TB > DEN_LabDensity (OD Index 107).

2. Write 1 to Density Viscosity Meter TB TB > DEN_StartDensOffsetCal (OD Index 13) to start the density offset calibration.

3. Wait for a few seconds while the calibration process is performed.

4. Check the values.

   If the calibration succeeded:

   - The new density offset is stored in Density Viscosity Meter TB TB > DEN_DensityOffet (OD Index 44).

   - For API referral, the referred density value in API Referral TB > API_Corr_Density (OD Index 8) is updated with the new offset.

   - For concentration measurement, the referred density and concentration values in Concentration Measurement TB > OD Indexes 8, 9, 13, 14 are updated with the new offset.

If the calibration failed, Density Offset is reset to the original value.

- Verify your laboratory reference value.
- Ensure that your process was stable during the entire procedure.
- Repeat the calibration.

9.4 Adjust temperature measurement with Temperature Offset

You can adjust the reported temperature measurement by modifying the value for Temperature Offset. The temperature offset is always added to the measured temperature value.

Meter-specific temperature calibration factors are determined at the factory. These values are available on the meter tag. Temperature Offset is applied after the temperature calibration factors.

The default value for Temperature Offset is 0. Accordingly, the default value has no effect on the reported temperature value.

Note

Temperature offset is applied only to temperature data from the on-board temperature sensors (RTD). External temperature data is not adjusted.

Prerequisites

You will need an external temperature measurement method that is highly accurate.

Ensure that your process is stable during the sampling procedure. Minimize variation in density, temperature, flow rate, and fluid composition. Minimize aeration.

Procedure

1. Take a temperature reading from the meter.
2. Immediately after the previous step, take a sample from a location as close to the meter as possible.
3. Using the external measurement method, measure the temperature of the sample.
4. Subtract the measured temperature value from the externally measured value.
5. Set Temperature Offset to the result.

   - Using the display: Not available
   - Using ProLink III: Device Tools > Configuration > Process Measurement > Line Temperature > Temperature Offset
   - Using Foundation fieldbus: Calibration TB > TEMP_OFFSET (OD Index 39)

   The default value is 0. The range is unlimited.

9.5 Adjust concentration measurement with Trim Offset

Trim Offset adjusts the meter's concentration measurement to match a reference value.

Tip

You can adjust concentration measurement by applying the trim offset only, or by applying both the trim offset and the trim slope. For most applications, the trim offset is sufficient.

Prerequisites

You must be able to take a sample of your process fluid and obtain a laboratory concentration value at line density and line temperature.

Procedure

1. Take a concentration reading from the meter, and record line density and line temperature.

2. Take a sample of the process fluid and obtain a laboratory value for concentration at line density and line temperature, in the units used by the meter.

3. Subtract the meter value from the laboratory value.

4. Enter the result as the trim offset.

   - Using the display: Not available

   - Using ProLink III: Device Tools > Configuration > Process Measurement > Concentration Measurement

   - Using a fieldbus host: Concentration Measurement TB > ED_Slope_Offset (OD Index 42)

5. Take another concentration reading from the meter, and compare it to the laboratory value.

   - If the two values are acceptably close, the trim is complete.

   - If the two values are not acceptably close, repeat this procedure.

Example: Calculating the trim offset

Laboratory value	64.21 °Brix
Meter value	64.93 °Brix

$$64.21 - 64.93 = -0.72$$

Concentration offset: −0.72

Related information

Adjust concentration measurement with Trim Offset and Trim Slope

9.6 Adjust concentration measurement with Trim Offset **and** Trim Slope

Trim Offset and Trim Slope adjust the meter's concentration measurement to match a reference value.

Tip

You can adjust concentration measurement by applying the trim offset only, or by applying both the trim offset and the trim slope. For most applications, the trim offset is sufficient.

Prerequisites

You must be able to take measurements of your process fluid at two different concentrations.

You must be able to take a sample of your process fluid at each of these concentrations.

For each sample, you must be able to obtain a laboratory concentration value at line density and line temperature.

Procedure

1. Collect data for Comparison 1.

    a. Take a concentration reading from the meter and record line density and line temperature.

    b. Take a sample of the process fluid at the current concentration.

    c. Obtain a laboratory value for concentration at line density and line temperature, in the units used by the meter.

2. Collect data for Comparison 2.

    a. Change the concentration of your process fluid.

    b. Take a concentration reading from the meter and record line density and line temperature.

    c. Take a sample of the process fluid at the current concentration.

    d. Obtain a laboratory value for concentration at line density and line temperature, in the units used by the meter.

3. Populate the following equation with values from each comparison.

$$\text{Concentration}_{\text{Lab}} = \left(A \times \text{Concentration}_{\text{Meter}} \right) + B$$

4. Solve for A (slope).

5. Solve for B (offset), using the calculated slope and one set of values.

6. Enter the results as the trim slope and the trim offset.

    - Using the display: Not available

    - Using ProLink III: Device Tools > Configuration > Process Measurement > Concentration Measurement

- Using a fieldbus host:
  - Concentration Measurement TB > ED_Slope_Trim (OD Index 41)
  - Concentration Measurement TB > ED_Slope_Offset (OD Index 42)

7. Take another concentration reading from the meter, and compare it to the laboratory value.

- If the two values are acceptably close, the trim is complete.
- If the two values are not acceptably close, repeat this procedure.

Example: Calculating the trim offset and the trim slope

Comparison 1	Laboratory value	50.00%
	Meter value	49.98%
Comparison 2	Laboratory value	16.00%
	Meter value	15.99%

Populate the equations:

$$50 = (A \times 49.98) + B$$

$$16 = (A \times 15.99) + B$$

Solve for A:

$$50.00 - 16.00 = 34.00$$

$$49.98 - 15.99 = 39.99$$

$$34 = A \times 33.99$$

$$A = 1.00029$$

Solve for B:

$$50.00 = (1.00029 \times 49.98) + B$$

$$50.00 = 49.99449 + B$$

$$B = 0.00551$$

Concentration slope (A): 1.00029

Concentration offset (B): 0.00551

Related information

Adjust concentration measurement with Trim Offset

9.7   Set up user-defined calculations

Display	*Not available*
ProLink III	Device Tools > Configuration > User-Defined Calculations
Fieldbus host	Density Viscosity Meter TB > DEN_ProgrammableConstA (OD Index 57)
	Density Viscosity Meter TB > DEN_ProgrammableConstB (OD Index 58)
	Density Viscosity Meter TB > DEN_ProgrammableConstC (OD Index 59)
	Density Viscosity Meter TB > DEN_ProgrammableConstE (OD Index 60)
	Density Viscosity Meter TB > DEN_ProgrammableConstF (OD Index 61)
	Density Viscosity Meter TB > DEN_ProgrammableValA (OD Index 62)
	Density Viscosity Meter TB > DEN_ProgrammableValB (OD Index 63)
	Density Viscosity Meter TB > DEN_ProgrammableValC (OD Index 64)
	Density Viscosity Meter TB > DEN_ProgrammableValD (OD Index 65)
	Density Viscosity Meter TB > DEN_ProgrammableValE (OD Index 66)
	Density Viscosity Meter TB > DEN_ProgrammableValF (OD Index 67)
	Density Viscosity Meter TB > DEN_ProgrAirWaterDensity (OD Index 74)
	Density Viscosity Meter TB > DEN_SpecialEqnLabel (OD Index 76)

Overview

User-defined calculations are used to enhance measurement or to adapt the meter to special process conditions.

A user-defined calculation allows you to create a new process variable by inserting constants and existing process variables into an equation. The output of the equation is the new process variable. Depending on your meter, either two or three equations are available.

Procedure

1. Select the user-defined calculation that you want to use.
2. If you selected User-Defined Calculation 1:

    a. Enter the values to be used for the constants: A, B, X, Y.

    b. Enter the values to be used for *a*, *b*, *c*, *d*, *e*, and *f*.

    For these terms:
    *   You can specify a constant value.
    *   You can specify a process variable. If you choose this, the current value of the process variable is used in the calculation.

Important

User-defined calculations are performed using the meter's internal measurement units. Therefore:
*   If a constant represents a process variable, you must enter its value in the internal measurement units.

- If a constant will be used to modify a process variable, you must use the internal measurement units to derive the constant.

3. If you selected User-Defined Calculation 2:

   a. Enter the values to be used for the constants: A, B, C.

   b. Enter the value to be used for *t*.

      For this term:
      - You can specify a constant value.
      - You can specify a process variable. If you choose this, the current value of the process variable is used in the calculation.

   Important

   User-defined calculations are performed using the meter's internal measurement units. Therefore:
   - If a constant represents a process variable, you must enter its value in the internal measurement units.
   - If a constant will be used to modify a process variable, you must use the internal measurement units to derive the constant.

4. If you selected User-Defined Calculation 3:

   a. Enter the values to be used for the constants: A, B, C, E, F.

   b. Enter the value to be used for ρ_W (the density of water at reference temperature and reference pressure)

   Restriction

   User-Defined Calculation 3 is available only if the concentration measurement application is enabled and a matrix is active.

   Important

   User-defined calculations are performed using the meter's internal measurement units. Therefore:
   - If a constant represents a process variable, you must enter its value in the internal measurement units.
   - If a constant will be used to modify a process variable, you must use the internal measurement units to derive the constant.

5. Enter a label to be used for the output of the user-defined calculation (the new process variable).

6. (Optional) Set up a reporting method for the new process variable.

   The new process variable can be configured as a display variable or assigned to the AI function block.

Important

The output of the user-defined calculation is based on internal measurement units for process variables. You may need to convert this value to the configured units before using it in your application or process.

Related information

9.7.1   Equations used in user-defined calculations

Each user-defined calculation has an equation and a set of user-programmable constants and/or user-specified process variables.

Equation 9-1: User-defined calculation 1 (square root)

$$y = A + B \times \left(\frac{a \times (b + (X \times c))}{d \times (e + (Y \times \sqrt{f}))} \right)$$

A, B, X, Y	User-programmable constants
a, b, c, d, e, f	User-programmable constants or user-specified process variables
y	Result of calculation

Equation 9-2: User-defined calculation 2 (exponential)

$$y = e^{\left(A + (B \times t) + \left(C \times t^2\right)\right)}$$

e	Natural logarithm
A, B, C	User-programmable constants
t	User-programmable constant or user-specified process variable
y	Result of calculation

Equation 9-3: User-defined calculation 3 (quartic)

$$y = A + B \times \left(\frac{\rho_B}{\rho_W} \right) + C \times \left(\frac{\rho_B}{\rho_W} \right)^2 + E \times \left(\frac{\rho_B}{\rho_W} \right)^3 + F \times \left(\frac{\rho_B}{\rho_W} \right)^4$$

A, B, C, E, F	User-programmable constants
ρ_W	Density of water at reference temperature and reference pressure, user-programmable
ρ_B	Referred density from the concentration measurement application
y	Result of calculation

9.7.2   Measurement units used in user-defined calculations

The meter's internal measurement units are used for all process variables referenced by a user-defined calculation. All constants must be entered in the internal measurement units or derived using the internal measurement units.

Table 9-1:   Process variables and internal measurement units

Process variable	Internal measurement unit
Density	g/cm³
Referred Density	g/cm³
Velocity	m/sec
Line Temperature	°C
Case Temperature	°C
External Temperature	°C
Board Temperature	°C
Tube-Case Temperature Difference	°C
Drive Gain	%
Concentration	%
Line Pressure	Bar g
Sensor Time Period	Microseconds
Specific Gravity (concentration measurement)	Unitless

Micro Motion® Compact Density Meters (CDM) with Foundation™ Fieldbus

10 Troubleshooting

Topics covered in this chapter:

10.1 Quick guide to troubleshooting

The meter may report or exhibit issues that are caused by installation problems, wiring problems, configuration problems, process problems, problems with external devices, or mechanical issues with the sensor itself.

To identify and resolve problems as effectively as possible, work through the following list of suggestions:

- If this is a first installation:
  - Verify the power wiring and power supply.
  - Verify the communications wiring and configuration.
  - Verify the grounding.
  - Verify cable shielding.
  - Check the sensor installation and orientation. Ensure that it is appropriate for your application.
  - Ensure that the installation meets temperature and/or pressure requirements.
- Check for active status alerts and follow the recommendations.

- If the device appears to be functioning correctly, but the process data is not acceptable, review the symptoms and suggestions in the following sections:
  - Density measurement problems (see *Section 10.6*)
  - Temperature measurement problems (see *Section 10.7*)
  - API referral problems (see *Section 10.8*)
  - Concentration measurement problems (see *Section 10.9*)
  - Velocity measurement problems (see *Section 10.10*)

- If the device appears to be functioning correctly, but the process is not responding as expected:
  - Verify the communications wiring and configuration.
  - Ensure that all devices on the network are operational, are receiving data, and are configured appropriately.

10.2   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.

Procedure

1. Use a voltmeter to test the voltage at the transmitter's 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. Before inspecting the power supply wiring, disconnect the power source.

   ### ⚠ CAUTION!

   If the transmitter is in a hazardous area, wait five minutes after disconnecting the power.

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. Reapply power to the transmitter.

> ⚠ **CAUTION!**
>
> **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.**

7.   Test the voltage at the terminals.

If there is no power, contact Micro Motion customer service.

10.3   Check grounding

The sensor and the transmitter must be grounded.

Prerequisites

You will need:

- 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.

10.4   Status LED states

The status LED on the transmitter indicates whether or not alerts are active. If alerts are active, view the alert list to identify the alerts, then take appropriate action to correct the alert condition.

Your meter has one or two status LEDs:

- A status LED on the display (only if your meter has a display)
- A status LED on the board, beneath the meter housing cover

> ⚠ **CAUTION!**
>
> **If your meter is in a hazardous area, do not remove the meter housing cover. Use a different method to determine meter status.**

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.

The status LEDs use colors and flashing to indicate device status.

Table 10-1: Transmitter status reported by status LED

LED state	Description	Recommendation
Green	No alerts are active.	Continue with configuration or process measurement.
Flashing green	No alerts are active. One or more previously active alerts have not been acknowledged.	Continue with configuration or process measurement. If you choose, you can acknowledge the alerts.
Yellow	One or more low-severity alerts are active, and have been acknowledged.	A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement. If you choose, you can identify and resolve the alert condition.
Flashing yellow	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. If you choose, you can identify and resolve the alert condition. You may also acknowledge the alert.
Red	One or more high-severity alerts are active, and have been acknowledged.	A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing.
Flashing red	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. You may also acknowledge the alert.

Related information

View and acknowledge status alerts

10.5   Status alerts, causes, and recommendations

Alert number	Alert title	Possible cause	Recommended actions
A001	EEPROM Error	The transmitter has detected a problem communicating with the sensor.	• Cycle power to the meter. • Contact Micro Motion.
A002	RAM Error	The transmitter has detected a problem communicating with the sensor.	• Cycle power to the meter. • Contact Micro Motion.

Alert number	Alert title	Possible cause	Recommended actions
A003	No Sensor Response	The transmitter is not receiving one or more basic electrical signals from the sensor.	• Check the drive gain and the pickoff voltage. See *Section 10.15* and *Section 10.16*. • Check the wiring between the sensor and the transmitter. See *Section 10.11*. • Check the integrity of the sensor tubes.
A004	Temperature Overrange	The RTD resistance is out of range for the sensor.	• Check your process conditions against the values reported by the device. • Verify temperature characterization or calibration parameters. • Check the wiring between the sensor and the transmitter. See *Section 10.11*. • Contact Micro Motion.
A005	Velocity Overrange	The measured velocity is greater than the maximum velocity limit of the sensor (ΔT greater than 200 µs).	• If other alerts are present, resolve those alert conditions first. If the current alert persists, continue with the recommended actions. • Check your process conditions against the values reported by the device. • Check for two-phase flow. See *Section 10.14*.
A006	Characterization Required	Calibration factors have not been entered, or the sensor type is incorrect, or the calibration factors are incorrect for the sensor type.	• Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter. • Contact Micro Motion.
A008	Density Overrange	The line density is greater than 3 g/cm^3 (3000 kg/m^3).	• If other alerts are present, resolve those alert conditions first. If the current alert persists, continue with the recommended actions. • Check for two-phase flow. See *Section 10.14*. • Check for foreign material in the process gas or fluid, coating, or other process problems. • Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter. • Check the drive gain and the pickoff voltage. See *Section 10.15* and *Section 10.16*. • Perform Known Density Verification. • Contact Micro Motion.

Alert number	Alert title	Possible cause	Recommended actions

A009	Transmitter Initializing/Warming Up	Transmitter is in power-up mode.	• Allow the meter to complete its power-up sequence. The alert should clear automatically.
			• If other alerts are present, resolve those alert conditions first. If the current alert persists, continue with the recommended actions.
			• Check the wiring between the sensor and the transmitter. See *Section 10.11*.
			• Verify that the transmitter is receiving sufficient power.
			  - If it is not, correct the problem and cycle power to the meter.
			  - If it is, this suggests that the transmitter has an internal power issue. Replace the transmitter.

A010	Calibration Failure	Many possible causes. This alert will not clear until you cycle power to the meter.	• Ensure that your calibration procedure meets the documented requirements, cycle power to the meter, then retry the procedure. • If this alert appears during zeroing, verify that there is no flow through the sensor, cycle power to the meter, then retry the procedure.
A011	Zero Calibration Failed: Low	Many possible causes, such as too much flow, especially reverse flow, through the sensor during a calibration procedure, or a zero result that is too low. This alert is accompanied by A010. This alert will not clear until you cycle power to the meter.	• Verify that there is no flow through the sensor, cycle power to the meter, then retry the procedure.
A012	Zero Calibration Failed: High	Many possible causes, such as too much flow, especially forward flow, through the sensor during a calibration procedure, or a zero result that is too high. This alert is accompanied by A010. This alert will not clear until you cycle power to the meter.	• Verify that there is no flow through the sensor, cycle power to the meter, then retry the procedure.
A013	Zero Calibration Failed: Unstable	There was too much process instability during the calibration procedure. This alert will not clear until you cycle power to the meter.	• Remove or reduce sources of electro-mechanical noise (e.g., pumps, vibration, pipe stress), cycle power to the meter, then retry the procedure.

Alert number	Alert title	Possible cause	Recommended actions
A014	Transmitter Failure	Many possible causes.	• Ensure that all wiring compartment covers are installed correctly. • Ensure that all transmitter wiring meets specifications and that all cable shields are properly terminated. • Check the grounding of all components. See *Section 10.3*. • Evaluate the environment for sources of high electromagnetic interference (EMI) and relocate the transmitter or wiring as necessary. • Contact Micro Motion.
A016	Sensor Temperature (RTD) Failure	The value computed for the resistance of the line RTD is outside limits.	• Check your process conditions against the values reported by the device. • Check the wiring between the sensor and the transmitter. See *Section 10.11*. • Contact Micro Motion.
A017	Sensor Case Temperature (RTD) Failure	The values computed for the resistance of the meter and case RTDs are outside limits.	• Check your process conditions against the values reported by the device. Temperature should be between −200 °F and +400 °F. • Check the wiring between the sensor and the transmitter. See *Section 10.11*. • Contact Micro Motion.
A018	EEPROM Error (Transmitter)	The transmitter has experienced a memory error. This alert will not clear until you cycle power to the meter.	• Ensure that all wiring compartment covers are installed correctly. • Ensure that all transmitter wiring meets specifications and that all cable shields are properly terminated. • Check the grounding of all components. See *Section 10.3*. • Evaluate the environment for sources of high electromagnetic interference (EMI) and relocate the transmitter or wiring as necessary. • Cycle power to the meter. • If the alert persists, replace the transmitter. • Contact Micro Motion.

Alert number	Alert title	Possible cause	Recommended actions
A019	RAM Error (Transmitter)	The transmitter has experienced a memory error. This alert will not clear until you cycle power to the meter.	• Ensure that all wiring compartment covers are installed correctly. • Ensure that all transmitter wiring meets specifications and that all cable shields are properly terminated. • Check the grounding of all components. See *Section 10.3*. • Evaluate the environment for sources of high electromagnetic interference (EMI) and relocate the transmitter or wiring as necessary. • Cycle power to the meter. • If the alert persists, replace the transmitter. • Contact Micro Motion.
A020	Calibration Factors Missing	Some calibration factors have not been entered or are incorrect.	• Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter.
A021	Transmitter/Sensor/ Software Mismatch	The configured board type does not match the physical board.	• Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter. • Ensure that the correct board is installed.
A029	Internal Electronics Failure	This can indicate a loss of communication between the transmitter and the display module.	• Cycle power to the meter. • Replace the display module. • Contact Micro Motion.
A033	Insufficient Pickoff Signal	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.	• Check for foreign material in the process gas or fluid, coating, or other process problems. • Check for fluid separation by monitoring the density value and comparing the results against expected density values. • Ensure that the sensor orientation is appropriate for your application. Settling from a two-phase or three-phase fluid can cause this alert.
A037	Sensor Check Failed	Known Density Verification failed.	• Check the subtest results and perform the recommended actions. • Retry the test. • Contact Micro Motion.
A038	Time Period Signal Out of Range	The time period signal is outside the limits for the sensor type.	• Check your process conditions against the values reported by the device.

Alert number	Alert title	Possible cause	Recommended actions
A102	Drive Overrange	The drive power (current/voltage) is at its maximum.	• Check the drive gain and the pickoff voltage. See *Section 10.15* and *Section 10.16*. • Check the wiring between the sensor and the transmitter. See *Section 10.11*. • Check for foreign material in the process gas or fluid, coating, or other process problems. • Check for fluid separation by monitoring the density value and comparing the results against expected density values. • Ensure that the sensor orientation is appropriate for your application. Settling from a two-phase or three-phase fluid can cause this alert.
A104	Calibration in Progress	A calibration procedure is in process.	• Allow the procedure to complete. • For zero calibration, you may abort the calibration, set Zero Time to a lower value, and restart the calibration.
A105	Two-Phase Flow	The line density is outside the user-defined two-phase flow limits.	• Check for two-phase flow. See *Section 10.14*.
A107	Power Reset Occurred	The transmitter has been restarted.	• No action required. • If desired, you can set Alert Severity Level to Ignore.
A116	Temperature Overrange (API Referral)	The measured temperature is outside the range of the API table.	• Check your process conditions against the values reported by the device. • Verify the configuration of the API referral application and related parameters. See *Section 10.8*.
A117	Density Overrange (API Referral)	The measured density is outside the range of the API table.	• Check your process conditions against the values reported by the device. • Verify the configuration of the API referral application and related parameters. See *Section 10.8*.
A120	Curve Fit Failure (Concentration)	The transmitter was unable to calculate a valid concentration matrix from the current data.	• Verify the configuration of the concentration measurement application.
A121	Extrapolation Alert (Concentration)	The line density or line temperature is outside the range of the concentration matrix plus the configured extrapolation limit.	• Check your process conditions against the values reported by the device. • Verify the configuration of the concentration measurement application.

Alert number	Alert title	Possible cause	Recommended actions
A122	Pressure Overrange (API Referral)	The line pressure is outside the range of the API table.	• Check your process conditions against the values reported by the device. • Verify the configuration of the API referral application and related parameters. See *Section 10.8*.
A128	Factory Configuration Invalid	The stored factory configuration is invalid. Many possible reasons.	• Contact Micro Motion.
A129	Factory Configuration Checksum Invalid	The checksum on the factory configuration is invalid. Many possible reasons.	• Contact Micro Motion.
A132	Sensor Simulation Active	Sensor simulation is enabled.	• Disable sensor simulation.
A133	EEPROM Error (Display)	There is a memory error in the display module.	• Cycle power to the meter. • Replace the display module. • Contact Micro Motion.
A134	Tube-Case Temperature Difference Overrange	The difference between the case temperature and the fluid temperature is greater than 20 °C.	• Check for process upsets. Changes to line temperature may not be immediately reflected in case temperature. • Install a thermal insulation jacket. • Contact Micro Motion.
A136	Incorrect Display Type	An incorrect display module has been installed on the device. This may cause a safety violation in hazardous areas.	• Replace the installed display module with an appropriate display module.
N/A	Zero Calibration in Progress	A zero calibration is in progress.	• No action required.

10.6 Density measurement problems

Table 10-2: Density measurement problems and recommended actions

Problem	Possible causes	Recommended actions
Erratic density reading	• Normal process noise • Two-phase flow • Flow rate too high • Contaminants or suspended solids in the process fluid • Vibration in the pipeline • Erosion or corrosion	• Check your process conditions. • Increase the density damping value. • Reduce the flow rate. • Check for two-phase flow. See *Section 10.14*. • Ensure that line pressure or sample pressure meets installation requirements. • Increase back pressure to minimize bubble formation. • Minimize vibration in the pipeline. • Install a flow control method (bypass, flow chamber, expander, etc.). • Perform Known Density Verification.
Inaccurate density reading	• Inaccurate temperature measurement • Incorrect calibration factors • Contaminants or suspended solids in the process fluid	• Verify the temperature reading from the RTD (on-board temperature sensor). • Verify the temperature reading from the external temperature device, if applicable. • Verify or adjust the density offset and/or the density meter factor. • Increase the flow rate. • Install a thermal insulation jacket. • Verify the calibration factors. • Perform Known Density Verification.
Density reading too high	• Plugged or coated flow tube • Inaccurate temperature measurement • Incorrect calibration factors • Erosion or corrosion on the sensor tubes	• Purge the flow tubes. • Check for coating on the flow tubes. • Verify the temperature reading from the RTD (on-board temperature sensor). • Verify the temperature reading from the external temperature device, if applicable.
Density reading too low	• Leaks in the pipework or fittings • Incorrect calibration factors • Inaccurate temperature measurement • Erosion or corrosion on the sensor tubes • Two-phase flow	• Verify the calibration factors. • Verify the temperature reading from the RTD (on-board temperature sensor). • Verify the temperature reading from the external temperature device, if applicable. • Check for two-phase flow. See *Section 10.14*.

10.7 Temperature measurement problems

Important

Temperature measurement is ISO 17025–calibrated and accredited. Do not perform a temperature calibration or change the temperature slope. Either of these actions will invalidate the accreditation. You may change the temperature offset.

Table 10-3: Temperature measurement problems and recommended actions

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 Micro Motion. • The temperature of the fluid may be changing rapidly. Allow sufficient time for the sensor to equalize with the process fluid. • Check the reading of Tube-Case Temperature Difference. • If Alert A004, A016, or A017 is active, perform the actions recommended for that alert. • The electrical connection between the RTD and the sensor may be damaged. This may require replacing the sensor.
Inaccurate temperature data from external device	• Wiring problem • Problem with input configuration • Problem with external device • Problem with input configuration	• Verify the wiring between the transmitter and the external device. • Verify that the external device is operating correctly. • Verify the configuration of the temperature input. • Ensure that both devices are using the same measurement unit.

Related information

Thermal insulation

10.7.1   Thermal insulation

Temperature measurement is a potential source of significant error in density measurement. Thermal insulation helps to maintain a constant temperature, and can reduce or eliminate temperature problems.

Thermal insulation is especially important when the line temperature and the ambient temperature are significantly different, or when there are abrupt changes in either the line temperature or the ambient temperature.

A thermal insulation jacket should protect both the sensor body and the flanges.

A thermal insulation jacket designed specifically for your meter is available from Micro Motion. See the product data sheet for your meter.

10.8   API referral problems

Problem	Possible causes	Recommended actions
No referred density reading	• Line pressure, line temperature, or line density is outside the range of the configured API table	• Check process conditions. • Ensure that the API referral application is configured correctly for your process fluid. See *Section 5.6*.
Inaccurate referred density reading	• Inaccurate density measurement • Inaccurate temperature measurement • Inaccurate pressure value • Incorrect reference conditions • Incorrect API table selection	• Verify the line density value. If it is not accurate, see *Section 10.6*. • Verify the line temperature value. If it is not accurate, see *Section 10.7*. • Ensure that the application is configured to use the appropriate temperature source. • Ensure that the pressure source is configured correctly, that the external pressure device is operating correctly, and that both devices are using the same measurement units. • Ensure that reference temperature and reference pressure, if applicable, are configured correctly. • Ensure that the selected API table is appropriate for the process fluid.

10.9   Concentration measurement problems

Problem	Possible causes	Recommended actions
Significantly incorrect concentration measurement after loading matrix	• The wrong temperature or density unit was configured when the matrix was loaded	• Set the temperature and density units to the units used when the matrix was built, then reload the matrix. For custom matrices, contact Micro Motion.
Inaccurate concentration measurement reading	• Inaccurate density measurement • Inaccurate temperature measurement • Incorrect reference conditions • Incorrect matrix data • Inappropriate trim values	• Verify the line density value. If it is not accurate, see *Section 10.6*. • Verify the line temperature value. If it is not accurate, see *Section 10.7*. • Ensure that the application is configured to use the appropriate temperature source. • Ensure that reference temperature is configured correctly. • Ensure that the appropriate matrix is active. • Ensure that the matrix is configured correctly. • Ensure that the matrix curve fit is good. • Adjust the extrapolation limits for the active matrix. • Adjust measurement with a concentration offset trim. See *Section 9.5*.

Related information

Standard matrices for the concentration measurement application
Concentration measurement matrices available by order
Load a concentration matrix using ProLink III

10.10   Velocity measurement problems

Table 10-4:   Velocity measurement problems and recommended actions

Problem	Possible causes	Recommended actions
Non-zero velocity reading at no-flow conditions or at zero offset	• Misaligned piping (especially in new installations) • Open or leaking valve • Incorrect sensor zero	• Zero the meter. See *Section 2.4*. • 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 Micro Motion.

Table 10-4: Velocity measurement problems and recommended actions *(continued)*

Problem	Possible causes	Recommended actions
Erratic non-zero velocity reading at no-flow conditions	• Leaking valve or seal • Two-phase flow • Plugged or coated sensor tube • Incorrect sensor orientation • Wiring problem • Vibration in pipeline at rate close to sensor tube frequency • Damping value too low • Mounting stress on sensor	• Verify that the sensor orientation is appropriate for your application (refer to the sensor installation manual). • Check the drive gain and the pickoff voltage. See *Section 10.15* and *Section 10.16*. • Check the wiring between the sensor and the transmitter. See *Section 10.11*. • 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. See *Section 10.14*. • Check for radio frequency interference. See *Check for radio frequency interference (RFI)*. • Contact Micro Motion.
Erratic non-zero velocity reading when velocity 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. See *Section 10.15* and *Section 10.16*. • Check for air entrainment, tube fouling, flashing, or tube damage. • Check the wiring between the sensor and the transmitter. See *Section 10.11*. • 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. See *Section 10.14*. • Check for radio frequency interference. See *Check for radio frequency interference (RFI)*. • Contact Micro Motion.

Table 10-4: Velocity measurement problems and recommended actions *(continued)*

Problem	Possible causes	Recommended actions
Inaccurate velocity reading	• Wiring problem • Inappropriate measurement unit • Incorrect flow calibration factor • Incorrect density calibration factors • Incorrect grounding • Two-phase flow • Problem with receiving device • Incorrect sensor zero	• Check the wiring between the sensor and the transmitter. See *Section 10.11*. • 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. • Zero the meter. See *Section 2.4*. • Check the grounding of all components. See *Section 10.3*. • Check for two-phase flow. See *Section 10.14*. • Verify the receiving device, and the wiring between the transmitter and the receiving device. • Replace transmitter.
Velocity switch triggered erroneously	• Incorrect sensor zero	• Zero the meter. See *Section 2.4*.

10.11   Check sensor-to-transmitter wiring

A number of power-supply and output problems may occur if the wiring between the sensor and the transmitter is improperly connected, or if the wiring becomes damaged.

Prerequisites

You will need the installation manual for your transmitter.

Procedure

1.   Before opening the wiring compartments, disconnect the power source.

   ⚠ **CAUTION!**

   If the transmitter is in a hazardous area, wait five minutes after disconnecting the power.

2.   Verify that the transmitter is connected to the sensor according to the information provided in your transmitter installation manual.

3.   Verify that the wires are making good contact with the terminals.

4.   Check the continuity of all wires from the transmitter to the sensor.

10.12 **Check** Flow Direction

If Flow Direction is set inappropriately for your process, the meter may report velocity data that is not appropriate for your requirements.

The Flow Direction parameter interacts with actual flow direction to affect velocity measurement. For the simplest operation, actual process flow should match the flow arrow that is on the side of the sensor case.

Procedure

1. Verify the actual direction of process flow through the sensor.
2. Verify the configuration of Flow Direction.

Related information

Configure Flow Direction

10.13 **Check the cutoffs**

If the density cutoff is configured incorrectly for your process, any density process variables and any calculations that rely on density may be based on programmed cutoff values rather than current density data. Additionally, if the velocity cutoff is configured incorrectly for your process, the velocity process variable may be based on programmed cutoff values rather than current velocity data. However, this does not affect density measurement.

Procedure

Verify the configuration of all cutoffs.

Related information

Configure Density Cutoff
Configure Velocity Cutoff

10.14 **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.

1. Check for two-phase flow alerts (e.g., A105).

   If the transmitter is not generating two-phase flow alerts, 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.

Related information

Configure two-phase flow parameters

10.15 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 10-5: Possible causes and recommended actions for excessive (saturated) drive gain

Possible cause	Recommended actions
Two-phase flow	Check for two-phase flow. See *Section 10.14*.
Sensor tubes not completely full	Correct process conditions so that the sensor tubes are full.
Plugged sensor tube	Check the pickoff voltages (see *Section 10.16*). 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.
Cavitation or flashing; settling of two-phase or three-phase fluids	• Increase the inlet or back pressure at the sensor. • If a pump is located upstream from the sensor, increase the distance between the pump and sensor. • The sensor may need to be reoriented or repositioned. Consult the installation manual for your sensor.
Drive board or module failure	Contact Micro Motion.
Bent sensor tube	Check the pickoff voltages (see *Section 10.16*). 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.
Sensor imbalance	Contact Micro Motion.

Table 10-5: Possible causes and recommended actions for excessive (saturated) drive gain *(continued)*

Possible cause	Recommended actions
Vibrating element not free to vibrate	Ensure that the vibrating element is free to vibrate.
Open drive or left pickoff sensor coil	Contact Micro Motion.
Flow rate out of range	Ensure that the flow rate is within sensor limits.
Incorrect sensor characterization	Verify the characterization or calibration parameters.

Erratic drive gain

Table 10-6: Possible causes and recommended actions for erratic drive gain

Possible cause	Recommended actions
Two-phase flow	Check for two-phase flow. See *Section 10.14*.
Foreign material caught in sensor tubes	• Purge the sensor tubes. • Replace the sensor.

10.15.1   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.

10.16   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.

Table 10-7: Possible causes and recommended actions for low pickoff voltage

Possible cause	Recommended actions
Cavitation or flashing; settling of two-phase or three-phase fluids	• Increase the inlet or back pressure at the sensor. • If a pump is located upstream from the sensor, increase the distance between the pump and sensor. • The sensor may need to be reoriented or repositioned. Consult the installation manual for your sensor.
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.
Two-phase flow	Check for two-phase flow. See *Section 10.14*.
The vibrating element is 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.

10.16.1 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.

10.17 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.

Table 10-8: Possible causes and recommended actions for electrical shorts

Possible cause	Recommended action
Liquid or moisture inside the sensor case	Contact Micro Motion.
Internally shorted feedthrough	Contact Micro Motion.

Table 10-8: Possible causes and recommended actions for electrical shorts *(continued)*

Possible cause	Recommended action
Faulty cable	Replace the cable.

Micro Motion® Compact Density Meters (CDM) with Foundation™ Fieldbus

Appendix A
Calibration certificate

A.1 Sample calibration certificates

Your meter was shipped with three calibration certificates. The calibration certificates describe the calibrations and configurations that were performed or applied at the factory.

The calibration factors are provided on three calibration certificates:

- The first certificate provides the calibration factors in the CDM format, A_n, in SI units. These are obtained from factory calibration of your device.

- The second certificate provides the calibration factors in the legacy format, K_n, in SI units. These factors represent the current calibration factors converted to the format used by the 7835 and 7845 meters.

- The third certificate provides the calibration factors in the legacy format, K_n, in imperial units. These factors represent the current calibration factors converted to the format used by the 7835 and 7845 meters, and then converted to imperial units.

If you have existing programs that use the K factors, update your programs with the new K values in the appropriate units. In all other situations, use the A-format calibration factors.

Figure A-1: Sample calibration certificate: A format

Micro Motion®	DENSITY CALIBRATION CERTIFICATE

Model Code:	CDM100PA18MBAZ00EANZZ	Serial No:	2012.10031
Customer Tag:		Calibration Date:	2013-07-01 11:05:22
		Pressure Test:	3263 psi(g)
		Calibration ID:	1.29825731

"A" Coefficients

Calibrated Range = 0.300-1.300 g/cm³ (300-1300 kg/m³)

Time Period Temperature Compensation Coefficient:
A1 =   2.803826E-004

Density Calibration Coefficients:
A2 =   -2.549393E+007
A3 =   3.083073E-005

Case Temperature Compensation Coefficient:
A4=   3.21

Pressure Compensation Coefficient:
A5=   1.207270E-001

Flow Compensation Coefficient:
A6=   3.23

Density Calibration Data:

Density (g/cm³)	Time Period, TP µsec
0.00097	5065.2054
0.79882	5587.3151
1.24079	5857.0031

Performance Check:

Density (g/cm³)	Error (g/cm³)
0.99822	-0.00007

Known Density Verification Data:

Verification Time Period (Air) @ 20°C =   765.1 µsec

SAMPLE

Definitions:		CALIBRATED BY:
Density	g/cm³	
Time period	µsec	
Temperature	°C	
Pressure	psi(g)	

All equipment used for this calibration is calibrated at routine intervals against
standards that are traceable to the International System of Units (SI).
Emerson Process Management Micro Motion, Inc. 7070 Winchester Circle, Boulder, CO 80301

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Figure A-2: Sample calibration certificate: K format, SI units

Micro Motion

DENSITY CALIBRATION CERTIFICATE

Model Code: CDM100PA18MBAZ00EANZZ
Customer Tag:

Serial No: 2012.10031
Calibration Date: 2013-07-01 11:05:22
Pressure Test: 225 bar(g)
Calibration ID: 1.29825731

7835|7845 "K" Coefficients (SI Units)

Calibrated Range = 300-1300 kg/m³ (0.3-1.300 g/cm³)

Density Calibration Coefficients @20°C $D = K0 + K1(TP) + K2(TP^2)$
K0 =   -3.675285E+000
K1 =   0
K2 =   1.432987E-007

Temperature Compensation Coefficients: $Dt = D[1+K18(T-20)]+K19(T-20)$
K18 =   -3.154066E-004
K19 =   -9.992198E-004

Pressure Compensation Coefficients: $Dp = Dt[...20(P-1)]+...21(P-1)$
                                                 where K20=...20A...20B(P-1)
                                                 K21=K21A+K21B(P-1)

	Range: 1-41 bar(a)	Range: 31-71 bar(a)	Range: 71-101 bar(a)	Range: 101-151 bar(a)
K20A=	0.0	0.0	0.0	0.0
K20B=	0.0	0.0	0.0	0.0
K21A=	1.238665E-004	1.238665E-004	1.238665E-004	1.238665E-004
K21B=	0.0	0.0	0.0	0.0

Density Calibration Data:

Density (kg/m³)	Time Period, TP µsec
0.97	5065.2054
798.82	5587.3151
1240.79	5857.0031

Performance Check:

Density (kg/m³)	Error (kg/m³)
998.22	-0.08

Known Density Verification Data:

Verification Time Period (Air) @ 20°C =   765.1 µsec

Definitions:
D = Density (uncompensated)   kg/m³
Dt = Density (Temperature compensated)   kg/m³
Dp = Density (Pressure & Temperature compensated) kg/m³
TP = Time period   µsec
T = Temperature   °C
P= Pressure   bar(a)

CALIBRATED BY:

All equipment used for this calibration is calibrated at routine intervals against
standards that are traceable to the International System of Units (SI).
Emerson Process Management Micro Motion, Inc. 7070 Winchester Circle, Boulder, CO 80301

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Figure A-3: Sample calibration certificate: K format, US units

Micro Motion	DENSITY CALIBRATION CERTIFICATE

Model Code:	CDM100PA18MBAZ00EANZZ	Serial No:	2012.10031
Customer Tag:		Calibration Date:	2013-07-01 11:05:22
		Pressure Test:	3263 psi(g)
		Calibration ID:	1.29825731

7835|7845 "K" Coefficients (US Units)

Calibrated Range = 0.3-1.3 g/cm³ (300-1300 kg/m³)

Density Calibration Coefficients @68°F $D = K0 + K1(TP) + K2(TP^2)$
K0 =   368
K1 =   369
K2 =   370

Temperature Compensation Coefficients: $Dt = D[1+K18(T-68)]+K19(T-68)$
K18 =   371
K19 =   372

Pressure Compensation Coefficients: $Dp = Dt[\ldots\ 20(P)]+K2\ldots(P)$
          where K20=...0A...20B(P)
          K21=K21A+K21B(P)

	Range: 1-580 psi(g)	Range: 435-1015 psi(g)	Range: 870-1450 psi(g)	Range: 1450-2175 psi(g)
K20A=	0.0	0.0	0.0	0.0
K20B=	0.0	0.0	0.0	0.0
K21A=	373	373	373	373
K21B=	0.0	0.0	0.0	0.0

Density Calibration Data:

Density (g/cm³)	Time Period, TP µsec
0.00097	5065.2054
0.79882	5587.3151
1.24079	5857.0031

Performance Check:

Density (g/cm³)	Error (g/cm³)
0.99822	-0.00008

Known Density Verification Data:

Verification Time Period (Air) @ 68°F =   765.1 µsec

Definitions:
D = Density (uncompensated)   g/cm³
Dt = Density (Temperature compensated)   g/cm³
Dp = Density (Pressure & Temperature compensated)   g/cm³
TP = Time period   µsec
T = Temperature   °F
P= Pressure   psi(g)

CALIBRATED BY:

All equipment used for this calibration is calibrated at routine intervals against
standards that are traceable to the International System of Units (SI).
Emerson Process Management Micro Motion, Inc. 7070 Winchester Circle, Boulder, CO 80301

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Appendix B
Using the transmitter display

Topics covered in this appendix:

- *Components of the transmitter interface*
- *Use the optical switches*
- *Access and use the display menu system*
- *Display codes for process variables*
- *Codes and abbreviations used in display menus*

B.1   Components of the transmitter interface

The transmitter interface includes the status LED, the display (LCD panel), and two optical switches.

Figure B-1: Transmitter interface
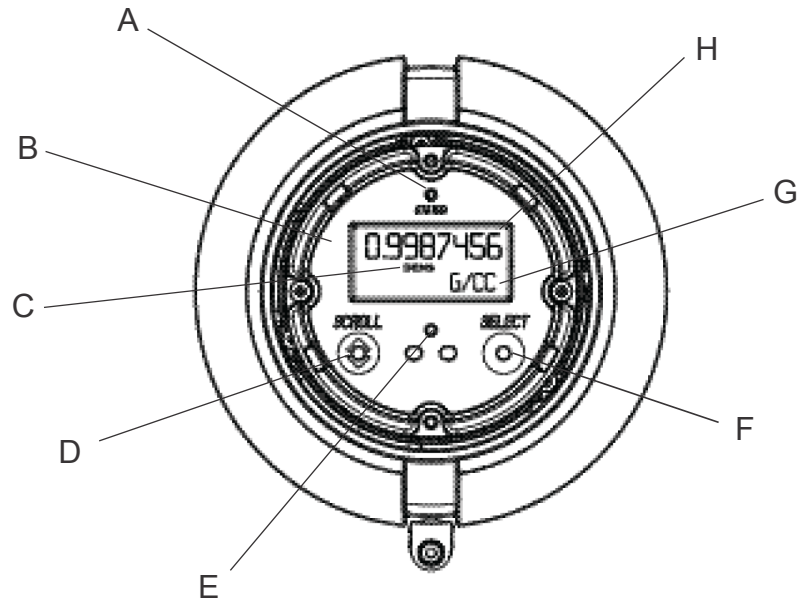
A. Status LED
B. Display (LCD panel)
C. Process variable
D. Scroll optical switch
E. Optical switch indicator
F. Select optical switch
G. Unit of measure for process variable
H. Current value of process variable

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.

B.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 B-1: Optical switch indicator and optical switch states

Optical switch indicator	State of optical switches
Solid red	One optical switch is activated.
Flashing red	Both optical switches are activated.

B.3 Access and use the display menu system

The display menu system is used to perform various configuration, administrative, and maintenance tasks.

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.

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.

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 ALARM.

- If no alert is active, 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 until the display times out and returns to displaying process variable data.

B.3.1 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:

  1. 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.

  2. Activate Scroll to change the value of the active digit.

  3. 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:

  1. Activate Select until the decimal point is flashing.

  2. Activate Scroll.

     The decimal point is removed from its current position.

  3. 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.

4. 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.

B.4 Display codes for process variables

Table B-2: Display codes for process variables

Code	Definition
Standard	
DENS	Line Density
TEMP	Line Temperature
TCASE	Case Temperature
TDIFF	Tube-Case Temperature Difference
EXT T	Line Temperature (External)
EXT P	Line Pressure (External)
VEL	Velocity
DGAIN	Drive Gain
TP B	Sensor Time Period
UCALC	User-Defined Calculation Output
API referral	
RDENS	Referred Density (API)
Concentration measurement	
SG	Specific Gravity
CONC	Concentration

B.5 Codes and abbreviations used in display menus

Table B-3: Display codes for measurement units

Code	Measurement unit
%	Percent
%PLATO	°Plato
%SOL-V	% solution by volume
%SOL-W	% solution by weight
°C	°Celsius
°F	°Fahrenheit
°K	°Kelvin
°R	°Rankine
ATM	Atmospheres
B BBL	Beer barrels

Table B-3: Display codes for measurement units *(continued)*

Code	Measurement unit
BALL	°Balling
BAR	Bars
BAUMH	°Baumé heavy
BAUML	°Baumé light
BBBL/D	Beer barrels per day
BBBL/H	Beer barrels per hour
BBBL/M	Beer barrels per minute
BBBL/S	Beer barrels per second
BBL	Barrels
BBL/D	Barrels per day
BBL/H	Barrels per hour
BBL/MN	Barrels per minute
BBL/S	Barrels per second
BTU/D	British Thermal Units per day
BTU/H	British Thermal Units per hour
BTU/lb	British Thermal Units per pound
BTU/MN	British Thermal Units per minute
BTU/scf	British Thermal Units per standard cubic foot
CM	Centimeters
CMHG0	Centimeters of mercury at 4 °C
CMW60	Centimeters of water at 60 °F
cP	Centipoise
cSt	Centistoke
CUF/LB	Cubic feet per pound
CUF/MN	Cubic feet per minute
CUFT	Cubic feet
CUFT/D	Cubic feet per day
CUFT/H	Cubic feet per hour
CUFT/S	Cubic feet per second
CUIN	Cubic inches
CUYD	Cubic yards
D API	°API
DAY	Days
DBRIX	°Brix
DTWAD	°Twaddle
FT	Feet

Table B-3: Display codes for measurement units *(continued)*

Code	Measurement unit
FT/S	Feet per second
FTH2O	Feet H20 @ 68 °F
FTW4C	Feet of water at 4 °C
FTW60	Feet of water at 60 °F
G	Grams
G/CM3	Grams per cubic centimeter
G/H	Grams per hour
G/L	Grams per liter
G/MIN	Grams per minute
G/mL	Grams per milliliter
G/MOL	Grams per mole
G/S	Grams per second
G/SCM	Grams per square centimeter
HL	Hectoliters
HOUR	Hours
HPA	Hectopascals
HZ	Hertz
IN	Inches
INH2O	Inches of water at 68 °F
INHG	Inches of mercury at 0 °C
INW4C	Inches of water at 4 °C
INW60	Inches of water at 60 °F
KG	Kilograms
KG/D	Kilograms per day
KG/H	Kilograms per hour
KG/L	Kilograms per liter
KG/M2	Kilograms per square meter
KG/M3	Kilograms per cubic meter
KG/MIN	Kilograms per minute
KG/S	Kilograms per second
KG/SCM	Kilograms per square centimeter
KPA	Kilopascals
L	Liters
L/H	Liters per hour
L/MIN	Liters per minute
L/S	Liters per second

Table B-3: Display codes for measurement units *(continued)*

Code	Measurement unit
LB	Pounds
LB/CUF	Pounds per cubic foot
LB/CUI	Pounds per cubic inch
LB/D	Pounds per day
LB/GAL	Pounds per gallon
LB/H	Pounds per hour
LB/MIN	Pounds per minute
LB/S	Pounds per second
LT/D	Long tons per day
LT/H	Long tons per hour
M/H	Meters per hour
M/S	Meters per second
M3	Cubic meters
M3/D	Cubic meters per day
M3/H	Cubic meters per hour
M3/MIN	Cubic meters per minute
M3/S	Cubic meters per second
mA	Milliamperes
mBAR	Millibars
METER	Meters
MHG0C	Meters of mercury at 0 °C
MILG/D	Million gallons per day
MILL/D	Million liters per day
MIN	Minutes
MJ/DAY	Megajoules per day
MJ/H	MegaJoules per hour
MJ/kg	Megajoules per kilogram
MJ/m3	Megajoules per cubic meter
MJ/MIN	Megajoules per minute
mm	Millimeters
mmH2O	Millimeters of water at 68 °F
mmHG	Millimeters of mercury at 0 °C
mmW4C	Millimeters of water at 4 °C
MPA	Megapascals
mV	Millivolts
MW4C	Meters of water at 4 °C

Table B-3: Display codes for measurement units *(continued)*

Code	Measurement unit
NL	Normal liters
NL/D	Normal liters per day
NL/H	Normal liters per hour
NL/MIN	Normal liters per minute
NL/S	Normal liters per second
NM3	Normal cubic meters
NM3/D	Normal cubic meters per day
NM3/H	Normal cubic meters per hour
NM3/M	Normal cubic meters per minute
NM3/S	Normal cubic meters per second
OHM	Ohms
OUNCE	Ounce
PA	Pascals
PF	Picofarads
PPM	Parts per million
PRF/M	Proof per mass
PRF/V	Proof per volume
PSF	Pounds per square foot
PSI	Pounds per square inch gauge
PSI A	Pounds per square inch absolute
SCF	Standard cubic feet
SCFD	Standard cubic feet per day
SCFH	Standard cubic feet per hour
SCFM	Standard cubic feet per minute
SCFS	Standard cubic feet per second
SEC	Seconds
SGU	Specific gravity units
SL	Standard liter
SL/D	Standard liters per day
SL/H	Standard liters per hour
SL/MIN	Standard liters per minute
SL/S	Standard liters per second
SM3	Standard cubic meter
SM3/D	Standard cubic meters per day
SM3/H	Standard cubic meters per hour
SM3/M	Standard cubic meters per minute

Table B-3:   Display codes for measurement units *(continued)*

Code	Measurement unit
SM3/S	Standard cubic meters per second
SPECL	Special
ST/CUY	Short tons per cubic yard
ST/D	Short tons per day
ST/H	Short tons per hour
ST/MIN	Short tons per minute
T	Metric tons
T/D	Metric tons per day
T/H	Metric tons per hour
T/MIN	Metric tons per minute
TONUK	Long tons (2240 pounds)
TONUS	Short tons (2000 pounds)
TORR	Torr at 0 °C
UKGAL	Imperial gallons
UKGPD	Imperial gallons per day
UKGPH	imperial gallons per hour
UKGPM	Imperial gallons per minute
UKGPS	Imperial gallons per second
UMHO	Microsiemens
uSEC	Microseconds
USGAL	Gallons
USGPD	Gallons per day
USGPH	Gallons per hour
USGPM	Gallons per minute
USGPS	Gallons per second
V	Volts

Table B-4:   Display codes for menus, controls, and data

Code	Definition
12 mA	12 mA value
20 mA	20 mA value
20 mA	20 mA
4 mA	4 mA value
4 mA	4 mA
ABORT	Abort

Table B-4: Display codes for menus, controls, and data *(continued)*

Code	Definition
ACCPT	Accept
ACK	Acknowledge
ACK ALL?	Acknowledge all
ACTIV	Active
ADDR	Address
ALARM	Alert
ALL	All
ALT	Altitude
ANTHR	Another
AO 1	mA Output 1
AO 1 SRC	mA Output 1 Source
AO 2	mA Output 2
AO 2 SRC	mA Output 2 Source
API	API (American Petroleum Institute)
APPLY	Apply
ASCII	ASCII
AUTO	Auto
AUTOSCRL	Auto Scroll
AVG	Average
BASE	Base
BDENS	Base Density
BRD T	Board temperature
CAL	Calibrate or Calibration
CAL	Calibration result
CALC	Calculate
CCAI	Calculated Carbon Aromaticity Index
CH B	Channel B
CHANGE	Change
CHMBR	Chamber
CII	Calculated Ignition Index
CO	Carbon monoxide
CO2	Carbon dioxide
CODE?	Passcode
CONC	Concentration
CONCENTR	Concentration
CONFG	Configure or Configuration

Table B-4: Display codes for menus, controls, and data *(continued)*

Code	Definition
CONFIG	Configure or Configuration
COR M	Mass flow rate from Coriolis input
COR V	Volume flow rate calculated from Coriolis input
CUR Z	Current zero value
CURVE	Matrix
CUSTD	Custody transfer (Weights & Measures)
CUSTODY XFER	Custody transfer (Weights & Measures)
CV	Calorific value
DENS	Density
DEV	Maximum deviation
DGAIN	Drive gain
DISBL	Disabled
DISPLAY	Display
DO	Discrete Output
DO SRC	Discrete Output Source
DRIVE	Drive gain
DRIVE%	Drive gain
DSPLY	Display
DYNV	Dynamic viscosity
ENABL	Enabled
ENGL	English
ENRGY	Energy
ENTER	Enter
ETO	Engineer To Order
EVNT1	Enhanced event 1
EVNT2	Enhanced event 2
EVNT3	Enhanced event 3
EVNT4	Enhanced event 4
EVNT5	Enhanced event 5
EXIT	Exit
EXT P	External or fixed pressure
EXT T	External or fixed temperature
FAC Z	Factory zero value
FACT	Factor
FACTORY	Factory
FAIL	Fail

Table B-4: Display codes for menus, controls, and data *(continued)*

Code	Definition
FAULT	Fault
FCTOR	Factor
FILL	Fill
FIX	Fix
FREN	French
GAS	Gas
GER	German
GOOD	Good
H2	Hydrogen
HART	HART
HIDE	Hide
HIGH	High
IO	Input/Output
K VAL	K value
K0	K0 calibration factor
K1	K1 calibration factor
K2	K2 calibration factor
KDV	Known Density Verification
KINV	Kinematic viscosity
LANG	Language
LANGUAGE	Language
LOADING	Loading
LOW	Low
LPO	Left pickoff
MAG M	Mass flow rate calculated from external volume input
MAG V	Volume flow rate from external input
MAINT	Maintenance
MAO 1	mA Output 1
MAO 2	mA Output 2
MASS	Mass
MBUS	Modbus
MDIUM	Medium
MEASR	Measurement
MMI	Micro Motion
mS	Millisecond
MTR F	Meter factor

Table B-4: Display codes for menus, controls, and data *(continued)*

Code	Definition
MW	Molecular weight
N2	Nitrogen
NET M	Net mass flow rate
NET V	Net volume flow rate
NO	No
nSEC	Nanoseconds
NUMBR	Number
OFF	Off
OFF-LINE	Offline
OFFLN	Offline
OFFSET	Offset
OFFST	Offset
ON	On
O-O-O-O	HART Squawk display
OOR	Out of range
PASS	Password or passcode
PASSW	Password or passcode
POLAR	Polarity
POLARITY	Polarity
POOR	Poor
PoVLt	Pickoff voltage
PTS	Time period signal
Q FCTOR	Quality Factor
RANG	Range
RATE	Scroll Rate or Display Rate
RD	Relative density
RDENS	Referred density
REF	Reference or Referred
RESTORE	Restore
RESULT	Result
RPO	Right pickoff
RTEMP	Reference temperature
RUN	Run
RVISC	Referred viscosity
SAVE	Save
SCALE	Scale

Table B-4: Display codes for menus, controls, and data *(continued)*

Code	Definition
SCL F	Dynamic viscosity scale factor
SCREEN	Screen
SCRLL	Scroll
SCROLL	Scroll
SECURE	Secure mode enabled
SEE	See
SELECT	Select
SET	Set, Set simulated value, Set configuration value
SETPOINT	Setpoint
SG	Specific gravity
SGU	Specific gravity
SHOW	Show
SIM	Simulate, Simulated
SLOPE	Slope
SPAN	Spanish
SRC	Source
SRVIS	Secondary referred viscosity
STAB	Stability
START	Start
STORE	Store
SW	Software
SWREV	Software revision
TCASE	Case temperature
TDIFF	Tube-Case Temperature Difference
TEMP	Temperature
TP	Time Period
TP A	Sensor Time Period (Upper)
TP B	Sensor Time Period
TPS	Time Period Signal
TYPE	Type
UCALC	User-defined calculation
ULTRA	Ultra-low
UNITS	Units
VEL	Velocity
VELSW	Flow switch or velocity switch
VERSION_STRING	Revision or Version

Table B-4: Display codes for menus, controls, and data *(continued)*

Code	Definition
VISC	Viscosity
VOL	Volume
VOLTS	Volts
WOBBE	Wobbe index
XMTR	Transmitter
YES	Yes
YES?	Confirm
Z	Compressibility
ZERO	Zero

Appendix C
Using ProLink III with the transmitter

Topics covered in this appendix:

- *Basic information about ProLink III*
- *Connect with ProLink III*

C.1 Basic information about ProLink III

ProLink III is a configuration and service tool available from Micro Motion. It runs on a Windows platform and provides complete access to transmitter functions and data.

Version requirements

The following version of ProLink III is required: v2.4 or later.

ProLink III requirements

To install ProLink III, you must have:

- The ProLink III installation media
- The ProLink III installation kit for your connection type:
    - Converter: RS-232 to RS-485, or RS-232 to Bell 202
    - Cables and connectors: Serial port or USB port

To obtain ProLink III and the appropriate installation kit, contact Micro Motion.

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 ProLink III manual (*ProLink® III Configuration and Service Tool for Micro Motion® Transmitters: 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 Micro Motion documentation CD or the Micro Motion web site (*www.micromotion.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:

- 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 ProLink III manual. They are not documented in the current 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.

C.2 Connect with ProLink III

A connection from ProLink III to your transmitter allows you to read process data, configure the transmitter, and perform maintenance and troubleshooting tasks.

- *Connection types supported by ProLink III* (Section C.2.1)
- *Connect with ProLink III to the service port* (Section C.2.2)

C.2.1 Connection types supported by ProLink III

Different connection types are available for connecting from ProLink III to the transmitter. Choose the connection type appropriate to your network and the tasks you intend to perform.

The transmitter supports the following ProLink III connection types:

- Service port connections

C.2.2 Connect with ProLink III to the service port

⚠ **CAUTION!**

If the transmitter is in a hazardous area, do not use a service port connection. Service port connections require opening the wiring compartment, and opening the wiring compartment while the transmitter is powered up could cause an explosion. To connect to the transmitter in a hazardous environment, use a connection method that does not require removing the transmitter housing cover.

Prerequisites

- ProLink III v2.4 or later installed and licensed on your PC
- One of the following:
  - RS-232 to RS-485 signal converter

- USB to RS-485 signal converter
- An available serial port or USB port
- Adapters as required (for example, 9-pin to 25-pin)

Procedure

1. Attach the signal converter to the serial port or USB port on your PC.

2. Access the service port terminals:

   a. Remove the transmitter end-cap to access the wiring compartment.

   b. Loosen the screw on the Warning flap and open the power supply compartment.

3. Connect the leads from the signal converter to the service port, terminals 7 (RS-485/A) and 8 (RS-485/B).

Tip
Usually, but not always, the black lead is RS-485/A and the red lead is RS-485/B.

Figure C-1: Connection to service port
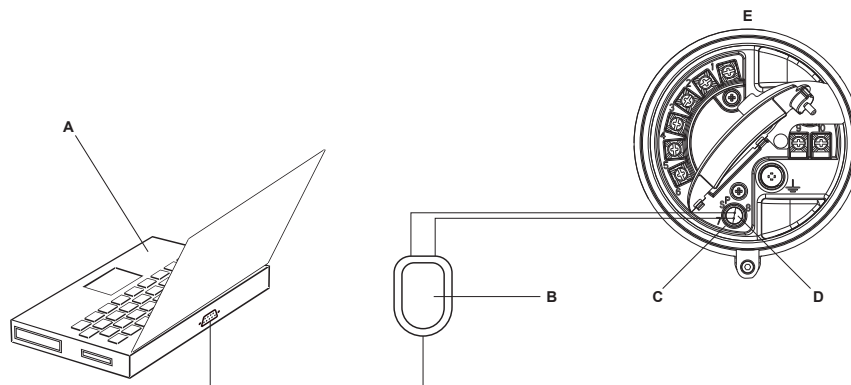
A. PC
B. Signal converter
C. Service port terminal 7 (RS-485/A)
D. Service port terminal 8 (RS-485/B)
E. Transmitter, with wiring compartment and power supply compartment opened

---

Note
This figure shows a serial port connection. USB connections are also supported.

---

4. Start ProLink III.

5. Choose Connect to Physical Device.

6. Set Protocol to Service Port.

Tip

Service port connections use standard connection parameters and a standard address. You do not need to configure them here.

7. Set the PC Port value to the PC COM port that you are using for this connection.

8. Click Connect.

Need help? If an error message appears:

- Switch the leads and try again.
- Ensure that you have specified the correct port on your PC.
- Check the wiring between the PC and the transmitter.

Appendix D
Foundation™ fieldbus resource block and transducer blocks

Topics covered in this appendix:

- *Resource block*
- *Transducer blocks and views*

D.1   Resource block

The following table lists the parameters contained in the resource block.

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

Many of the parameters are common to all fieldbus devices. Definitions for these parameters are available in the referenced fieldbus specification.

Table D-1: Resource block

Index	Name	View 1	2	3	3_1	4	4_1	4_2	Description
1	ST_REV	2	2	2	2	2	2	2	Refer to the FF-891 specification.
2	TAG_DESC								Refer to the FF-891 specification.
3	STRATEGY					2			Refer to the FF-891 specification.
4	ALERT_KEY					1			Refer to the FF-891 specification.
5	MODE_BLK	4		4					Refer to the FF-891 specification.
6	BLOCK_ERR	2		2					Refer to the FF-891 specification.
7	RS_STATE	1		1					Refer to the FF-891 specification.
8	TEST_RW								Refer to the FF-891 specification.
9	DD_RESOURCE								Refer to the FF-891 specification.
10	MANUFAC_ID					4			Refer to the FF-891 specification.
11	DEV_TYPE					2			Refer to the FF-891 specification.
12	DEV_REV					1			Refer to the FF-891 specification.
13	DD_REV					1			Refer to the FF-891 specification.
14	GRANT_DENY		2						Refer to the FF-891 specification.
15	HARD_TYPES					2			Refer to the FF-891 specification.
16	RESTART								Refer to the FF-891 specification.

Table D-1: Resource block *(continued)*

Index	Name	View 1	2	3	3_1	4	4_1	4_2	Description
17	FEATURES					2			Refer to the FF-891 specification.
18	FEATURE_SEL		2						Refer to the FF-891 specification.
19	CYCLE_TYPE					2			Refer to the FF-891 specification.
20	CYCLE_SEL		2						Refer to the FF-891 specification.
21	MIN_CYCLE_T					4			Refer to the FF-891 specification.
22	MEMORY_SIZE					2			Refer to the FF-891 specification.
23	NV_CYCLE_T		4						Refer to the FF-891 specification.
24	FREE_SPACE		4						Refer to the FF-891 specification.
25	FREE_TIME	4		4					Refer to the FF-891 specification.
26	SHED_RCAS		4						Refer to the FF-891 specification.
27	SHED_ROUT		4						Refer to the FF-891 specification.
28	FAULT_STATE	1		1					Refer to the FF-891 specification.
29	SET_FSTATE								Refer to the FF-891 specification.
30	CLR_FSTATE								Refer to the FF-891 specification.
31	MAX_NOTIFY					1			Refer to the FF-891 specification.
32	LIM_NOTIFY		1						Refer to the FF-891 specification.
33	CONFIRM_TIME		4						Refer to the FF-891 specification.
34	WRITE_LOCK		1						Refer to the FF-891 specification.
35	UPDATE_EVT								Refer to the FF-891 specification.
36	BLOCK_ALM								Refer to the FF-891 specification.
37	ALARM_SUM	8		8					Refer to the FF-891 specification.
38	ACK_OPTION					2			Refer to the FF-891 specification.
39	WRITE_PRI					1			Refer to the FF-891 specification.
40	WRITE_ALM								Refer to the FF-891 specification.
41	ITK_VER					2			Refer to the FF-891 specification.
42	FD_VER					2			Refer to the FF-912 specification.
43	FD_FAIL_ACTIVE	4		4					Refer to the FF-912 specification.
44	FD_OFFSPEC_AC-TIVE	4		4					Refer to the FF-912 specification.
45	FD_MAINT_AC-TIVE	4		4					Refer to the FF-912 specification.
46	FD_CHECK_AC-TIVE	4		4					Refer to the FF-912 specification.
47	FD_FAIL_MAP					4			Refer to the FF-912 specification.
48	FD_OFFSPEC_MAP					4			Refer to the FF-912 specification.

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Table D-1:   Resource block *(continued)*

Index	Name	View 1	2	3	3_1	4	4_1	4_2	Description
49	FD_MAINT_MAP					4			Refer to the FF-912 specification.
50	FD_CHECK_MAP					4			Refer to the FF-912 specification.
51	FD_FAIL_MASK					4			Refer to the FF-912 specification.
52	FD_OFFSPEC_ MASK					4			Refer to the FF-912 specification.
53	FD_MAINT_MASK					4			Refer to the FF-912 specification.
54	FD_CHECK_MASK					4			Refer to the FF-912 specification.
55	FD_FAIL_ALM								Refer to the FF-912 specification.
56	FD_OFFSPEC_ ALM								Refer to the FF-912 specification.
57	FD_MAINT_ALM								Refer to the FF-912 specification.
58	FD_CHECK_ALM								Refer to the FF-912 specification.
59	FD_FAIL_PRI					1			Refer to the FF-912 specification.
60	FD_OFFSPEC_PRI					1			Refer to the FF-912 specification.
61	FD_MAINT_PRI					1			Refer to the FF-912 specification.
62	FD_CHECK_PRI					1			Refer to the FF-912 specification.
63	FD_SIMULATE			9					Refer to the FF-912 specification.
64	FD_RECOMMEN_ ACT	2		2					Refer to the FF-912 specification.
65	FD_EXTENDED_ ACTIVE_1	4		4					Refer to the FF-912 specification.
66	FD_EXTENDED_ MAP_1					4			Refer to the FF-912 specification.
67	COMPATIBILITY_ REV								This parameter is used when replacing field devices. The correct value of this parameter is the DEV_REV value of the replaced device.
68	HARDWARE_RE-VISION								Hardware revision of the hardware.
69	SOFTWARE_REV								Software revision of the source code that contains the resource block.
70	PD_TAG						32		PD tag description of device
71	DEV_STRING						32		This is used to load new licensing into the device. The value can be written but will always read back with a value of 0.
72	DEV_OPTIONS						4		Indicates which device licensing options are enabled.

Table D-1: Resource block *(continued)*

Index	Name	View 1	2	3	3_1	4	4_1	4_2	Description
73	OUTPUT_ BOARD_SN						4		Output board serial number.
74	FINAL_ASSY_ NUM						4		The same final assembly number placed on the neck label.
75	DOWNLOAD_ MODE								Gives access to the boot block code for over the wire downloads 0=Uninitialized 1=Run mode 2=Download mode
76	HEALTH_INDEX			1					Parameter representing the overall health of the device. 100=Perfect.
77	FAILED_PRI							1	Designates the alerting priority of the FAILED_ALM and also used as switch b/w Field Diagnostics and legacy PlantWeb alerts. If value is greater than or equal to 1, PlantWeb alerts will be active in device; otherwise, device will use Field Diagnostics alerts.
78	RECOMMENDED_ ACTION				2				Enumerated list of recommended actions displayed with a device alert.
79	FAILED_ALM								Alert indicating a failure within a device which makes the device non-operational.
80	MAINT _ALM								Alert indicating that the device needs maintenance soon. If the condition is ignored, the device will eventually fail.
81	ADVISE _ALM								Alert indicating advisory alerts. These conditions do not have a direct impact on the process or device integrity.
82	FAILED_ENABLE						4		Enabled FAILED_ALM alert conditions. Corresponds bit for bit to FAILED_ACTIVE. A bit on means that the corresponding alert condition is enabled and will be detected. A bit off means the corresponding alert condition is disabled and will not be detected. This parameter is the Read Only copy of FD_FAIL_MAP.
83	FAILED_MASK						4		Mask of Failure Alert. Corresponds bit for bit to the FAILED_ACTIVE. A bit on means that the failure is masked out from alerting. This parameter is the Read Only copy of FD_FAIL_MASK.

Table D-1: Resource block *(continued)*

Index	Name	View							Description
		1	2	3	3_1	4	4_1	4_2	
84	FAILED_ACTIVE				4				Enumerated list of advisory conditions within a device. All open bits are free to be used as appropriate for each specific device. This parameter is the Read Only copy of FD_FAIL_ACTIVE.
85	MAINT_PRI							1	Designates the alerting priority of the MAINT_ALM.
86	MAINT_ENABLE							4	Enabled MAINT_ALM alert conditions. Corresponds bit for bit to MAINT_ACTIVE. A bit on means that the corresponding alert condition is enabled and will be detected. A bit off means the corresponding alert condition is disabled and will not be detected. This parameter is the Read Only copy of FD_OFFSPEC_MAP
87	MAINT _MASK							4	Mask of Maintenance Alert. Corresponds bit for bit to MAINT_ACTIVE. A bit on means that the failure is masked out from alerting. This parameter is the Read Only copy of FD_OFFSPEC_ MASK
88	MAINT _ACTIVE				4				Enumerated list of advisory conditions within a device. All open bits are free to be used as appropriate for each specific device. This parameter is the Read Only copy of FD_OFFSPEC_ACTIVE
89	ADVISE_PRI							1	Designates the alerting priority of the ADVISE_ALM.
90	ADVISE_ENABLE							4	Enabled ADVISE_ALM alert conditions. Corresponds bit for bit to ADVISE_ACTIVE. A bit on means that the corresponding alert condition is enabled and will be detected. A bit off means the corresponding alert condition is disabled and will not be detected. This parameter is the Read Only copy of FD_MAINT_MAP & FD_CHECK_MAP
91	ADVISE _MASK							4	Mask of Advisory Alert. Corresponds bit for bit to ADVISE_ACTIVE. A bit on means that the failure is masked out from alerting. This parameter is the Read Only copy of FD_MAINT_MASK & FD_CHECK_MASK

Table D-1: Resource block *(continued)*

Index	Name	View 1	2	3	3_1	4	4_1	4_2	Description
92	ADVISE _ACTIVE				4				Enumerated list of advisory conditions within a device. This parameter is the Read Only copy of FD_MAINT_ACTIVE & FD_CHECK_ACTIVE
93	FD_MASK_ALL							4	Masks FD conditions in all FD categories.
94	FD_MAP_VALUE_ 1							16	This parameter shall be used to map FD conditions from 0-15 bit positions to any of 4 FD categories. FD_MAP_ VALUE_1 & FD_*_MAP parameters shall reflect similar FD mapping configuration for bit 0-15
95	FD_MAP_VALUE_ 2							16	Maps FD conditions from 16-31 bit position to any of 4 FD categories. FD_ MAP_VALUE_2 & FD_*_MAP parameters shall reflect similar FD mapping configuration for bit 16-31.
96	ATTACHEDCORE-TYPE								Enumerated value indication for attached core processor type.

D.2　Transducer blocks and views

Transducer blocks

The fieldbus interface is implemented via the following transducer blocks.

Table D-2: Transducer blocks

Transducer block	Tag	Alternate name	Description
Measurement	MEASUREMENT TB	TRANSDUCER 1200	Configuration parameters and data for mass flow rate, volume flow rate, density, and temperature
Calibration	CALIBRATION TB	TRANSDUCER 1400	Calibration data and routines, pressure compensation data, temperature compensation data
Diagnostics	DIAGNOSTICS TB	TRANSDUCER 1600	Two-phase flow parameters, alert status, and diagnostic data
Device Information	DEVICE INFORMA-TION TB	TRANSDUCER 1800	Informational static data such as software revision, serial number, and sensor limits
Local Display	LOCAL DISPLAY TB	TRANSDUCER 2000	Configuration parameters for the display

Table D-2: Transducer blocks *(continued)*

Transducer block	Tag	Alternate name	Description
API Referral	PM TB	TRANSDUCER 2200	Configuration parameters and data for API referral
Concentration Measurement	CM TB	TRANSDUCER 2400	Configuration parameters and data for concentration measurement
DVM	Density Viscosity Meter TB	TRANSDUCER 2600	Configuration parameters and data for specialized density and viscosity measurement, calibration, and Known Density Verification

Views of transducer blocks

Four views are defined for each transducer block.

Table D-3: Views of transducer blocks

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 maximum size of a view is 122 bytes.

D.2.1   Measurement transducer block and related information

In the following table:

OD index	Index of the parameter in the object dictionary
Name	Name used in code
Message type	One of the following:

	VARIABLE	A value
	ENUM	A value from an enumeration
	METHOD	Initiates an action in the device
	STRING	A set of ASCII characters
	ARRAY	A set of values
	RECORD	A data structure defined by the Fieldbus Foundation

Data type	The data type of the parameter, and the size in bytes, when required
Memory class	Class of memory required, and the update rate in Hz if applicable:

	D	Dynamic store (cyclic data, parameter updated periodically)

S	Static store (acyclic data, parameter changed on a deliberate write)	
N	Nonvolatile parameter (saved across power cycles)	

Initial value	The value that the parameter will have after a master reset is performed. *Calc* = calculated
Access	The type of access allowed for the parameter:

R	Read-only
RW (Any)	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

View and size in view	The views that contain the parameter, and the size of the parameter in the view, in bytes. Example: View 2 (4)
Device	The meter or meters that use this parameter
Comments	A quick definition of the parameter, the name of the parameter in ProLink III, or other information about the parameter

Table D-4: Measurement transducer block

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
Fieldbus standard									
0	BLOCK_STRUCTURE	VARIA-BLE	DS_64 (5)	S	N/A	RW (OOS or Auto)		All	Beginning of the transducer block
1	ST_REV	VARIA-BLE	Un-sign-ed16 (2)	S	0	R	1 (2) 2 (2) 3 (2) 4 (2)	All	The revision level of the static data associated with the function block. Incremented with each write of static store.
2	TAG_DESC	STRING	OCTET STRING (32)	S	Spaces	RW (OOS or Auto)		All	The user descrip-tion of the inten-ded application of the block.
3	STRATEGY	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS or Auto)	4 (2)	All	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.

Table D-4: Measurement transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
4	ALERT_KEY	VARIA-BLE	Un-signed8 (1)	S	0	RW (OOS or Auto)	4 (1)	All	The identification number of the plant unit. This in-formation may be used in the host for sorting alarms, etc.
5	MODE_BLK	RECORD	DS-69 (4)	Mixed	Auto	RW (OOS or Auto)	1 (4) 3 (4)	All	The actual, target, permitted, and normal modes of the block.
6	BLOCK_ERR	STRING	BIT STRING (2)	D/20	–	R	1 (2) 3 (2)	All	The error status as-sociated with the hardware or soft-ware components associated with a block.
7	XD_ERROR	VARIA-BLE	Un-signed8 (1)	D	–	R	1 (1) 3 (1)	All	Used for all config-uration, hardware, connection failure, or system prob-lems in the block.
Process data									
14	TEMPERA-TURE	VARIA-BLE	DS-65 (5)	D/20	–	R	1 (5) 3 (5)	All	Temperature
16	DENSITY	VARIA-BLE	DS-65 (5)	D/20	–	R	1 (5) 3 (5)	All	Density
73	SNS_Actual-FlowDirec-tion	VARIA-BLE	DS-66 (2)	–	0	R	2 (2)	CDM	Actual direction of flow See *Table D-6*
Configuration parameters									
15	TEMPERA-TURE_UNITS	ENUM	Un-sign-ed16 (2)	S	°C	RW (OOS)	2 (2)	All	Temperature unit See *Table D-7*
17	DENSITY_UNITS	ENUM	Un-sign-ed16 (2)	S	g/cm³	RW (OOS)	2 (2)	All	Density unit See *Table D-8*
27	TEMPERA-TURE_DAMP-ING	VARIA-BLE	FLOAT (4)	S	4.8	RW (OOS)	2 (4)	All	Temperature damping (sec-onds)
28	DENSITY_DAMPING	VARIA-BLE	FLOAT (4)	S	1.6	RW (OOS)	2 (4)	All	Density damping (seconds)

Table D-4: Measurement transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
34	DENSITY_ LOW_CUT-OFF	VARIA-BLE	FLOAT (4)	S	0.2	RW (OOS)	2 (4)	All	Density cutoff
35	FLOW_DI-RECTION	ENUM	Un-sign-ed16 (2)	S	0	RW (Any)	2 (2)	CDM	Configuration of Flow Direction pa-rameter See *Table D-9*
37	HIGH_TEMP_ LIMIT	VARIA-BLE	FLOAT (4)	S	Calc	R	2 (4)	All	High temperature limit of sensor
38	HIGH_DENSI-TY_LIMIT	VARIA-BLE	FLOAT (4)	S	Calc	R	2 (4)	All	High density limit of sensor (g/cm³)
41	LOW_TEMP_ LIMIT	VARIA-BLE	FLOAT (4)	S	Calc	R	2 (4)	All	Low temperature limit of sensor
42	LOW_DENSI-TY_LIMIT	VARIA-BLE	FLOAT (4)	S	Calc	R	2 (4)	All	Low density limit of sensor (g/cm³)
System									
64	MEAS_SYS_ AttachedCor-eType	ENUM	Un-sign-ed16 (2)	S	0	R		All	Device type See *Table D-10*

Table D-5: Integer codes for XD_ERROR

Code in decimal	Code in hexadecimal	Description
0	0x0000	No error
18	0x0012	Calibration error
19	0x0013	Configuration error
20	0x0014	Electronics failure
21	0x0015	Sensor failure
26	0x001A	Process error
27	0x001B	Calibration in progress

Table D-6: Integer codes for SNS_ActualFlowDirection

Code in decimal	Code in hexadecimal	Description
0	0x0000	Forward flow or zero flow
1	0x0001	Reverse flow

Table D-7: Integer codes for TEMPERATURE_UNITS

Code in decimal	Code in hexadecimal	Description
1000	0x	Kelvin
1001	0x	°Celsius
1002	0x	°Fahrenheit
1003	0x	°Rankine

Table D-8: Integer codes for DENSITY_UNITS

Code in decimal	Code in hexadecimal	Description
1097	0x	kg/m³
1100	0x	g/cm³
1103	0x	kg/L
1104	0x	g/ml
1105	0x	g/L
1106	0x	lb/in³
1107	0x	lb/ft³
1108	0x	lb/gal
1109	0x	Ston/yd³
1113	0x	°API
1114	0x	SGU
253	0x00FD	Special

Table D-9: Integer codes for FLOW_DIRECTION

Code in decimal	Code in hexadecimal	Description
0	0x0000	Forward only
1	0x0001	Reverse only
2	0x0002	Bidirectional
3	0x0003	Absolute value
4	0x0004	Negate/Forward only
5	0x0005	Negate/Bidirectional

Table D-10: Integer codes for MEAS_SYS_AttachedCoreType

Code in decimal	Code in hexadecimal	Description
5	0x0005	Core processor for CDM
6	0x0006	Core processor for FDM

Table D-10: Integer codes for MEAS_SYS_AttachedCoreType *(continued)*

Code in decimal	Code in hexadecimal	Description
7	0x0007	Core processor for FVM

D.2.2   Calibration transducer block and related information

In the following table:

OD index	Index of the parameter in the object dictionary
Name	Name used in code
Message type	One of the following:

VARIABLE	A value
ENUM	A value from an enumeration
METHOD	Initiates an action in the device
STRING	A set of ASCII characters
ARRAY	A set of values
RECORD	A data structure defined by the Fieldbus Foundation

Data type	The data type of the parameter, and the size in bytes, when required
Memory class	Class of memory required, and the update rate in Hz if applicable:

D	Dynamic store (cyclic data, parameter updated periodically)
S	Static store (acyclic data, parameter changed on a deliberate write)
N	Nonvolatile parameter (saved across power cycles)

Initial value	The value that the parameter will have after a master reset is performed. *Calc* = calculated
Access	The type of access allowed for the parameter:

R	Read-only
RW (Any)	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

View and size in view	The views that contain the parameter, and the size of the parameter in the view, in bytes. Example: View 2 (4)
Device	The meter or meters that use this parameter
Comments	A quick definition of the parameter, the name of the parameter in ProLink III, or other information about the parameter

Table D-11: Calibration transducer block

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
Fieldbus standard									
0	BLOCK_ STRUCTURE	VARIA-BLE	DS_64 (5)	S	N/A	RW (OOS or Auto)		All	Beginning of the transducer block
1	ST_REV	VARIA-BLE	Un-sign-ed16 (2)	S	0	R	1 (2) 2 (2) 3 (2) 4 (2)	All	The revision level of the static data associated with the function block. Incremented with each write of static store.
2	TAG_DESC	STRING	OCTET STRING (32)	S	Spaces	RW (OOS or Auto)		All	The user descrip-tion of the inten-ded application of the block.
3	STRATEGY	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS or Auto)	4 (2)	All	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	VARIA-BLE	Un-signed8 (1)	S	0	RW (OOS or Auto)	4 (1)	All	The identification number of the plant unit. This in-formation may be used in the host for sorting alarms, etc.
5	MODE_BLK	RECORD	DS-69 (4)	Mixed	Auto	RW (OOS or Auto)	1 (4) 3 (4)	All	The actual, target, permitted, and normal modes of the block.
6	BLOCK_ERR	STRING	BIT STRING (2)	D/20	–	R	1 (2) 3 (2)	All	The error status as-sociated with the hardware or soft-ware components associated with a block.
7	XD_ERROR	VARIA-BLE	Un-signed8 (1)	D	–	R	1 (1) 3 (1)	All	Used for all config-uration, hardware, connection failure, or system prob-lems in the block.

Table D-11: Calibration transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
Calibration									
8	MASS_FLOW_GAIN	VARIA-BLE	FLOAT (4)	S	1	RW (OOS)	2 (4)	CDM	Flow calibration factor
10	ZERO_CAL	VARIA-BLE	DS-66 (2)	–	0	RW (OOS)	2 (2)	CDM	Value part of DS-66 • 0=Abort zero calibration • 1=Start zero calibration
11	ZERO_TIME	VARIA-BLE	Un-sign-ed16 (2)	S	20	RW (OOS)	2 (2)	CDM	Duration of zero calibration (sec-onds)
12	ZERO_STD_DEV	VARIA-BLE	FLOAT (4)	S	0	R	3 (4)	CDM	Standard deviation of zero value dur-ing zero calibration
13	ZERO_OFF-SET	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	3 (4)	CDM	Present flow signal offset at zero flow (msec)
14	ZERO_FAILED_VAULE	VARIA-BLE	FLOAT (4)	S	0	R	3 (4)	CDM	Value of the zero if the zero cal failed
36	TEMP_LOW_CAL	METH-OD	Un-sign-ed16 (2)	–	0	RW (OOS)	2 (2)	All	Perform tempera-ture calibration at the low point (point 1) • 0=No action • 1=Start
37	TEMP_HIGH_CAL	METH-OD	Un-sign-ed16 (2)	–	0	RW (OOS)	2 (2)	All	Perform tempera-ture calibration at the high point (point 2) • 0=No action • 1=Start
38	TEMP_VALUE	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	2 (4)	All	Temperature Val-ue for temp cali-brations (°C)
39	TEMP_OFF-SET	VARIA-BLE	FLOAT (4)	S	0	R /W (OOS)	3 (4)	FDM FVM	Temperature off-set
40	TEMP_SLOPE	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	3 (4)	FDM FVM	Temperature slope

Table D-11: Calibration transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
49	SNS_ZeroIn-Progress	VARIA-BLE	DS-66 (2)	–	0	R	2 (2)	All	• 0=No calibra-tion in pro-gress • 1=Calibration in progress
50	CAL_TEM-PERATURE_UNITS	ENUM	Un-sign-ed16 (2)	S	°C	RW (OOS)	2 (2)	All	Temperature unit See *Table D-13*
Pressure compensation									
41	PRESSURE_COMP	VARIA-BLE	DS-65 (5)	D/20	0	RW (any)	1 (5) 3 (5)	All	Pressure
42	PRESSURE_UNITS	ENUM	Un-sign-ed16 (2)	S	psi	RW (OOS)	2 (2)	All	Pressure unit See *Table D-14*
43	ENABLE_PRESSURE_COMP	ENUM	Un-sign-ed16 (2)	S	0	RW (OOS)	4 (2)		Pressure compen-sation status • 0=Disabled • 1=Enabled
Temperature compensation									
47	SNS_PuckE-nableExt-Temp	Method	Un-sign-ed16 (2)	S	0	RW (OOS)	2 (2)	All	Temperature com-pensation status • 0=Disabled • 1=Enabled
48	SNS_Exter-nalTempIn-put	VARIA-BLE	DS-65 (5)	S	0	RW (any)	1 (5)	All	Temperature source for temper-ature compensa-tion • 0=Internal • 1=External

Table D-12: Integer codes for XD_ERROR

Code in decimal	Code in hexadecimal	Description
0	0x0000	No error
18	0x0012	Calibration error
19	0x0013	Configuration error
20	0x0014	Electronics failure
21	0x0015	Sensor failure
26	0x001A	Process error

Table D-12: Integer codes for XD_ERROR *(continued)*

Code in decimal	Code in hexadecimal	Description
27	0x001B	Calibration in progress

Table D-13: Integer codes for CAL_TEMP_UNITS

Code	Code in hexadecimal	Description
1000		Kelvin
1001		°Celsius
1002		°Fahrenheit
1003		°Rankine

Table D-14: Integer codes for PRESSURE_UNITS

Code in decimal	Code in hexadecimal	Description
1130		Pascals
1132		Megapascals
1133		Kilopascals
1137		Bar
1138		Millibar
1139		Torr at 0 °C
1140		Atmospheres
1141		PSI
1144		g/cm²
1145		kg/cm²
1147		Inches water at 4 °C
1148		Inches water at 68 °F / Inches water at 60 °F[1]
1150		Millimeters water at 4 °C
1151		Millimeters water at 68 °F
1154		Feet water at 68 °F
1156		Inches mercury (HG) at 0 °C
1158		Millimeters mercury (HG) at 0 °C

(1)   Enhancement to fieldbus specification in progress.

D.2.3 Diagnostic transducer block and related information

In the following table:

OD index   Index of the parameter in the object dictionary

Name	Name used in code
Message type	One of the following:

VARIABLE	A value
ENUM	A value from an enumeration
METHOD	Initiates an action in the device
STRING	A set of ASCII characters
ARRAY	A set of values
RECORD	A data structure defined by the Fieldbus Foundation

Data type	The data type of the parameter, and the size in bytes, when required
Memory class	Class of memory required, and the update rate in Hz if applicable:

D	Dynamic store (cyclic data, parameter updated periodically)
S	Static store (acyclic data, parameter changed on a deliberate write)
N	Nonvolatile parameter (saved across power cycles)

Initial value	The value that the parameter will have after a master reset is performed. *Calc* = calculated
Access	The type of access allowed for the parameter:

R	Read-only
RW (Any)	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

View and size in view	The views that contain the parameter, and the size of the parameter in the view, in bytes. Example: View 2 (4)
Device	The meter or meters that use this parameter
Comments	A quick definition of the parameter, the name of the parameter in ProLink III, or other information about the parameter

Table D-15: Diagnostic transducer block

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
Fieldbus standard									
0	BLOCK_STRUCTURE	VARIA-BLE	DS_64 (5)	S	N/A	RW (OOS or Auto)		All	Beginning of the transducer block

Table D-15: Diagnostic transducer block *(continued)*

OD index	Name	Message type	Data type (size)	Memory class	Initial value	Access	View (size)	Device	Comments
1	ST_REV	VARIABLE	Unsigned16 (2)	S	0	R	1 (2) 2 (2) 3 (2) 4 (2)	All	The revision level of the static data associated with the function block. Incremented with each write of static store.
2	TAG_DESC	STRING	OCTET STRING (32)	S	Spaces	RW (OOS or Auto)		All	The user description of the intended application of the block.
3	STRATEGY	VARIABLE	Unsigned16 (2)	S	0	RW (OOS or Auto)	4 (2)	All	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	VARIABLE	Unsigned8 (1)	S	0	RW (OOS or Auto)	4 (1)	All	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	RECORD	DS-69 (4)	Mixed	Auto	RW (OOS or Auto)	1 (4) 3 (4)	All	The actual, target, permitted, and normal modes of the block.
6	BLOCK_ERR	STRING	BIT STRING (2)	D/20	–	R	1 (2) 3 (2)	All	The error status associated with the hardware or software components associated with a block.
7	XD_ERROR	VARIABLE	Unsigned8 (1)	D	–	R	1 (1) 3 (1)	All	Used for all configuration, hardware, connection failure, or system problems in the block.
Configuration									
17	ALARM_INDEX	ENUM	Unsigned16 (2)	S	0	RW (Any)	4 (2)	All	Alert Index See *Table D-17*

Table D-15: Diagnostic transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
18	ALARM_SE-VERITY	ENUM	Un-sign-ed16 (2)	S	0	RW (OOS)	4 (2)	All	Alert Severity See *Table D-18*
16	LAST_MEAS-URED_VAL-UE_FAULT_ TIMEOUT	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (Any)	2 (2)	All	Fault timeout (0–60 seconds)
83	ALERT_TIME-OUT	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (Any)	2 (2)	All	Field Diagnostics alert timeout 0–300 seconds
Two-phase flow									
8	SLUG_TIME	VARIA-BLE	FLOAT (4)	S	0	RW (Any)	4 (4)	All	Two-phase flow duration (seconds)
9	SLUG_LOW_ LIMIT	VARIA-BLE	FLOAT (4)	S	0	RW (Any)	4 (4)	All	Two-phase flow low limit (g/cm³)
10	SLUG_HIGH_ LIMIT	VARIA-BLE	FLOAT (4)	S	5	RW (Any)	4 (4)	All	Two-phase flow high limit (g/cm³)
Alerts									
11	ALARM1_ STATUS	ENUM	BIT STRING (2)	D/20	–	R	1 (2) 3 (2)	All	Status Word 1 See *Table D-19*
12	ALARM2_ STATUS	ENUM	BIT STRING (2)	D/20	–	R	1 (2) 3 (2)	All	Status Word 2 See *Table D-20*
13	ALARM3_ STATUS	ENUM	BIT STRING (2)	D/20	–	R		All	Status Word 3 See *Table D-21*
14	ALARM4_ STATUS	ENUM	BIT STRING (2)	D/20	–	R		All	Status Word 4 See *Table D-22*
114	ALARM5_ STATUS	ENUM	BIT STRING (2)	D/20	–	R		All	Status Word 5 See *Table D-23*
15	FAULT_LIMIT	ENUM	Un-sign-ed16 (2)	S	5	RW (OOS)	2 (2)	All	Fault action See *Table D-24*
16	LAST_MEAS-URED_VAL-UE_FAULT_ TIMEOUT	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (Any)	2 (2)	All	Fault timeout (sec-onds)

Table D-15: Diagnostic transducer block *(continued)*

OD index	Name	Message type	Data type (size)	Memory class	Initial value	Access	View (size)	Device	Comments
112	SYS_AnalogOutput_Fault	VARIABLE	DS-66 (2)	–	0	R	2 (2)	All	Value part of DS-66 • 0=No critical fault • 1=Critical fault present
Diagnostics									
19	DRIVE_GAIN	VARIABLE	DS-65 (50	D/20	–	R	1 (5) 3 (5)	All	Drive Gain
20	TUBE_FREQUENCY	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	All	Raw Tube Period
22	LEFT_PICKUP_VOLTAGE	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	All	Left Pickoff Voltage
23	RIGHT_PICKUP_VOLTAGE	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	CDM FVM	Right Pickoff Voltage
24	BOARD_TEMPERATURE	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	All	Board Temperature (°C)
25	ELECT_TEMP_MAX	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	All	Maximum electronics temperature
26	ELECT_TEMP_MIN	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	All	Minimum electronics temperature
27	ELECT_TEMP_AVG	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	All	Average electronics temperature
28	SENSOR_TEMP_MAX	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	All	Maximum sensor temperature
29	SENSOR_TEMP_MIN	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	All	Minimum sensor temperature
30	SENSOR_TEMP_AVG	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	All	Average sensor temperature
31	RTD_RESISTANCE_CABLE	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	All	9-wire cable RTD Resistance (ohms)
32	RTD_RESISTANCE_METER	VARIABLE	FLOAT (4)	D/20	–	R	3 (4)	All	Meter RTD Resistance (ohms)
33	CP_POWER_CYCLE	VARIABLE	Unsigned16 (2)	D	–	R	3 (2)	All	Number of core processor power cycles

Table D-15: Diagnostic transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
46	SYS_Power-OnTimeSec	VARIA-BLE	Un-signe-dI32 (4)	D	–	R	3 (4)	All	Power-on time (seconds since last reset)
47	SNS_Input-Voltage	VARIA-BLE	FLOAT (4)	D	–	R	3 (4)	All	Input voltage (volts)
48	SNS_Targe-tAmplitude	VARIA-BLE	FLOAT (4)	D	–	R	3 (4)	All	Actual target am-plitude (mV/Hz)
50	SYS_Restore-FactoryCon-fig	Method	Un-sign-ed16 (2)	S	0	RW (OOS)	2 (2)	All	Restore factory configuration • 0=No action • 1=Restore
53	SYS_ResetPo-werOnTime	Method	Un-sign-ed16 (2)	S	0	RW (Any)	2 (2)	All	Reset power-on time • 0=No action • 1=Reset
115	DIAG_TEM-PERATURE_UNITS	ENUM	Un-sign-ed16 (2)	S	°C	RW (OOS)	2 (2)	All	Temperature unit See *Table D-26*
System									
45	DIAG_FEA-TURE_KEY	STRING	BIT STRING (2)	S	–	R	4 (2)	All	Available applica-tions See *Table D-25*
117	DIAG_SYS_AttachedCor-eType	ENUM	Un-sign-ed16 (2)	S	0	R		All	Core processor type See *Table D-27*

Table D-16: Integer codes for XD_ERROR

Code in decimal	Code in hexadecimal	Description
0	0x0000	No error
18	0x0012	Calibration error
19	0x0013	Configuration error
20	0x0014	Electronics failure
21	0x0015	Sensor failure
26	0x001A	Process error
27	0x001B	Calibration in progress

Table D-17: Integer Codes for ALARM_INDEX

Code in deci-mal	Code in hexa-decimal	Correspond-ing status alert	Alert title
1		A001	EEPROM Error
2		A002	RAM Error
3		A003	No Sensor Response
4		A004	Temperature Overrange
5		A005	Velocity Overrange
6		A006	Characterization Required
8		A008	Density Overrange
9		A009	Transmitter Initializing/Warming Up
10		A010	Calibration Failure
11		A011	Zero Calibration Failed: Low
12		A012	Zero Calibration Failed: High
13		A013	Zero Calibration Failed: Unstable
14		A014	Transmitter Failure
16		A016	Sensor Temperature (RTD) Failure
17		A017	Sensor Case Temperature (RTD) Failure
18		A018	EEPROM Error (Transmitter)
19		A019	RAM Error (Transmitter)
20		A020	Calibration Factors Missing
21		A021	Transmitter/Sensor/Software Mismatch
29		A029	Internal Electronics Failure
30		A029	Incorrect Board Type
33		A033	Insufficient Pickoff Signal
37		A037	Sensor Check Failed
38		A038	Time Period Signal Out of Range
42		A102	Drive Overrange
44		A104	Calibration in Progress
45		A105	Two-Phase Flow
47		A107	Power Reset Occurred
56		A116	Temperature Overrange (API Referral)
57		A117	Density Overrange (API Referral)
60		A120	Curve Fit Failure (Concentration)
61		A121	Extrapolation Alert (Concentration)
62		A122	Pressure Overrange (API Referral)
68		A128	Factory Configuration Invalid

Table D-17: Integer Codes for ALARM_INDEX *(continued)*

Code in decimal	Code in hexadecimal	Corresponding status alert	Alert title
69		A129	Factory Configuration Checksum Invalid
72		A132	Sensor Simulation Active
73		A133	EEPROM Error (Display)
74		A134	Tube-Case Temperature Difference Overrange
76		A136	Incorrect Display Type

Table D-18: Integer codes for ALARM_SEVERITY

Code in decimal	Code in hexadecimal	Description
0		Ignore
1		Informational
2		Fault

Table D-19: Integer codes for Status Word 1

Code in decimal	Code in hexadecimal	Description	Corresponding status alert
	0x0001	Transmitter Fail	
	0x0002	Sensor Fail	
	0x0004	EEPROM error (CP)	
	0x0008	RAM error (CP)	
	0x0010	Boot Fail (CP)	
	0x0020	Uncofig – FloCal	A020
	0x0040	Uncofig – K1	A020
	0x0080	Input Overrange	
	0x0100	Temp. Overrange	A004
	0x0200	Dens. Overrange	A008
	0x0800	Cal Failed	A010
	0x1000	Xmitter Init	A009
	0x2000	Sns/Xmitter comm fault	A002
	0x8000	Xmitter Not Characterized	

Table D-20: Integer codes for Status Word 2

Code in decimal	Code in hexadecimal	Description	Corresponding status alert
	0x0001	Line RTD Over	A106
	0x0002	Meter RTD Over	A107
	0x0004	CP Exception	
	0x0008	API: Temp OOL	A116
	0x0010	API: Density OOL	A117
	0x0020	ED: Unable to fit curve data	A120
	0x0040	ED: Extrapolation alarm	A121
	0x0080	Not used	N/A
	0x0100	EEPROM err (2700)	
	0x0200	RAM err (2700)	
	0x0400	Factoy Config err	
	0x0800	Low Power	
	0x1000	Tube not full	
	0x2000	Not used	N/A
	0x4000	Not used	N/A
	0x8000	Not used	N/A

Table D-21: Integer codes for Status Word 3

Code in decimal	Code in hexadecimal	Description	Corresponding status alert
	0x0001	Drive Overrange	A102
	0x0002	Slug Flow	A105
	0x0004	Cal in Progress	A104
	0x0008	Not used	N/A
	0x0010	Upgrade Series 2000	
	0x0020	Simulation Mode	
	0x0080	Warming Up	
	0x0100	Power Reset	A107
	0x0200	Reverse Flow	
	0x0400	AI/AO Simulation Active	
	0x0800	Not used	N/A
	0x1000	Not used	N/A
	0x2000	Not used	N/A
	0x4000	Not used	N/A

Table D-21: Integer codes for Status Word 3 *(continued)*

Code in decimal	Code in hexadecimal	Description	Corresponding status alert
	0x8000	Not used	N/A

Table D-22: Integer codes for Status Word 4

Code in decimal	Code in hexadecimal	Description	Corresponding status alert
	0x0001	Cal Fail: Low	A011
	0x0002	Cal Fail: High	A012
	0x0004	Cal Fail: Noisy	A013
	0x0008	Auto Zero IP	A104
	0x0010	D1 IP	A104
	0x0020	D2 IP	A104
	0x0040	FD IP	A104
	0x0080	Temp slope IP	
	0x0100	Temp offset IP	
	0x0200	D3 IP	A104
	0x0400	D4 IP	A104
	0x0800	1 – Factory configuration invalid	
	0x1000	1 – Factory configuration data checksum invalid	
	0x2000	Core EEPROM DB corrupt	
	0x4000	Core EEPROM Totals corrupt	

Table D-23: Integer codes for Status Word 5

Code in decimal	Code in hexadecimal	Description	Corresponding status alert
	0x0001	Viscosity Out of Limits	
	0x0002	Sensor Check Fail	A037
	0x0004	API referral: Pressure Out of Range	A122
	0x0008	Incorrect Display Type	A136
	0x0010	Incorrect Board Type	
	0x0020	Time Period Out of Limits	
	0x0040	Case/Meter Temperature Difference Out of Range	A134
	0x0080	Not used	N/A

Table D-23: Integer codes for Status Word 5 *(continued)*

Code in decimal	Code in hexadecimal	Description	Corresponding status alert
	0x0100	Not used	N/A
	0x0200	Not used	N/A
	0x0400	Not used	N/A
	0x0800	Not used	N/A
	0x1000	Not used	N/A
	0x2000	Not used	N/A
	0x4000	Not used	N/A
	0x8000	Not used	N/A

Table D-24: Integer codes for FAULT_LIMIT

Code in decimal	Code in hexadecimal	Description
0		Upscale
1		Downscale
2		Zero
3		Not-A-Number
4		Flow goes to zero
5		None

Table D-25: Integer codes for DIAG_FEATURE_KEY

Code in decimal	Code in hexadecimal	Description
	0x0000	Standard
	0x0008	Concentration measurement
	0x0010	API referral

Table D-26: Integer codes for DIAG_TEMPERATURE_UNITS

Code in decimal	Code in hexadecimal	Description
1000		Kelvin
1001		°Celsius
1002		°Fahrenheit
1003		°Rankine

Table D-27: Integer codes for DIAG_SYS_AttachedCoreType

Code in decimal	Code in hexadecimal	Description
5	0x0005	Core processor for CDM
6	0x0006	Core processor for FDM
7	0x0007	Core processor for FVM

D.2.4 Device Information transducer block and related information

In the following table:

OD index Index of the parameter in the object dictionary

Name Name used in code

Message type One of the following:

VARIABLE	A value
ENUM	A value from an enumeration
METHOD	Initiates an action in the device
STRING	A set of ASCII characters
ARRAY	A set of values
RECORD	A data structure defined by the Fieldbus Foundation

Data type The data type of the parameter, and the size in bytes, when required

Memory class Class of memory required, and the update rate in Hz if applicable:

D Dynamic store (cyclic data, parameter updated periodically)

S Static store (acyclic data, parameter changed on a deliberate write)

N Nonvolatile parameter (saved across power cycles)

Initial value The value that the parameter will have after a master reset is performed. *Calc* = calculated

Access The type of access allowed for the parameter:

R	Read-only
RW (Any)	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

View and size in view The views that contain the parameter, and the size of the parameter in the view, in bytes. Example: View 2 (4)

Device The meter or meters that use this parameter

| | Comments | A quick definition of the parameter, the name of the parameter in ProLink III, or other information about the parameter |

Table D-28: Device Information transducer block

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
Fieldbus standard									
0	BLOCK_STRUCTURE	VARIA-BLE	DS_64 (5)	S	N/A	RW (OOS or Auto)		All	Beginning of the transducer block
1	ST_REV	VARIA-BLE	Un-sign-ed16 (2)	S	0	R	1 (2) 2 (2) 3 (2) 4 (2)	All	The revision level of the static data associated with the function block. Incremented with each write of static store.
2	TAG_DESC	STRING	OCTET STRING (32)	S	Spaces	RW (OOS or Auto)		All	The user descrip-tion of the inten-ded application of the block.
3	STRATEGY	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS or Auto)	4 (2)	All	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	VARIA-BLE	Un-signed8 (1)	S	0	RW (OOS or Auto)	4 (1)	All	The identification number of the plant unit. This in-formation may be used in the host for sorting alarms, etc.
5	MODE_BLK	RECORD	DS-69 (4)	Mixed	Auto	RW (OOS or Auto)	1 (4) 3 (4)	All	The actual, target, permitted, and normal modes of the block.
6	BLOCK_ERR	STRING	BIT STRING (2)	D/20	–	R	1 (2) 3 (2)	All	The error status as-sociated with the hardware or soft-ware components associated with a block.

Table D-28: Device Information transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
7	XD_ERROR	VARIA-BLE	Un-signed8 (1)	D	–	R	1 (1) 3 (1)	All	Used for all config-uration, hardware, connection failure, or system prob-lems in the block.
Transmitter									
8	SERIAL_NUM-BER	VARIA-BLE	Un-sign-ed32 (4)	S	0	RW (Any)	2 (4)	All	Transmitter serial number
9	OPTION_ BOARD_ CODE	ENUM	Un-sign-ed16 (2)	S	20	R		All	Output option board See *Table D-30*
11	2700_SW_ REV	VARIA-BLE	Un-sign-ed16 (2)	S	S/W Rev	R	2 (2)	All	Software revision
12	CEQ_NUM-BER	VARIA-BLE	Un-sign-ed16 (2)	S	S/W Rev	R	2 (2)	All	ETO number
13	DESCRIPTION	STRING	VISIBLE STRING (16)	S	(1)	RW (Any)	4 (16)	All	User-defined string
Sensor									
14	SENSOR_SN	VARIA-BLE	Un-sign-ed32 (4)	S	0	RW (Any)	2 (4)	All	Sensor serial num-ber
15	SENSOR_ TYPE	STRING	VISIBLE STRING (16)	S	(2)	R	4 (16)	All	Sensor type
17	SENSOR_MA-TERIAL	ENUM	Un-sign-ed16 (2)	S	253	RW (Any)	2 (4)	All	Sensor material See *Table D-31*
18	SENSOR_LIN-ER	ENUM	Un-sign-ed16 (2)	S	253	RW (Any)	4 (2)	CDM	Liner material See *Table D-32*
19	SENSOR_END	ENUM	Un-sign-ed16 (2)	S	253	RW (Any)	4 (2)	All	Flange type See *Table D-33*
20	MASS_MIN_ RANGE	VARIA-BLE	FLOAT (4)	S	Calc	R	4 (4)	CDM	Mass flow mini-mum range
21	TEMP_MIN_ RANGE	VARIA-BLE	FLOAT (4)	S	Calc	R	4 (4)	All	Temperature mini-mum range

Table D-28: Device Information transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
22	DENSITY_MIN_RANGE	VARIA-BLE	FLOAT (4)	S	Calc	R	4 (4)	All	Density minimum range (g/cm³)
24	SNS_PuckDe-viceType-Code	ENUM	Un-sign-ed16 (2)	S	–	R	4 (2)	All	Device type • 61=Density/viscosity
27	SYS_Device-Type	VARIA-BLE	Un-sign-ed16 (2)	S	43	R	4 (2)	All	Transmitter device type
System									
28	SYS_Manu-facturerID	VARIA-BLE	Un-sign-ed16 (2)	S	31	R	4 (2)	All	Manufacturer ID
64	DEV_SYS_At-tachedCore-Type	ENUM	Un-sign-ed16 (2)	S	0	R		All	Core processor type See *Table D-34*

(1)   "CONFIGURE XMTR"
(2)   "@@@@@@@@@@@@@@@@"

Table D-29: Integer codes for XD_ERROR

Code in decimal	Code in hexadecimal	Description
0	0x0000	No error
18	0x0012	Calibration error
19	0x0013	Configuration error
20	0x0014	Electronics failure
21	0x0015	Sensor failure
26	0x001A	Process error
27	0x001B	Calibration in progress

Table D-30: Integer codes for OPTION_BOARD_CODE

Code in decimal	Code in hexadecimal	Description
0		None
20		Foundation fieldbus Hornet board

Table D-31: Integer codes for SENSOR_MATERIAL

Code in decimal	Code in hexadecimal	Description
3		Hastelloy C-22
6		Titanium
252		Unknown
253		Special

Table D-32: Integer codes for SENSOR_LINER

Code in decimal	Code in hexadecimal	Description
10		PTFE (Teflon)
11		Halar
16		Tefzel
251		None
252		Unknown
253		Special

Table D-33: Integer codes for SENSOR_END

Code in decimal	Code in hexadecimal	Description
0		ANSI 150 (FDM, FVM)
1		ANSI 300
2		ANSI 600
5		PN 40
9		ANSI 900 (CDM, FDM)
10		Sanitary Clamp Fitting (FDM)
12		PN 100 (CDM)
13		PN 16 (FDM, FVM)
14		ANSI 1500 (FDM)
15		Cone Seat Compression Fitting (FDM, FVM)
251		None
252		Unknown
253		Special

Table D-34: Integer codes for DEV_SYS_AttachedCoreType

Code in decimal	Code in hexadecimal	Description
5		Core processor for CDM

Table D-34: Integer codes for DEV_SYS_AttachedCoreType *(continued)*

Code in decimal	Code in hexadecimal	Description
6		Core processor for FDM
7		Core processor for FVM

D.2.5   Local Display transducer block and related information

In the following table:

OD index   Index of the parameter in the object dictionary

Name   Name used in code

Message type   One of the following:

    VARIABLE   A value

    ENUM   A value from an enumeration

    METHOD   Initiates an action in the device

    STRING   A set of ASCII characters

    ARRAY   A set of values

    RECORD   A data structure defined by the Fieldbus Foundation

Data type   The data type of the parameter, and the size in bytes, when required

Memory class   Class of memory required, and the update rate in Hz if applicable:

    D   Dynamic store (cyclic data, parameter updated periodically)

    S   Static store (acyclic data, parameter changed on a deliberate write)

    N   Nonvolatile parameter (saved across power cycles)

Initial value   The value that the parameter will have after a master reset is performed. *Calc* = calculated

Access   The type of access allowed for the parameter:

    R   Read-only

    RW (Any)   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

View and size in view   The views that contain the parameter, and the size of the parameter in the view, in bytes. Example: View 2 (4)

Device   The meter or meters that use this parameter

Comments   A quick definition of the parameter, the name of the parameter in ProLink III, or other information about the parameter

Table D-35: Local Display transducer block

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
Fieldbus standard									
0	BLOCK_ STRUCTURE	VARIA-BLE	DS_64 (5)	S	N/A	RW (OOS or Auto)		All	Beginning of the transducer block
1	ST_REV	VARIA-BLE	Un-sign-ed16 (2)	S	0	R	1 (2) 2 (2) 3 (2) 4 (2)	All	The revision level of the static data associated with the function block. Incremented with each write of static store.
2	TAG_DESC	STRING	OCTET STRING (32)	S	Spaces	RW (OOS or Auto)		All	The user descrip-tion of the inten-ded application of the block.
3	STRATEGY	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS or Auto)	4 (2)	All	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	VARIA-BLE	Un-signed8 (1)	S	0	RW (OOS or Auto)	4 (1)	All	The identification number of the plant unit. This in-formation may be used in the host for sorting alarms, etc.
5	MODE_BLK	RECORD	DS-69 (4)	Mixed	Auto	RW (OOS or Auto)	1 (4) 3 (4)	All	The actual, target, permitted, and normal modes of the block.
6	BLOCK_ERR	STRING	BIT STRING (2)	D/20	–	R	1 (2) 3 (2)	All	The error status as-sociated with the hardware or soft-ware components associated with a block.
7	XD_ERROR	VARIA-BLE	Un-signed8 (1)	D	–	R	1 (1) 3 (1)	All	Used for all config-uration, hardware, connection failure, or system prob-lems in the block.

Table D-35: Local Display transducer block *(continued)*

OD index	Name	Message type	Data type (size)	Memory class	Initial value	Access	View (size)	Device	Comments
Display									
10	EN_LDO_AUTO_SCROLL	ENUM	Unsigned16 (2)	S	0	RW (Any)	4 (2)	All	Autoscroll feature • 0=Disabled • 1=Enabled
11	EN_LDO_OFFLINE_MENU	ENUM	Unsigned16 (2)	S	1	RW (Any)	4 (2)	All	Operator access to offline menu • 0=Disabled • 1=Enabled
12	EN_LDO_OFFLINE_PWD	ENUM	Unsigned16 (2)	S	0	RW (Any)	4 (2)	All	Password required for access to offline menu • 0=Not required • 1=Required
13	EN_LDO_ALARM_MENU	ENUM	Unsigned16 (2)	S	1	RW (Any)	4 (2)	All	Operator access to alert menu • 0=Disabled • 1=Enabled
14	EN_LDO_ACK_ALL_ALARMS	ENUM	Unsigned16 (2)	S	1	RW (Any)	4 (2)	All	Ack All feature • 0=Disabled • 1=Enabled
15	LDO_OFFLINE_PWD	VARIABLE	Unsigned16 (2)	S	1234	RW (Any)	2 (2)	All	Display password (4 digits: 0000–9999)
16	LDO_SCROLL_RATE	VARIABLE	Unsigned16 (2)	S	10	RW (Any)	4 (2)	All	Scroll rate for Autoscroll (0–30 seconds)
17	LDO_BACKLIGHT_ON	ENUM	Unsigned16 (2)	S	1	RW (Any)	4 (2)	All	Display backlight • 0=Off • 1=On
18	UI_Language	ENUM	Unsigned16 (2)	S	0	RW (Any)	4 (2)	All	Display language See *Table D-37*
19	LDO_VAR_1_CODE	ENUM	Unsigned16 (2)	S	0	RW (Any)	4 (2)	All	Display variable (251 is not valid) See *Table D-38*
20	LDO_VAR_2_CODE	ENUM	Unsigned16 (2)	S	2	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*

Table D-35: Local Display transducer block *(continued)*

OD index	Name	Message type	Data type (size)	Memory class	Initial value	Access	View (size)	Device	Comments
21	LDO_VAR_3_ CODE	ENUM	Unsigned16 (2)	S	5	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
22	LDO_VAR_4_ CODE	ENUM	Unsigned16 (2)	S	6	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
23	LDO_VAR_5_ CODE	ENUM	Unsigned16 (2)	S	3	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
24	LDO_VAR_6_ CODE	ENUM	Unsigned16 (2)	S	1	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
25	LDO_VAR_7_ CODE	ENUM	Unsigned16 (2)	S	47	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
26	LDO_VAR_8_ CODE	ENUM	Unsigned16 (2)	S	251	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
27	LDO_VAR_9_ CODE	ENUM	Unsigned16 (2)	S	251	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
28	LDO_VAR_ 10_CODE	ENUM	Unsigned16 (2)	S	251	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
29	LDO_VAR_ 11_CODE	ENUM	Unsigned16 (2)	S	251	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
30	LDO_VAR_ 12_CODE	ENUM	Unsigned16 (2)	S	251	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
31	LDO_VAR_ 13_CODE	ENUM	Unsigned16 (2)	S	251	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
32	LDO_VAR_ 14_CODE	ENUM	Unsigned16 (2)	S	251	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*
33	LDO_VAR_ 15_CODE	ENUM	Unsigned16 (2)	S	251	RW (Any)	4 (2)	All	Display variable (all are valid) See *Table D-38*

Table D-35: Local Display transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
34	FBUS_UI_ProcVarIndex	ENUM	Un-sign-ed16 (2)	S	0	RW (Any)	4 (2)	All	Display variable in-dex, by code See *Table D-38*
35	UI_NumDeci-mals	VARIA-BLE	Un-sign-ed16 (2)	S	4	RW (Any)	4 (2)	All	Precision of in-dexed display vari-able (0–5)
36	UI_Update-Periodmsec	VARIA-BLE	Un-sign-ed16 (2)	S	200	RW (Any)	4 (2)	All	Display refresh rate (100–1000 milliseconds)
37	UI_Enable-StatusLed-Blinking	ENUM	Un-sign-ed16 (2)	S	1	RW (Any)	4 (2)	All	Status LED Blinking • 0=Disabled • 1=Enabled
38	UI_EnableA-larmPass-word	ENUM	Un-sign-ed16 (2)	S	0	RW (Any)	4 (2)	All	Password required for access to alert menu • 0=Not required • 1=Required
System									
39	LDO_FEA-TURE_KEY	STRING	BIT STRING (2)	S	–	R	4 (2)	All	Active applications See *Table D-39*
40	LDO_SYS_At-tachedCore-Type	ENUM	Un-sign-ed16 (2)	S	0	R		All	Core processor type See *Table D-40*

Table D-36: Integer codes for XD_ERROR

Code in decimal	Code in hexadecimal	Description
0	0x0000	No error
18	0x0012	Calibration error
19	0x0013	Configuration error
20	0x0014	Electronics failure
21	0x0015	Sensor failure
26	0x001A	Process error
27	0x001B	Calibration in progress

Table D-37: Integer codes for UI_Language

Code in decimal	Code in hexadecimal	Description
0		English
1		German
2		French
3		Reserved
4		Spanish

Table D-38: Integer codes for LDO_VARx_Code

Code in decimal	Code in hexadecimal	Description
1		Line temperature
3		Line density
15		Referred density (API)
21		Referred density (concentration)
22		Density in SGU (concentration)
26		Net mass flow (concentration)
32		Concentration
47		Drive gain
48		Case temperature (CDM only)
49		LPO amplitude (CDM only)
50		RPO amplitude
51		Board temperature
53		External pressure
55		External temperature
159		User-defined calculation output
160		Sensor Time Period (Upper) (FVM only)
151		Tube-Case Temperature Difference (CDM only)
162		Dynamic viscosity (FVM only)
163		Kinematic viscosity (FVM only)
164		Base viscosity (FVM only)
166		CCAI (FVM only)
167		CII (FVM only)
168		Quality factor
208		Velocity (CDM only)
215		Sensor Time Period

Table D-38: Integer codes for LDO_VARx_Code *(continued)*

Code in decimal	Code in hexadecimal	Description
251[1]		None

(1)   Not valid for Display Variable 1

Table D-39: Integer codes for LDO_FEATURE_KEY

Code in decimal	Code in hexadecimal	Description
	0x0000	Standard
	0x0800	Not applicable
	0x0080	Not applicable
	0x0008	Concentration measurement
	0x0010	API referral

Table D-40: Integer codes for LDO_SYS_AttachedCoreType

Code in decimal	Code in hexadecimal	Description
5		Core processor for CDM
6		Core processor for FDM
7		Core processor for FVM

D.2.6   API Referral transducer block and related information

In the following table:

OD index	Index of the parameter in the object dictionary
Name	Name used in code
Message type	One of the following:

	VARIABLE	A value
	ENUM	A value from an enumeration
	METHOD	Initiates an action in the device
	STRING	A set of ASCII characters
	ARRAY	A set of values
	RECORD	A data structure defined by the Fieldbus Foundation

Data type	The data type of the parameter, and the size in bytes, when required
Memory class	Class of memory required, and the update rate in Hz if applicable:

	D	Dynamic store (cyclic data, parameter updated periodically)

S	Static store (acyclic data, parameter changed on a deliberate write)
N	Nonvolatile parameter (saved across power cycles)

Initial value	The value that the parameter will have after a master reset is performed. *Calc* = calculated
Access	The type of access allowed for the parameter:

R	Read-only
RW (Any)	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

View and size in view	The views that contain the parameter, and the size of the parameter in the view, in bytes. Example: View 2 (4)
Device	The meter or meters that use this parameter
Comments	A quick definition of the parameter, the name of the parameter in ProLink III, or other information about the parameter

Table D-41: API Referral transducer block

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
Fieldbus standard									
0	BLOCK_ STRUCTURE	VARIA-BLE	DS_64 (5)	S	N/A	RW (OOS or Auto)		All	Beginning of the transducer block
1	ST_REV	VARIA-BLE	Un-sign-ed16 (2)	S	0	R	1 (2) 2 (2) 3 (2) 4 (2)	All	The revision level of the static data associated with the function block. Incremented with each write of static store.
2	TAG_DESC	STRING	OCTET STRING (32)	S	Spaces	RW (OOS or Auto)		All	The user descrip-tion of the inten-ded application of the block.
3	STRATEGY	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS or Auto)	4 (2)	All	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.

Table D-41: API Referral transducer block *(continued)*

OD index	Name	Message type	Data type (size)	Memory class	Initial value	Access	View (size)	Device	Comments
4	ALERT_KEY	VARIABLE	Unsigned8 (1)	S	0	RW (OOS or Auto)	4 (1)	All	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	RECORD	DS-69 (4)	Mixed	Auto	RW (OOS or Auto)	1 (4) 3 (4)	All	The actual, target, permitted, and normal modes of the block.
6	BLOCK_ERR	STRING	BIT STRING (2)	D/20	–	R	1 (2) 3 (2)	All	The error status associated with the hardware or software components associated with a block.
7	XD_ERROR	VARIABLE	Unsigned8 (1)	D	–	R	1 (1) 3 (1)	All	Used for all configuration, hardware, connection failure, or system problems in the block.
Process data									
8	API_Corr_ Density	VARIABLE	DS-65 (5)	D/20	–	R	1 (5) 3 (5)	All	Referred Density
10	API_Ave_ Corr_Density	VARIABLE	DS-65 (5)	D/20	–	R	1 (5) 3 (5)	All	Batch Weighted Average Density
11	API_Ave_ Corr_Temp	VARIABLE	DS-65 (5)	D/20	–	R	1 (5) 3 (5)	All	Batch Weighted Average Temperature
12	API_CTL	VARIABLE	DS-65 (5)	D/20	–	R	1 (5) 3 (5)	All	CPTL
Configuration									
16	EN_API	ENUM	Unsigned16 (2)	S	0	R	4 (2)	All	Application status • 0=Disabled • 1=Enabled
17	API_Ref_ Temp	VARIABLE	FLOAT (4)	S	15	RW (OOS)	4 (4)	All	Reference temperature
18	API_TEC	VARIABLE	FLOAT (4)	S	0.001	RW (OOS)	4 (4)	All	Thermal Expansion Coefficient (TEC)

Table D-41: API Referral transducer block *(continued)*

OD index	Name	Message type	Data type (size)	Memory class	Initial value	Access	View (size)	Device	Comments
19	API_Table_Type	ENUM	Unsigned16 (2)	S	81	RW (OOS)	4 (2)	All	API 2540 CTLTable Type See *Table D-43*
22	API_TEMPERATURE_UNITS	ENUM	Unsigned16 (2)	S	C°	R	2 (2)	All	Temperature Unit See *Table D-44*
23	API_DENSITY_UNITS	ENUM	Unsigned16 (2)	S	g/cm³	R	2 (2)	All	Density Unit See *Table D-45*
25	APIRefPress	VARIABLE	Float(4)	D	0.0f	RW (OOS)	1 (4)	All	Reference pressure
27	API_PressureUnit	ENUM	Unsigned16 (2)	S	psi	RO	2 (2)	All	Pressure Unit See *Table D-46*
System									
20	API_FEATURE_KEY	STRING	BIT STRING (2)	S	–	R	4 (2)	All	Available applications See *Table D-47*
26	PM_SYS_AttachedCoreType	ENUM	Unsigned16 (2)	S	0	R		All	Core processor type See *Table D-48*

Table D-42: Integer codes for XD_ERROR

Code in decimal	Code in hexadecimal	Description
0	0x0000	No error
18	0x0012	Calibration error
19	0x0013	Configuration error
20	0x0014	Electronics failure
21	0x0015	Sensor failure
26	0x001A	Process error
27	0x001B	Calibration in progress

Table D-43: Integer codes for API_Table_Type

Code in decimal	Code in hexadecimal	Description
17		Table 5A

Table D-43: Integer codes for API_Table_Type *(continued)*

Code in decimal	Code in hexadecimal	Description
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
69		Table 24E

Table D-44: Integer codes for API_TEMPERATURE_UNITS

Code in decimal	Code in hexadecimal	Description
1000		Kelvin
1001		°Celsius
1002		°Fahrenheit
1003		°Rankine

Table D-45: Integer codes for API_DENSITY_UNITS

Code in decimal	Code in hexadecimal	Description
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		°API
1114		SGU

Table D-45: Integer codes for API_DENSITY_UNITS *(continued)*

Code in decimal	Code in hexadecimal	Description
253		Special

Table D-46: Integer codes for API_PressureUnit

Code in decimal	Code in hexadecimal	Description
1130		Pascals
1132		Megapascals
1133		Kilopascals
1137		Bar
1138		Millibar
1139		Torr at 0 °C
1140		Atmospheres
1141		PSI
1144		g/cm²
1145		kg/cm²
1147		Inches water at 4 °C
1148		Inches water at 68 °F / Inches water at 60 °F[1]
1150		Millimeters water at 4 °C
1151		Millimeters water at 68 °F
1154		Feet water at 68 °F
1156		Inches mercury (HG) at 0 °C
1158		Millimeters mercury (HG) at 0 °C

(1)   Enhancement to fieldbus specification in progress.

Table D-47: Integer codes for API_FEATURE_KEY

Code in decimal	Code in hexadecimal	Description
	0x0000	Standard
	0x0008	Concentration measurement
	0x0010	API referral

Table D-48: Integer codes for PM_SYS_AttachedCoreType

Code in decimal	Code in hexadecimal	Description
5		Core processor for CDM
6		Core processor for FDM

Table D-48: Integer codes for PM_SYS_AttachedCoreType *(continued)*

Code in decimal	Code in hexadecimal	Description
7		Core processor for FVM

D.2.7 Concentration Measurement transducer block and related information

In the following table:

OD index	Index of the parameter in the object dictionary
Name	Name used in code
Message type	One of the following:

	VARIABLE	A value
	ENUM	A value from an enumeration
	METHOD	Initiates an action in the device
	STRING	A set of ASCII characters
	ARRAY	A set of values
	RECORD	A data structure defined by the Fieldbus Foundation

Data type	The data type of the parameter, and the size in bytes, when required
Memory class	Class of memory required, and the update rate in Hz if applicable:

	D	Dynamic store (cyclic data, parameter updated periodically)
	S	Static store (acyclic data, parameter changed on a deliberate write)
	N	Nonvolatile parameter (saved across power cycles)

Initial value	The value that the parameter will have after a master reset is performed. *Calc* = calculated
Access	The type of access allowed for the parameter:

	R	Read-only
	RW (Any)	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

View and size in view	The views that contain the parameter, and the size of the parameter in the view, in bytes. Example: View 2 (4)
Device	The meter or meters that use this parameter
Comments	A quick definition of the parameter, the name of the parameter in ProLink III, or other information about the parameter

Table D-49: Concentration Measurement transducer block

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
Fieldbus standard									
0	BLOCK_ STRUCTURE	VARIA-BLE	DS_64 (5)	S	N/A	RW (OOS or Auto)		All	Beginning of the transducer block
1	ST_REV	VARIA-BLE	Un-sign-ed16 (2)	S	0	R	1 (2) 2 (2) 3 (2) 4 (2)	All	The revision level of the static data associated with the function block. Incremented with each write of static store.
2	TAG_DESC	STRING	OCTET STRING (32)	S	Spaces	RW (OOS or Auto)		All	The user descrip-tion of the inten-ded application of the block.
3	STRATEGY	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS or Auto)	4 (2)	All	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	VARIA-BLE	Un-signed8 (1)	S	0	RW (OOS or Auto)	4 (1)	All	The identification number of the plant unit. This in-formation may be used in the host for sorting alarms, etc.
5	MODE_BLK	RECORD	DS-69 (4)	Mixed	Auto	RW (OOS or Auto)	1 (4) 3 (4)	All	The actual, target, permitted, and normal modes of the block.
6	BLOCK_ERR	STRING	BIT STRING (2)	D/20	–	R	1 (2) 3 (2)	All	The error status as-sociated with the hardware or soft-ware components associated with a block.
7	XD_ERROR	VARIA-BLE	Un-signed8 (1)	D	–	R	1 (1) 3 (1)	All	Used for all config-uration, hardware, connection failure, or system prob-lems in the block.

Table D-49: Concentration Measurement transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
Process data									
8	ED_Ref_Dens	VARIA-BLE	DS-65 (5)	D/20	–	R	1 (5) 3 (5)	All	Referred Density
9	ED_Spec_Grav	VARIA-BLE	DS-65 (5)	D/20	–	R	1 (5) 3 (5)	All	Density (Fixed SG Units)
11	ED_Net_Mass_Flow	VARIA-BLE	DS-65 (5)	D/20	–	R	1 (5) 3 (5)	Not used	Net Mass Flow Rate
12	ED_Net_Vol_Flow	VARIA-BLE	DS-65 (5)	D/20	–	R	1 (5) 3 (5)	Not used	Net Volume Flow Rate
13	ED_Conc	VARIA-BLE	DS-65 (5)	D/20	–	R	1 (5) 3 (5)	All	Concentration
Configuration									
24	EN_ED	ENUM	Un-sign-ed16 (2)	S	0	R	4 (2)	All	Application status • 0=Disabled • 1=Enabled
26	ED_Mode	ENUM	Un-sign-ed16 (2)	S	3	RW (OOS)	4 (2)	All	Derived variable See *Table D-51*
27	ED_Active_Curve	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (Any)	4 (2)	All	Active Matrix (0-5)
28	ED_Curve_In-dex	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (Any)	4 (2)	All	Matrix Index (Ma-trix$_n$) (0-5)
29	ED_Temp_In-dex	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (Any)	4 (2)	All	Matrix$_n$: Tempera-ture Isotherm In-dex (Tempera-ture$_X$) (0-5)
30	ED_Conc_In-dex	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (Any)	4 (2)	All	Matrix$_n$: Concen-tration Index (Con-centration$_Y$) (0-5)
31	ED_Temp_ISO	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	4 (4)	All	Matrix$_n$: Tempera-ture value of Tem-perature$_X$
32	ED_Dens_At_Temp_ISO	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	4 (4)	All	Matrix$_n$: Density at Temperature$_X$ Concentration $_Y$

Table D-49: Concentration Measurement transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
33	ED_Dens_At_Temp_Coeff	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	4 (4)	All	Matrix$_n$: Coeffi-cient at Tempera-ture$_X$ Concentra-tion$_Y$
34	ED_Conc_La-bel_55	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	4 (4)	All	Matrix$_n$: Label for Concentration $_Y$ See *Table D-52*
35	ED_Dens_At_Conc	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	4 (4)	All	Matrix$_n$: Density at Reference Temper-ature and Concen-tration $_Y$
36	ED_Dens_At_Conc_Coeff	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	4 (4)	All	Matrix$_n$: Coeffi-cient at Reference Temperature and Concentration $_Y$
37	ED_Conc_La-bel_51	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	4 (4)	All	Matrix$_n$: Concen-tration value at Concentration $_Y$ The concentration value in the 6x1 matrix that converts density values at reference temperature to concentration val-ues.
38	ED_Ref_Temp	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	4 (4)	All	Matrix$_n$: Reference Temperature
39	ED_SG_Wa-ter_Ref_Temp	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	4 (4)	All	Matrix$_n$: Specific Gravity of Water at Reference Temper-ature The reference tem-perature of water, for use in calculat-ing specific gravity

Table D-49: Concentration Measurement transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
40	ED_SG_Wa-ter_Ref_Dens	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	4 (4)	All	Matrix$_n$ SG Water Density at Refer-ence Temperature The density of wa-ter at the specified reference temper-ature (OD Index 39), as calculated by the transmitter.
41	ED_Slope_Trim	VARIA-BLE	FLOAT (4)	S	0.8	RW (OOS)	4 (4)	All	Matrix$_n$: Trim Slope
42	ED_Slope_Offset	VARIA-BLE	FLOAT (4)	S	0	RW (OOS)	4 (4)	All	Matrix$_n$: Trim Off-set
43	ED_Extrap_Alarm_Limit	VARIA-BLE	FLOAT (4)	S	5	RW (Any)	4 (4)	All	Matrix$_n$: Extrapola-tion Alert Limit (%)
44	ED_Curve_Name	VARIA-BLE	VISIBLE STRING (12)	S	[1]	RW (Any)	4 (12)	All	Matrix$_n$: Name
45	ED_Max_Fit_Order	VARIA-BLE	Un-sign-ed16 (2)	S	3	RW (OOS)	4 (2)	All	Matrix$_n$: Curve Fit Max Order
46	ED_Fit_Re-sults	ENUM	Un-sign-ed16 (2)	S	0	R	3 (2)	All	Matrix$_n$: Curve Fit Results See *Table D-53*
47	ED_Conc_Unit_Code	ENUM	Un-sign-ed16 (2)	S	1343	RW (OOS)	2 (2)	All	Matrix$_n$: Concen-tration Units See *Table D-54*
48	ED_Expec-ted_Acc	VARIA-BLE	FLOAT (4)	S	0	R	4 (4)	All	Matrix$_n$: Expected Accuracy
58	ED_TEMPER-ATURE_UNITS	ENUM	Un-sign-ed16 (2)	S	°C	R	2 (2)	All	Temperature Unit See *Table D-55*
59	ED_DENSI-TY_UNITS	ENUM	Un-sign-ed16 (2)	S	g/cm³	R	2 (2)	All	Density Unit See *Table D-56*
60	ED_VOL_FLOW_UNITS	ENUM	Un-sign-ed16 (2)	S	l/s	R	2 (2)	All	Standard or special volume flow rate unit See *Table D-57*

Table D-49: Concentration Measurement transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
62	DEN_Select-ConcEqn	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW	4 (2)	All	Calculation meth-od See *Table D-58*
63	DEN_Enable_CMAutos-witch	VARIA-BLE	Un-sign-ed16 (2)			RW		All	Matrix switching • 0=Disabled • 1=Enabled
65	SNS_ED_ConcUnits_SpecialUnit	STRING	Visible String	S	(2)	RW (OOS)		All	Matrix$_n$: Label for Special Concentra-tion Unit
66	ED_MASS-FLOW_UNITS	ENUM	Un-sign-ed16 (2)	S		RO		FDM	Mass Flow Unit See *Table D-59*
System									
49	ED_FEA-TURE_KEY	STRING	BIT STRING (2)	S	–	R	4 (2)	All	Available applica-tions See *Table D-60*
64	ED_SYS_At-tachedCore-Type	ENUM	Un-sign-ed16 (2)	S	0	R		All	Core processor type See *Table D-61*

(1)   """Empty Curve"
(2)   'N','O','N','E',' ',' ',' ',' '

Table D-50: Integer codes for XD_ERROR

Code in decimal	Code in hexadecimal	Description
0	0x0000	No error
18	0x0012	Calibration error
19	0x0013	Configuration error
20	0x0014	Electronics failure
21	0x0015	Sensor failure
26	0x001A	Process error
27	0x001B	Calibration in progress

Table D-51: Integer codes for ED_Mode

Code in decimal	Code in hexadecimal	Description
0		None

Table D-51: Integer codes for ED_Mode *(continued)*

Code in decimal	Code in hexadecimal	Description
1		Referred density
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)

Table D-52: Integer codes for ED_Conc_Label_55

Code in decimal	Code in hexadecimal	Description
1110		°Twaddell
1426		°Brix
1111		°Baume (heavy)
1112		°Baume (light)
1343		% sol/wt
1344		% sol/vol
1427		°Balling
1428		Proof Per Volume
1429		Proof Per mass
1346		°Plato
253		Special Unit
255		Special Concentration Unit

Table D-53: Integer codes for ED_Fit_Results

Code in decimal	Code in hexadecimal	Description
0		Good
1		Poor
2		Failed
3		Empty

Table D-54: Integer codes for ED_Conc_Unit_Code

Code in decimal	Code in hexadecimal	Description
1110		°Twaddell
1426		°Brix
1111		°Baume (heavy)
1112		°Baume (light)
1343		% sol/wt
1344		% sol/vol
1427		°Balling
1428		Proof Per Volume
1429		Proof Per mass
1346		°Plato
253		Special Unit
255		Special Concentration Unit

Table D-55: Integer codes for ED_TEMPERATURE_UNITS

Code in decimal	Code in hexadecimal	Description
1000		Kelvin
1001		°Celsius
1002		°Fahrenheit
1003		°Rankine

Table D-56: Integer codes for ED_DENSITY_UNITS

Code in decimal	Code in hexadecimal	Description
1097		kg/m^3
1100		g/cm^3
1103		kg/L
1104		g/ml
1105		g/L
1106		lb/in^3
1107		lb/ft^3
1108		lb/gal
1109		Ston/yd^3
1113		°API
1114		SGU

Table D-56: Integer codes for ED_DENSITY_UNITS *(continued)*

Code in decimal	Code in hexadecimal	Description
253		Special

Table D-57: Integer codes for ED_VOL_FLOW_UNITS

Code in decimal	Code in hexadecimal	Description
1347		m3/s
1348		m3/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

Table D-58: Integer codes for DEN_SelectConcEqn

Code in decimal	Code in hexadecimal	Description
0		Concentration Matrix
1		°Baume
2		°Twaddell
3		°Plato
4		°Brix

Table D-59: Integer codes for ED_MASSFLOW_UNITS

Code in decimal	Code in hexadecimal	Description
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

Table D-60: Integer codes for ED_FEATURE_KEY

Code in decimal	Code in hexadecimal	Description
	0x0000	Standard
	0x0008	Concentration measurement

Table D-60: Integer codes for ED_FEATURE_KEY *(continued)*

Code in decimal	Code in hexadecimal	Description
	0x0010	API referral

Table D-61: Integer codes for ED_SYS_AttachedCoreType

Code in decimal	Code in hexadecimal	Description
5		Core processor for CDM
6		Core processor for FDM
7		Core processor for FVM

D.2.8   Density Viscosity Meter transducer block and related information

In the following table:

OD index   Index of the parameter in the object dictionary

Name   Name used in code

Message type   One of the following:

     VARIABLE   A value

     ENUM   A value from an enumeration

     METHOD   Initiates an action in the device

     STRING   A set of ASCII characters

     ARRAY   A set of values

     RECORD   A data structure defined by the Fieldbus Foundation

Data type   The data type of the parameter, and the size in bytes, when required

Memory class   Class of memory required, and the update rate in Hz if applicable:

     D   Dynamic store (cyclic data, parameter updated periodically)

     S   Static store (acyclic data, parameter changed on a deliberate write)

     N   Nonvolatile parameter (saved across power cycles)

Initial value   The value that the parameter will have after a master reset is performed. *Calc* = calculated

Access   The type of access allowed for the parameter:

     R   Read-only

     RW (Any)   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

View and size in view The views that contain the parameter, and the size of the parameter in the view, in bytes. Example: View 2 (4)

Device The meter or meters that use this parameter

Comments A quick definition of the parameter, the name of the parameter in ProLink III, or other information about the parameter

Table D-62: Density Viscosity Meter transducer block

OD index	Name	Message type	Data type (size)	Memory class	Initial value	Access	View (size)	Device	Comments
Fieldbus standard									
0	BLOCK_STRUCTURE	VARIABLE	DS_64 (5)	S	N/A	RW (OOS or Auto)		All	Beginning of the transducer block
1	ST_REV	VARIABLE	Unsigned16 (2)	S	0	R	1 (2) 2 (2) 3 (2) 4 (2)	All	The revision level of the static data associated with the function block. Incremented with each write of static store.
2	TAG_DESC	STRING	OCTET STRING (32)	S	Spaces	RW (OOS or Auto)		All	The user description of the intended application of the block.
3	STRATEGY	VARIABLE	Unsigned16 (2)	S	0	RW (OOS or Auto)	4 (2)	All	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	VARIABLE	Unsigned8 (1)	S	0	RW (OOS or Auto)	4 (1)	All	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	RECORD	DS-69 (4)	Mixed	Auto	RW (OOS or Auto)	1 (4) 3 (4)	All	The actual, target, permitted, and normal modes of the block.

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD index	Name	Message type	Data type (size)	Memory class	Initial value	Access	View (size)	Device	Comments
6	BLOCK_ERR	STRING	BIT STRING (2)	D/20	–	R	1 (2) 3 (2)	All	The error status associated with the hardware or software components associated with a block.
7	XD_ERROR	VARIABLE	Unsigned8 (1)	D	–	R	1 (1) 3 (1)	All	Used for all configuration, hardware, connection failure, or system problems in the block.
Process data									
11	DEN_VelocityOOR	VARIABLE	Unsigned16 (2)	D		R	1 (2) 2 (2)	CDM	Velocity overrange indication • 0=In range • 1=Overrange
46	DEN_Velocity	VARIABLE	DS65	D/20		R	1 (4) 3 (4)	CDM	Velocity
54	DEN_TimePeriodB	VARIABLE	Float(4)	D/20		R	1 (4) 3 (4)	All	Sensor Time Period (μsec)
55	DEN_TimePeriodA	VARIABLE	Float(4)	D/20		R	1 (4) 3 (4)	FVM	Sensor Time Period (Upper) (μsec)
56	DEN_SpecialEqnOutput	VARIABLE	DS65	D/20		R	1 (5) 3 (5)	All	User-defined calculation output
81	DEN_QualityFactor	VARIABLE	Float(4)	D		R	1 (4) 3 (4)	FVM	Quality Factor
82	DEN_DynamicViscosity	VARIABLE	DS65	D		R	1 (5) 3 (5)	FVM	Dynamic Viscosity
83	DEN_KinematicViscosity	VARIABLE	DS65	D		R	1 (5) 3 (5)	FVM	Kinematic Viscosity
100	DEN_ReferenceViscosity	VARIABLE	DS65	D		R	1 (4) 3 (5)	FVM	Referred Viscosity
101	DEN_CAII	VARIABLE	DS65	D		R	1 (5) 3 (5)	FVM	Calculated Carbon Aromaticity Index (CCAI)
102	DEN_TubeCaseTempDiff	VARIABLE	Float(4)	D		R	1 (4) 3 (4)	CDM	Tube-Case Temperature Difference

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
125	DEN_CII	VARIA-BLE	DS65	D/20		R	1 (5) 3 (5)	FVM	Calculated Ignition Index (CII)
144	DEN_TPA_ Microsec	VARIA-BLE	Float(4)	D		R	1 (4) 3 (4)	FVM	Sensor Time Peri-od (Upper) (micro-seconds)
145	DEN_TPB_Mi-crosec	VARIA-BLE	Float(4)	D		R	1 (4) 3 (4)	All	Sensor Time Peri-od (microseconds)
157	DEN_SecBa-seViscosity	VARIA-BLE	DS65	D		R	1 (4) 3 (5)	FVM	Secondary Refer-red Viscosity
Calibration									
8	SNS_Flow-ZeroRestore-Previous	METH-OD	Un-sign-ed16 (2)	S	0	RW (OOS)		CDM	Restore Previous Zero • 0=No action • 1=Restore
10	DEN_Com-pressionFilter-Parameter	VARIA-BLE	Float(4)	S	1.0 f	RW (OOS)		FVM	Viscosity Compres-sion Filter Parame-ter
13	DEN_Start-DensOffset-Cal	METH-OD	Un-sign-ed16 (2)	S	0	RW (OOS)		All	Start Density Off-set Calibration • 0=No action • 1=Start
15	DEN_Start-ViscScaleCal	METH-OD	Un-sign-ed16 (2)	S	0	RW (OOS)		FVM	Start Viscosity Me-ter Factor Calibra-tion • 0=No action • 1=Start
24	DEN_K0	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	FDM FVM	K0 Calibration Fac-tor
25	DEN_K1	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	FDM FVM	K1 Calibration Fac-tor
26	DEN_K2	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	FDM FVM	K2 Calibration Fac-tor
27	DEN_K18	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	FDM FVM	K18 Calibration Factor
28	DEN_K19	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	FDM FVM	K19 Calibration Factor
29	DEN_KV4	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	FVM	KVRrange$_r$: KV4 calibration factor

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
30	DEN_KV5	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	FVM	KVRrange$_r$: KV5 calibration factor
31	DEN_KV6	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	FVM	KVRrange$_r$: KV6 calibration factor
32	DEN_Calibra-tionStatus	VARIA-BLE	Un-signed8 (1)	S		R		All	Calibration status
33	DEN_KV_In-dex	VARIA-BLE	Un-signed8 (1)	S		RW (OOS)	4 (1)	FVM	KV Range index (KVRange$_r$) (0–3) See *Table D-70*
34	DEN_KV_Crossover	VARIA-BLE	Float(4)	S		RW (OOS)	4 (4)	FVM	KV Calibration crossover point
35	DEN_A1	VARIA-BLE	Float(4)	S	0	RW (OOS)	4 (4)	CDM	A1 Calibration Fac-tor
36	DEN_A2	VARIA-BLE	Float(4)	S	0	RW (OOS)	4 (4)	CDM	A2 Calibration Fac-tor
37	DEN_A3	VARIA-BLE	Float(4)	S	0	RW (OOS)	4 (4)	CDM	A3 Calibration Fac-tor
38	DEN_A4	VARIA-BLE	Float(4)	S	0	RW (OOS)	4 (4)	CDM	A4 Calibration Fac-tor
39	DEN_A5	VARIA-BLE	Float(4)	S	0	RW (OOS)	4 (4)	CDM	A5 Calibration Fac-tor
40	DEN_A6	VARIA-BLE	Float(4)	S	0	RW (OOS)	4 (4)	CDM	A6 Calibration Fac-tor
41	DEN_A7	VARIA-BLE	Float(4)	S	0	RW (OOS)	4 (4)	CDM	A7 Calibration Fac-tor
42	DEN_A8	VARIA-BLE	Float(4)	S	0	RW (OOS)	4 (4)	CDM	A8 Calibration Fac-tor
43	DEN_A9	VARIA-BLE	Float(4)	S	0	RW (OOS)	4 (4)	CDM	A9 Calibration Fac-tor
86	VISC_RANGE_SEL_INDEX	ENUM	Un-sign-ed16 (2)	S	0	RW (OOS)	4 (2)	FVM	Viscosity range in-dex (ViscosityR-ange$_v$ See *Table D-70*
87	DEN_V0	VARIA-BLE	Float(4)	S	[1]	RW (OOS)	4 (4)	FVM	V0 at ViscosityR-ange$_v$ (array of 4)
88	DEN_V1	VARIA-BLE	Float(4)	S	[2]	RW (OOS)	4 (4)	FVM	V1 at ViscosityR-ange$_v$ (array of 4)
89	DEN_V2	VARIA-BLE	Float(4)	S	[3]	RW (OOS)	4 (4)	FVM	V2 at ViscosityR-ange$_v$ (array of 4)

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
90	DEN_Vis-cRangeScale	VARIA-BLE	Float(4)	S	(4)	RW (OOS)	4 (4)	FVM	Range scale at Vis-cosityRange$_V$ (ar-ray of 4)
91	ViscRangeS-witchIndex	VARIA-BLE	Un-sign-ed16 (2)	S	0 = Ultra Low	RW (OOS)		FVM	Viscosity range switch setpoint in-dex (RangeSet-point$_S$ See *Table D-70*
92	DEN_Vis-cRangeLimit	VARIA-BLE	Float(4)	S	(5)	RW (OOS)		FVM	Viscosity setpoint for RangeSetpoint$_S$
107	DEN_Lab-Density	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	Laboratory Density
124	DEN_LabVis-cosity	VARIA-BLE	Float(4)	S	0.0f	RW (OOS)		FVM	Laboratory Viscosi-ty
133	DEN_Legacy_K0	VARIA-BLE	Float(4)	S	0	R	2 (4)	CDM	K012$_n$: K0 legacy calibration factor
134	DEN_Legacy_K1	VARIA-BLE	Float(4)	S	0	R	2 (4)	CDM	K012$_n$: K1 legacy calibration factor
135	DEN_Legacy_K2	VARIA-BLE	Float(4)	S	0	R	2 (4)	CDM	K012$_n$: K2 legacy calibration factor
136	DEN_Legacy_K18	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	CDM	K18 Legacy Cali-bration Factor
137	DEN_Legacy_K19	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	CDM	K19 Legacy Cali-bration Factor
138	DEN_Legacy_K20A	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	CDM	K2021$_n$: K20A con-stant used to com-pute K20
139	DEN_Legacy_K20B	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	CDM	K2021$_n$: K20B con-stant used to com-pute K20
140	DEN_Legacy_K21A	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	CDM	K2021$_n$: K21A con-stant used to com-pute K21
141	DEN_Legacy_K21B	VARIA-BLE	Float(4)	S	0	RW (OOS)	2 (4)	CDM	K2021$_n$: K21B con-stant used to com-pute K21
142	DEN_Legacy_K20_K21_In-dex	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS)	2 (2)	CDM	K20, K21 index (K2021$_n$) (0–2)

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD index	Name	Message type	Data type (size)	Memory class	Initial value	Access	View (size)	Device	Comments
143	DEN_Legacy_K0_K1_K2_Index	VARIABLE	Unsigned16 (2)	S	0	RW (OOS)	2 (2)	CDM	K0, K1, K2 index (K012$_n$) (0–3)
149	DEN_Legacy_K22	VARIABLE	Float(4)	S	0	RW (OOS)		CDM	K22 Legacy Calibration Factor
150	DEN_Legacy_K23	VARIABLE	Float(4)	S	0	RW(OOS)		CDM	K23 Legacy Calibration Factor
Configuration									
14	DEN_TineType	ENUM	Unsigned16 (2)	S	0	RW (OOS)		FDM FVM	Tine length • 0=Short • 1=Long
16	SNS_EnableIntExtTemp	VARIABLE	Unsigned16 (2)	S	0	RW (Any)		CDM FDM	Temperature source for temperature compensation • 0=Internal • 1=External
17	DensityOffset	VARIABLE	Unsigned16 (2)	S	32768	RW (OOS)	4 (2)	All	Density offset
18	TemperatureOffset	VARIABLE	Unsigned16 (2)	S	32768	RW (OOS)	4 (2)	All	Temperature offset
19	DensityScaleFactor	VARIABLE	Unsigned16 (2)	S	1	RW (OOS)	4 (2)	All	Density meter factor
20	TemperatureScaleFactor	VARIABLE	Unsigned16 (2)	S	1	RW (OOS)	4 (2)	All	Temperature meter factor
21	FlowSwitchHysterisis	VARIABLE	Float(4)	S	0.05	RW (Any)	4 (4)	CDM	Velocity switch hysteresis (not used)
22	FlowRateSwitchThreshold	VARIABLE	Float(4)	S	0	RW (Any)		CDM	Velocity switch setpoint
44	DEN_DensityOffset	VARIABLE	Float(4)	S	0	RW (OOS)	4 (4)	All	Density Offset
45	DEN_DensityMeterFactor	VARIABLE	Float(4)	S	1	RW (OOS)	4 (4)	All	Density Meter Factor

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
47	DEN_Fixed-Velocity	VARIA-BLE	Float(4)	S	0x0F	RW (OOS)		CDM	Fixed velocity val-ue (m/sec) (veloci-ty simulation)
48	DEN_Veloci-tyUnits	VARIA-BLE	Un-sign-ed16 (2)	S	1061 (m/sec)	RW (OOS)	2 (2)	CDM	Velocity unit
49	DEN_Veloci-tyCutoff	VARIA-BLE	Float(4)	S	0	RW (OOS)	4 (4)	CDM	Velocity cutoff
50	DEN_Veloci-tyHiLim	VARIA-BLE	Float(4)	S		R	4 (4)	CDM	Velocity Upper Sensor Limit
51	DEN_Veloci-tyLoLim	VARIA-BLE	Float(4)	S		R	4 (4)	CDM	Velocity Lower Sensor Limit
52	DEN_Veloci-tySpan	VARIA-BLE	Float(4)	S		R	4 (4)	CDM	Velocity Minimum Span
53	DEN_Veloci-tyDamping	VARIA-BLE	Float(4)	S	0.8	RW (OOS)	4 (4)	CDM	Velocity Damping
57	DEN_Pro-grammable-ConstA	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	User-defined cal-culation: *A* (Con-stant)
58	DEN_Pro-grammable-ConstB	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	User-defined cal-culation: *B* (Con-stant)
59	DEN_Pro-grammable-ConstC	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	User-defined cal-culation: • Equation type 1: *X* (Constant) • Equation type 2 or 3: *C* (Con-stant)
60	DEN_Pro-grammable-ConstE	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	User-defined cal-culation: • Equation type 1: *Y* (Constant) • Equation type 2: Not used • Equation type 3: *E* (Constant)
61	DEN_Pro-grammable-ConstF	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	User-defined cal-culation: *F* (Con-stant)

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
62	DEN_Pro-grammable-ValA	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	User-defined cal-culation: *a* (Value or pointer)
63	DEN_Pro-grammable-ValB	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	User-defined cal-culation: *b* (Value or pointer)
64	DEN_Pro-grammable-ValC	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	User-defined cal-culation: *c* (Value or pointer)
65	DEN_Pro-grammable-ValD	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	User-defined cal-culation: *d* (Value or pointer)
66	DEN_Pro-grammable-ValE	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	User-defined cal-culation: *e* (Value or pointer)
67	DEN_Pro-grammable-ValF	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	User-defined cal-culation: *f* (Value or pointer)
74	DEN_ProgAir-WaterDensity	VARIA-BLE	Float(4)	S	1.0f	RW (OOS)	2 (4)	All	User-defined cal-culation: Density of water
75	DEN_UserBa-seDensity	VARIA-BLE	Float(4)	S	0.98	RW (OOS)	2 (4)	All	User-defined cal-culation: Referred density
76	DEN_Special-EqnLabel	STRING	Visible String	S	(6)	RW (OOS)		All	User-defined cal-culation: Label
77	DEN_Density-SpecUnitLa-bel	STRING	Visible String	S	(6)	RW (OOS)		All	Special density unit: Label
78	DEN_Density-SpecUnitBa-seUnits	VARIA-BLE	Un-sign-ed16 (2)	S	1100 (g/cm³)	RW (OOS)	2 (2)	All	Special density unit: Base density unit
79	DEN_KinVisc-SpecialUnitBa-seUnits	VARIA-BLE	Un-sign-ed16 (2)	S	1164 (cSt)	RW (OOS)	2 (2)	FVM	Special kinematic viscosity unit: Base kinematic viscosity unit
80	DEN_Density-SpecUnit-ConvFactoR	VARIA-BLE	Float(4)	S	1	RW (OOS)	2 (4)	All	Special density unit: Conversion factor
84	DEN_Dynam-icViscosityU-nits	VARIA-BLE	Un-sign-ed16 (2)	S	1162 (cP)	RW (OOS)	2 (2)	FVM	Dynamic Viscosity Unit

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
85	DEN_Kine-maticViscosi-tyUnits	VARIA-BLE	Un-sign-ed16 (2)	S	1164 (cSt)	RW (OOS)	2 (2)	FVM	Kinematic Viscosi-ty Unit
93	DEN_Vi-scHysteresis	VARIA-BLE	Float(4)	S	0.05f	RW (OOS)		FVM	Viscosity Hystere-sis
94	DEN_Viscosi-tyOffset	VARIA-BLE	Float(4)	S	0	RW (OOS)		FVM	Viscosity Offset
95	DEN_Dyn-ViscSpecialU-nitLabel	STRING	Visible String	S	(6)	RW (OOS)		FVM	Special dynamic viscosity unit: La-bel
96	DEN_KinVisc-SpecialUnitLa-bel	STRING	Visible String	S	(6)	RW (OOS)		FVM	Special kinematic viscosity unit: La-bel
97	DEN_Dyn-ViscSpecialU-nitConvFac-tor	VARIA-BLE	Float(4)	S	1.0f	RW (OOS)		FVM	Special dynamic viscosity unit: Con-version factor
98	DEN_KinVisc-SpecialUnit-ConvFactor	VARIA-BLE	Float(4)	S	1.0f	RW (OOS)		FVM	Special kinematic viscosity unit: Con-version factor
99	DEN_Dyn-ViscSpecialU-nitBaseUnits	VARIA-BLE	Un-sign-ed16 (2)	S	1162 (cP)	RW (OOS)	2 (2)	FVM	Special dynamic viscosity unit: Base dynamic viscosity unit
108	DEN_Refer-redViscMe-thod	ENUM	ENUM	S	2	RW (OOS)		FVM	Referred viscosity calculation meth-od See *Table D-71*
109	MBUS_Visc_CurveIndex	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS)		FVM	Referred Viscosity: Curve Index ASTM D341 Single-Curve: 0 ASTM D341 Multi-Curve: 0–7 Matrix: 0–5 (For Matrix Meth-od n = 0–5 and for ASTM method n = 0–7)

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
110	MBUS_Visc_TempIndex	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS)		FVM	Referred Viscosity: Temperature Index ASTM D341 Single-Curve: 0 ASTM D341 Multi-Curve: 0–1 Matrix: 0–5 Referred Viscosity Temperature Iso-therm Index (For Matrix Methd n = 0–5 and for ASTM method n = 0–1)
111	DEN_Re-fVisc_Mat_MaxFitOrder	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS)		FVM	Referred Viscosity Maximum Order for curve fit (2,3,4,5)
112	EN_RefVisc_Mat_TempI-SO	VARIA-BLE	Float(4)	S	0	RW (OOS)		FVM	Referred Viscosity, Matrix method: Temperature value for Tempx Matrix n
113	DEN_Re-fVisc_Mat_ViscAtTempI-SO	VARIA-BLE	Float(4)	S	3	RW (OOS)		FVM	Referred Viscosity, Matrix method: Viscosity at Tempx
114	DEN_Re-fTemp1	VARIA-BLE	Float(4)	S	NA	RW (OOS)		FVM	Referred Viscosity: Reference Temper-ature 1
115	DEN_Re-fTemp2	VARIA-BLE	Float(4)	S	NA	RW (OOS)		FVM	Referred Viscosity Reference Temper-ature 2
116	DEN_Re-fVisc_Mat_Fi-tAccuracy	VARIA-BLE	Float(4)	S	NA	R		FVM	Referred Viscosity, Matrix method: Ex-pected Accuracy
117	DEN_Re-fVisc_Mat_Fi-tResults	ENUM	Un-sign-ed16 (2)	S	NA	R		FVM	Referred Viscosity, Matrix method: Curve Fit Result See *Table D-72*
118	REF_VISC_IN-PUT_SOURCE	ENUM	Un-sign-ed16 (2)	S	163 (Kine-matic)	RW (OOS)		FVM	Referred Viscosity, Matrix method: Viscosity input • 162=Dynamic • 163=Kinematic

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
119	DEN_Re-fVisc_ASTM_NumCurves	VARIA-BLE	Un-sign-ed16 (2)	S	4	RW (OOS)		FVM	Referred Viscosity, Matrix method: Curve index (2–8)
120	DEN_Re-fVisc_ASTM_TempISO	VARIA-BLE	Float(4)	S	0	RW (OOS)		FVM	ASTM Tempera-ture Value (2X8) @ Point1 oo Point2 Curve n (n = 0–7) (Indexed by MBUS_Visc_Cur-veIndex and MBUS_Visc_Tem-pIndex)
121	DEN_Re-fVisc_ASTM_ViscAtTempI-SO	VARIA-BLE	Float(4)	S	0	RW (OOS)		FVM	ASTM Referral Vis-cosity (2X8) @ TemperatureX , Curve n (n=0–7) (Indexed by MBUS_Visc_Cur-veIndex and MBUS_Visc_Tem-pIndex)
132	DEN_Special-EquationType	ENUM	Un-sign-ed16 (2)	S	0 (Type 1)	RW (OOS)	4 (2)	All	User-defined cal-culation: Equation type See *Table D-66*
146	SNS_Ena-blePM	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS)		All	API referral: Appli-cation status • 0=Disabled • 1=Enabled
147	SNS_Ena-bleCM	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS)		All	Concentration measurement: Ap-plication status • 0=Disabled • 1=Enabled
148	DEN_Pressur-eOffset	VARIA-BLE	Float(4)	S	0.0f	RW (OOS)		All	Pressure Offset
154	DEN_Enable-ExtTempMo-dulus	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (Any)		All	Temperature source for temper-ature compensa-tion • 0=Internal • 1=External

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD index	Name	Message type	Data type (size)	Memory class	Initial value	Access	View (size)	Device	Comments
155	DEN_Enable-ExtTempFor-Visc	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (Any)		FVM	Temperature source for referred viscosity • 0=Internal • 1=External
158	DEN_RefVis-cUnits	VARIA-BLE	Un-sign-ed16 (2)	S	1164 (cSt)	RW (OOS)	2 (2)	FVM	Referred viscosity unit • 1162=cP • 1164=cSt
159	DEN_TEM-PERATURE_UNITS	ENUM	Un-sign-ed16 (2)	S	C°	RW (OOS)	2 (2)	All	Temperature Unit See *Table D-67*
160	DENSITY_UNITS	ENUM	Un-sign-ed16 (2)	S	g/cm³	RW (OOS)	2 (2)	All	Density Unit See *Table D-68*
161	PRESSURE_UNITS	ENUM	Un-sign-ed16 (2)	S	psi	RW (OOS)	2 (2)	All	Pressure Unit See *Table D-69*
Known Density Verification (KDV)									
9	DEN_Star-tHealthCheck	METH-OD	Un-sign-ed16 (2)	S	0	RW (OOS)		All	Start KDV • 0=No action • 1=Start
103	DEN_Avera-geTimePer-iod	VARIA-BLE	Float(4)	S		R		All	Average time period
105	DEN_Health-CheckResult	ENUM	Un-sign-ed16 (2)	S		R		All	KDV Results
106	DEN_Health-CheckFailure-Bits	VARIA-BLE	BiT STRING (2)	S		R		All	KDV Failure Bits
12	DEN_UseU-serSensorCh-eckValue	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS)		All	KDV result to use for process variable calculation • 0=User result • 1=Factory result
104	DEN_Time-PeriodStabli-ty	VARIA-BLE	Float(4)	S		R		All	KDV Stability

Table D-62: Density Viscosity Meter transducer block *(continued)*

OD in-dex	Name	Mes-sage type	Data type (size)	Memo-ry class	Initial value	Access	View (size)	Device	Comments
122	DEN_Base-DensityFor-SensorCheck	VARIA-BLE	Float(4)	S	0	RW (OOS)		All	KDV Base Density
123	DEN_Eleva-tionAbove-SeaLev	ENUM	Un-sign-ed16 (2)	S	0	RW (OOS)		All	KDV Altitude
126	DEN_Tem-perature-CheckAver-age	VARIA-BLE	Float(4)	S		R		All	Average Tempera-ture
127	DEN_Drive-GainAverage	VARIA-BLE	Float(4)	S		R		FVM	Average Drive Gain
128	DEN_Drive-GainStability	VARIA-BLE	Float(4)	S		R		FVM	Drive Gain Stability
129	DEN_Tem-perature-CheckStabili-ty	VARIA-BLE	Float(4)	S		R		All	Temperature Sta-bility
130	DEN_Case-Temperatur-eAverage	VARIA-BLE	Float(4)	S		R		CDM	Average Case Temperature Aver-age
131	DEN_Case-Temperatur-eStability	VARIA-BLE	Float(4)	S		R		CDM	Case Temperature Stability
151	DEN_KDV_CalIndex	VARIA-BLE	Un-sign-ed16 (2)	S	0	RW (OOS)		All	KDV Results index (KDV$_r$)
152	DEN_Temp-DiffAverage	VARIA-BLE	Float(4)	S		R		CDM	Average Tube-Case Temperature Difference
153	DEN_Temp-DiffStability	VARIA-BLE	Float(4)	S		R		CDM	Tube-Case Tem-perature Differ-ence Stability
System									
156	SYS_Atta-chedCore-Type	ENUM	Un-sign-ed16 (2)	S	0	R		All	Core processor type See *Table D-10*
162	DEN_Pro-ductCode	STRING	VISIBLE STRING (32)	S		R		All	Product code

(1) -4.07^{e-1f}, $-1.78f$, 6.70^{e-2f}, 1.39^{e+2f}
(2) 7.00^{e+5f}, 8.36^{e+5f}, 8.40^{e+5f}, 5.35^{e+5f}
(3) 3.15^{e+9f}, 1.45^{e+8f}, -5.22^{e+6f}, 1.27^{e+8f}
(4) $1.0f$, $1.0f$, $1.0f$, $1.0f$
(5) $1.0,10.0,100.0,1000.0,12500.00$
(6) 'N','O','N','E',' ',' ',' ',' '

Table D-63: Integer codes for XD_ERROR

Code in decimal	Code in hexadecimal	Description
0	0x0000	No error
18	0x0012	Calibration error
19	0x0013	Configuration error
20	0x0014	Electronics failure
21	0x0015	Sensor failure
26	0x001A	Process error
27	0x001B	Calibration in progress

Table D-64: Integer codes for DEN_VelocityUnits

Code in decimal	Code in hexadecimal	Description
1061		Meters/Second
1063		Meters/Hour
1066		Inches/Second
1067		Feet/Second
1069		Inches/Minute
1070		Feet/Minute

Table D-65: Integer codes for DEN_SpecialEqnSlot(A/B/C/D/E/F)

Code in decimal	Code in hexadecimal	Description
1		Temperature
3		Density
15		Referred density (API referral)
21		Referred density (concentration)
22		Density (SGU)
32		Concentration
33		CTPL
46		Raw Tube Frequency
47		Drive Gain

Table D-65: Integer codes for DEN_SpecialEqnSlot(A/B/C/D/E/F) *(continued)*

Code in decimal	Code in hexadecimal	Description
48		Case Temperature (CDM only)
49		LPO Amplitude
50		RPO Amplitude (CDM only)
51		Board Temperature
53		Ext. Input Pressure
55		Ext. Input Temp
160		Sensor Time Period (Upper) (FVM only)
161		Tube-Case Temperature Differential (CDM only)
168		Quality Factor (FVM only)
162		Dynamic Viscosity (FVM only)
163		Kinematic Viscosity (FVM only)
164		Base Viscosity (FVM only)
166		CCAI (FVM only)
167		CII (FVM only)
208		Velocity (CDM only)
215		Sensor Time Period
251		None

Table D-66: Integer codes for DEN_SpecialEquationType

Code in decimal	Code in hexadecimal	Description
0		Type 1 (Square root)
1		Type 2 (Exponential)
2		Type 3 (Quartic)
99		None

Table D-67: Integer codes for DEN_TEMPERATURE_UNITS

Code in decimal	Code in hexadecimal	Description
1000	0x	Kelvin
1001	0x	°Celsius
1002	0x	°Fahrenheit
1003	0x	°Rankine

Table D-68: Integer codes for DENSITY_UNITS and DEN_DensitySpecUnitBaseUnits

Code in decimal	Code in hexadecimal	Description
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		°API
1114		SGU
253[1]		Special

(1)   Not valid for DEN_DensitySpecUnitBaseUnits

Table D-69: Integer codes for PRESSURE_UNITS

Code in decimal	Code in hexadecimal	Description
1130		Pascals
1132		Megapascals
1133		Kilopascals
1137		Bar
1138		Millibar
1139		Torr at 0 °C
1140		Atmospheres
1141		PSI
1144		g/cm²
1145		kg/cm²
1147		Inches water at 4 °C
1148		Inches water at 68 °F / Inches water at 60 °F[1]
1150		Millimeters water at 4 °C
1151		Millimeters water at 68 °F
1154		Feet water at 68 °F
1156		Inches mercury (HG) at 0 °C
1158		Millimeters mercury (HG) at 0 °C

(1)   Enhancement to fieldbus specification in progress.

Table D-70: Integer codes for VISC_RANGE_SEL_INDEX and ViscRangeSwitchIndex

Code in decimal	Code in hexadecimal	Description
0		Ultra Low
1		Ultra Low to Low
2		Low to Medium
3		Medium to High
4		High

Table D-71: Integer codes for DEN_ReferredViscMethod

Code in decimal	Code in hexadecimal	Description
0		Matrix
1		ASTM D341 single-curve
2		ASTM D341 multi-curve

Table D-72: Integer codes for DEN_RefVisc_Mat_FitResults

Code in decimal	Code in hexadecimal	Description
0		Good
1		Poor
2		Failed
3		Empty

Table D-73: Integer codes for DEN_HealthCheckResult

Code in decimal	Code in hexadecimal	Description
0		Good
2		Failed
3		Not run
4		In progress
5		No factory calibration

Table D-74: Integer codes for DEN_HealthCheckFailureBits

Code in decimal	Code in hexadecimal	Description
Bit #0		Corrected Time Period Average Out of Range
Bit #1		Corrected Time Period Stability Out of Range
Bit #2		Temperature Stability Out of Range

Table D-74: Integer codes for DEN_HealthCheckFailureBits *(continued)*

Code in decimal	Code in hexadecimal	Description
Bit #3		Drive Gain Average Out of range
Bit #4		Case Temperature Stability Out of Range (Tube Density Only)

Table D-75: Integer codes for DEN_ElevationAboveSeaLev

Code in decimal	Code in hexadecimal	Description
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

Table D-76: Integer codes for SYS_AttachedCoreType

Code in decimal	Code in hexadecimal	Description
5		Core processor for CDM
6		Core processor for FDM
7		Core processor for FVM

Appendix E
Concentration measurement matrices, derived variables, and process variables

Topics covered in this appendix:

- *Standard matrices for the concentration measurement application*
- *Concentration measurement matrices available by order*
- *Derived variables and calculated process variables*

E.1　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.

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.

Table E-1:　Standard concentration matrices and associated measurement units

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)

Table E-1: Standard concentration matrices and associated measurement units *(continued)*

Matrix name	Description	Density unit	Temperature unit	Derived variable
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)

E.2 Concentration measurement matrices available by order

Depending on your product, you may be able to order one or more of the matrices listed here. You can have it loaded at the factory or you can load it from a file.

Table E-2: Concentration matrices, names, ranges, units, and derived variable

Process fluid	Matrix file name	Default matrix name	Concentration range	Temperature range	Density unit	Temperature unit	Derived variable
Alcohol (by volume)	Alcohol 0–20%Vol 0–40C.xml	Alcohol	0–20% (by volume)	0–40 °C	g/cm^3	°C	Concentration (Density)
	Alcohol 50–100%Vol 40–70C.xml	Alcohol	50–100% (by volume)	40–70 °C	g/cm^3	°C	Concentration (Density)
	Alcohol 80–100%Vol 50–90C.xml	Alcohol	80–100% (by volume)	50–90 °C	g/cm^3	°C	Concentration (Density)
Alcohol (proof)	Alcohol 100–200 Proof 50–70C.xml	Alcohol	100–200 (proof)	50–70 °C	g/cm^3	°C	Concentration (Density)
	Alcohol 160–200 Proof 50–90C.xml	Alcohol	160–200 (proof)	50–90 °C	g/cm^3	°C	Concentration (Density)
Sucrose solution (Brix)	Sucrose 0–40 Brix 0–100C.xml	Sucrose	0–40%	0–100 °C	g/cm^3	°C	Concentration (Density)

Table E-2: Concentration matrices, names, ranges, units, and derived variable *(continued)*

Process fluid	Matrix file name	Default matrix name	Concentration range	Temperature range	Density unit	Temperature unit	Derived variable
	Sucrose 30–80 Brix 0–100C.xml	Sucrose	30–80%	0–100 °C	g/cm³	°C	Concentration (Density)
Sucrose solution (Balling)	Sucrose 0–20 Balling 0–100C.xml	Sucrose	0–20 °Balling	0–100 °C	g/cm³	°C	Concentration (Density)
Sodium hydroxide (NaOH)	NaOH 0–20% 0–50C.xml	NaOH	0–20%	0– 50 °C	g/cm³	°C	Concentration (Density)
	NaOH 0–50% 0–80C.xml	NaOH	0–50%	0–80 °C	g/cm³	°C	Concentration (Density)
	NaOH 0–74% 80–100C.xml	NaOH	0–74%	80–100 °C	g/cm³	°C	Concentration (Density)
Sulfuric acid (H_2SO_4)	H2SO4 75–94% 24–38C.xml	H2SO4	75–94%	24–38 °C	g/cm³	°C	Concentration (Density)
	H2SO4 0–10% 0–38C .xml	H2SO4	0–10%	0–38 °C	g/cm³	°C	Concentration (Density)
	H2SO4 0–20% 0–24c.xml	H2SO4	0–20%	0–24 °C	g/cm³	°C	Concentration (Density)
	H2SO4 0–93% 0–38C.xml	H2SO4	0–93%	0–38 °C	g/cm³	°C	Concentration (Density)
	H2SO4 0–25% 0–50C.xml	H2SO4	0–25%	0–50 °C	g/cm³	°C	Concentration (Density)
Nitric acid (HNO_3)	HNO3 0–40% 10–50C.xml	HNO3	0–40%	10–50 °C	g/cm³	°C	Concentration (Density)
	HNO3 0–70% 0–50C.xml	HNO3	0–70%	0–50 °C	g/cm³	°C	Concentration (Density)
	HNO3 0–100% 5–30C.xml	HNO3	0–100%	5–30 °C	g/cm³	°C	Concentration (Density)
Potassium hydroxide (KOH)	KOH 0–40% 0–90C.xml	KOH	0–40%	0–90 °C	g/cm³	°C	Concentration (Density)
High-fructose corn syrup	HFCS 42 0–50% 0–100C.xml	HFCS 42	0–50%	0–100 °C	g/cm³	°C	Concentration (Density)
	HFCS 55 0–50% 0–100c.xml	HFCS 55	0–50%	0–100 °C	g/cm³	°C	Concentration (Density)
	HFCS 90 0–50% 0–100c.xml	HFCS 90	0–50%	0–100 °C	g/cm³	°C	Concentration (Density)
Wort	Plato 0–30 Plato 0–100C.xml	Plato	0–30 °Plato	0–100 °C	g/cm³	°C	Concentration (Density)
Hydrochloric acid (HCl)	HCl 0–5% 0–90C.xml	HCl	0–5%	0–90 °C	g/cm³	°C	Concentration (Density)

Table E-2: Concentration matrices, names, ranges, units, and derived variable *(continued)*

Process fluid	Matrix file name	Default matrix name	Concentration range	Temperature range	Density unit	Temperature unit	Derived variable
	HCl 0–32% 0–49C.xml	HCl	0–32%	0–49 °C	g/cm³	°C	Concentration (Density)
Methanol	Methanol 35–60% 0–40C.xml	Methanol	35–60%	0–40 °C	g/cm³	°C	Concentration (Density)
Ethylene glycol	Ethylene Glycol 10–50% –20 – 40C.xml	Eth. Glycol	10–50%	−20 – +40 °C	g/cm³	°C	Concentration (Density)

E.3 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.

Table E-3: Derived variables and calculated process variables

Derived Variable	Description	Calculated process variables					
		Density at reference temperature	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	✓	✓				
Specific Gravity	The ratio of the density of a process fluid at a given temperature to the density of water at a given temperature. The two given temperature conditions do not need to be the same.	✓	✓	✓			
Mass Concentration (Density)	The percent mass of solute or of material in suspension in the total solution, derived from reference density	✓	✓		✓	✓	

Table E-3: Derived variables and calculated process variables *(continued)*

Derived Variable	Description	Calculated process variables					
		Density at reference temperature	**Standard volume flow rate**	**Specific gravity**	**Concentration**	**Net mass flow rate**	**Net volume flow rate**
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	✓	✓	✓	✓		

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