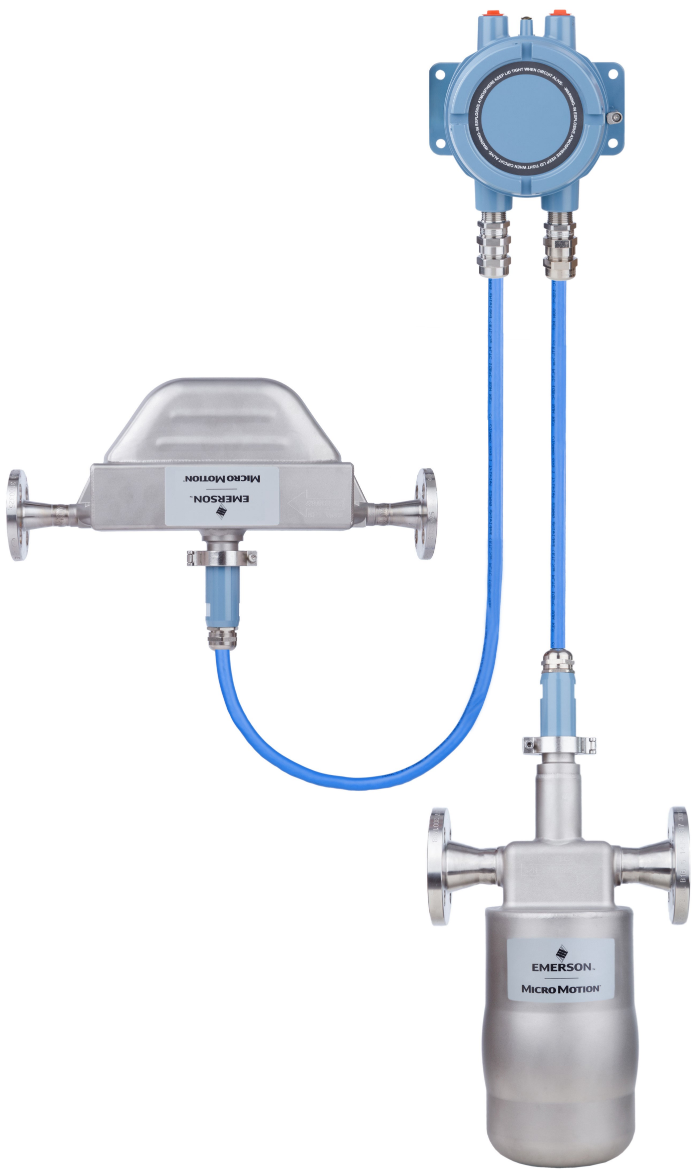
Configuration and Use Manual
MMI-20032809, Rev AA
February 2017

Micro Motion® LNG Series Meters



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Safety messages

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

Emerson Flow customer service

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		South Africa	800 991 390		
		Saudi Arabia	800 844 9564		
		UAE	800 0444 0684		

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Part I
Getting Started

Chapters covered in this part:

1 Before you begin

Topics covered in this chapter:

1.1 About this manual

This manual provides information to help you configure, commission, use, maintain, and troubleshoot the Micro Motion LNG Series meter.

Important

This manual assumes that the following conditions apply:

- The meter has been installed correctly and completely according to the instructions in the installation manual
- The installation complies with all applicable safety requirements
- The user is trained in applicable safety standards

1.2 Meter model codes

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

The transmitter model number has the following form:
LNGM10S***N(P/Z)(D/I/N)***********

Table 1-1: Model codes and device types

Model code	Description	I/O and communications
N	Standard case	• One dedicated service port/ Modbus • One dedicated RS-485 port/ Modbus
P	LNGS06S and LNGM10S are paired	
D	With a dual core processor	
Z	Standalone sensor	
I	With enhanced core processor for direct host connection with IS barrier	

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

Model code	Description	I/O and communications
N	Spare sensor without electronics	

1.3 Communications tools and protocols

You can use these communications tools and protocols to interface with the transmitter.

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

Communications tool	Supported protocols	Scope	In this manual	For more information
ProLink III	• Modbus/RS-485 • Service port	Complete configuration and commissioning	Basic user information. See *Appendix A*.	User manual • Installed with software • Micro Motion user documentation CD • *www.micromotion.com*
Modbus host	• Service port • Modbus/RS-485	Complete configuration and commissioning	None.	*Modbus Interface Tool (MIT) — available at www.micromotion.com*

1.4 Additional documentation

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

Table 1-3: Additional documentation and resources

Topic	Document
Transmitter installation	*Micro Motion Liquified Natural Gas Dispenser Installation Manual*
Product Data Sheet	*Micro Motion LNG Series Meters Product Data Sheet (PDS)*
Hazardous area installation	See the approval documentation shipped with the transmitter, or download the appropriate documentation from the Micro Motion web site at *www.micromotion.com*.

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

2 Quick start

Topics covered in this chapter:

2.1 Power up the meter

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

1. Ensure that all device covers and seals are closed.

   ⚠ **WARNING!**

   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.

Postrequisites

Although the sensor is ready to measure 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 equalize for approximately 10 minutes.

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.

2. Connect to the transmitter and check for active alerts.

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.

Communications tool	Connection type to use	Instructions
ProLink III	Service Port	*Section A.1.2*
	RS-485 port	*Section A.1.3*

2.4 Characterize the flowmeter (if required)

ProLink III	Device Tools > Calibration Data

Overview

Characterizing the flowmeter adjusts your transmitter to match the unique traits of the sensor it is paired with. The characterization parameters (also called calibration parameters) describe the sensor's sensitivity to flow, density, and temperature. Depending on your sensor type, different parameters are required. Values for your sensor are provided by Micro Motion on the sensor tag or the calibration certificate.

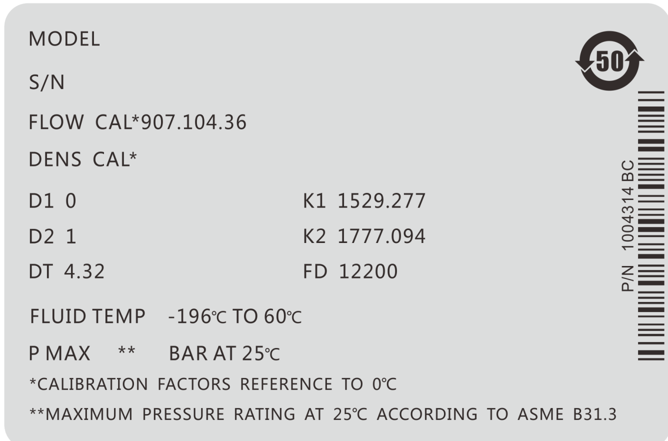
Tip
If your meter was ordered as a unit, it has already been characterized at the factory. However, you should still verify the characterization parameters.

Procedure

1. Specify Sensor Type.
   - LNG-Series (LNGS06S, LNGM10S)
2. Set the flow characterization parameters. Be sure to include all decimal points.
   - Set Flow Cal (Flow Calibration Factor).
3. Set the density characterization parameters.
   - Set D1, D2, TC, K1, K2, and FD.

2.4.1 Sensor tags

Figure 2-1: Tag on sensors



2.4.2 Density calibration parameters (D1, D2, K1, K2, FD, TC)

Density calibration parameters are typically on the sensor tag and the calibration certificate.

2.5 Verify mass flow measurement

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

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

Postrequisites

If the reported mass flow rate is not accurate:

- Check the characterization parameters.
- Review the troubleshooting suggestions for flow measurement issues.

2.6 Verify the zero

Verifying the zero helps you determine if the stored zero value is appropriate to your installation, or if a field zero can improve measurement accuracy.

The zero verification procedure analyzes the Live Zero value under conditions of zero flow, and compares it to the Zero Stability range for the sensor. If the average Live Zero value is within a reasonable range, the zero value stored in the transmitter is valid. Performing a field calibration will not improve measurement accuracy.

2.6.1 Verify the zero using ProLink III

Verifying the zero helps you determine if the stored zero value is appropriate to your installation, or if a field zero can improve measurement accuracy.

Important

In most cases, the factory zero is more accurate than the field zero. Do not zero the meter unless one of the following is true:

- The zero is required by site procedures.
- The stored zero value fails the zero verification procedure.

Prerequisites

ProLink III v3.5, or a later release

Important

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

Procedure

1. Prepare the meter:
    a. Allow the meter to warm up for at least 20 minutes after applying power.
    b. Run the process fluid through the sensor until the sensor temperature reaches the normal process operating temperature.
    c. Stop flow through the sensor by shutting the downstream valve, and then the upstream valve if available.
    d. Verify that the sensor is blocked in, that flow has stopped, and that the sensor is completely full of process fluid.
2. Choose Device Tools > Device Calibration > Zero Verification and Calibration > Verify Zero and wait until the procedure completes.
3. If the zero verification procedure fails:
    a. Confirm that the sensor is completely blocked in, that flow has stopped, and that the sensor is completely full of process fluid.
    b. Verify that the process fluid is not flashing or condensing, and that it does not contain particles that can settle out.
    c. Repeat the zero verification procedure.
    d. If it fails again, zero the meter.

Postrequisites

Restore normal flow through the sensor by opening the valves.

2.6.2 Terminology used with zero verification and zero calibration

Table 2-1: Terminology used with zero verification and zero calibration

Term	Definition
Zero	In general, the offset required to synchronize the left pickoff and the right pickoff under conditions of zero flow. Unit = microseconds.
Factory Zero	The zero value obtained at the factory, under laboratory conditions.
Field Zero	The zero value obtained by performing a zero calibration outside the factory.
Prior Zero	The zero value stored in the transmitter at the time a field zero calibration is begun. May be the factory zero or a previous field zero.
Manual Zero	The zero value stored in the transmitter, typically obtained from a zero calibration procedure. It may also be configured manually. Also called “mechanical zero” or “stored zero.”
Live Zero	The real-time bidirectional mass flow rate with no flow damping or mass flow cutoff applied. An adaptive damping value is applied only when the mass flow rate changes dramatically over a very short interval. Unit = configured mass flow measurement unit.
Zero Stability	A laboratory-derived value used to calculate the expected accuracy for a sensor. Under laboratory conditions at zero flow, the average flow rate is expected to fall within the range defined by the Zero Stability value (0 ± Zero Stability). Each sensor size and model has a unique Zero Stability value. Statistically, 95% of all data points should fall within the range defined by the Zero Stability value.
Zero Calibration	The procedure used to determine the zero value.
Zero Time	The time period over which the Zero Calibration procedure is performed. Unit = seconds.
Field Verification Zero	A 3-minute running average of the Live Zero value, calculated by the transmitter. Unit = configured mass flow measurement unit.
Zero Verification	A procedure used to evaluate the stored zero and determine whether or not a field zero can improve measurement accuracy.

Part II
Configuration and commissioning

Chapters covered in this part:

3 Introduction to configuration and commissioning

Topics covered in this chapter:

3.1 Default values and ranges

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

3.2 Disable write-protection on the transmitter configuration

ProLink III	Device Tools > Configuration > Write-Protection

Overview

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

Tip

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

3.3 Restore the factory configuration

ProLink III	Device Tools > Configuration Transfer > Restore Factory Configuration

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.

4 Configure process measurement

Topics covered in this chapter:

- *Configure mass flow measurement*
- *Configure volume flow measurement for liquid applications*
- *Configure gas standard volume (GSV) flow measurement*
- *Configure flow direction*
- *Configure density measurement*
- *Configure temperature measurement*

4.1 Configure mass flow measurement

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

The mass flow measurement parameters include:

- Mass Flow Measurement Unit
- Flow Damping
- Mass Flow Cutoff

4.1.1 Configure Mass Flow Measurement Unit

ProLink III	Device Tools > Configuration > Process Measurement > Flow

Overview

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

Procedure

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

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

Options for Mass Flow Measurement Unit

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

Table 4-1: Options for Mass Flow Measurement Unit

Unit description	ProLink III label
Grams per second	g/sec
Grams per minute	g/min
Grams per hour	g/hr
Kilograms per second	kg/sec
Kilograms per minute	kg/min
Kilograms per hour	kg/hr
Kilograms per day	kg/day
Metric tons per minute	mTon/min
Metric tons per hour	mTon/hr
Metric tons per day	mTon/day
Pounds per second	lbs/sec
Pounds per minute	lbs/min
Pounds per hour	lbs/hr
Pounds per day	lbs/day
Short tons (2000 pounds) per minute	sTon/min
Short tons (2000 pounds) per hour	sTon/hr
Short tons (2000 pounds) per day	sTon/day
Long tons (2240 pounds) per hour	lTon/hr
Long tons (2240 pounds) per day	lTon/day
Special unit	special

Define a special measurement unit for mass flow

ProLink III	Device Tools > Configuration > Process Measurement > Flow > Special Units

Overview

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

Procedure

1. Specify Base Mass Unit.

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

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

3. Calculate Mass Flow Conversion Factor as follows:
   a. x base units = y special units
   b. Mass Flow Conversion Factor = x ÷ y

   The original mass flow rate value is divided by this value.
4. Enter Mass Flow Conversion Factor.
5. Set Mass Flow Label to the name you want to use for the mass flow unit.
6. Set Mass Total Label to the name you want to use for the mass total and mass inventory unit.

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

Example: Defining a special measurement unit for mass flow

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

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

4.1.2 Configure Flow Damping

ProLink III	Device Tools > Configuration > Process Measurement > Flow

Overview

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

Procedure

Set Flow Damping to the value you want to use.

The default value is 0.64 seconds. The range is 0 to 60 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.
- The combination of a high damping value and rapid, large changes in flow rate can result in increased measurement error.
- Whenever the damping value is non-zero, the reported measurement will lag the actual measurement because the reported value is being averaged over time.
- In general, lower damping values are preferable because there is less chance of data loss, and less lag time between the actual measurement and the reported value.
- For gas applications, Micro Motion recommends setting Flow Damping to 2.56 or higher.

The value you enter is automatically rounded down to the nearest valid value. Valid damping values are 0, 0.04, 0.08, 0.16, 0.32... 40.96.

Effect of Flow Damping on volume measurement

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

4.1.3 Configure Mass Flow Cutoff

ProLink III	Device Tools > Configuration > Process Measurement > Flow

Overview

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

Procedure

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

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

Effect of Mass Flow Cutoff on volume measurement

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

4.2 Configure volume flow measurement for liquid applications

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

The volume flow measurement parameters include:

- Volume Flow Type
- Volume Flow Measurement Unit
- Volume Flow Cutoff

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

4.2.1 Configure Volume Flow Type for liquid applications

ProLink III	Device Tools > Configuration > Process Measurement > Flow

Overview

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

Restriction
If you are using the concentration measurement application, you must set Volume Flow Type to Liquid. Gas standard volume measurement is incompatible with the concentration measurement application.

Procedure

Set Volume Flow Type to Liquid.

4.2.2 Configure Volume Flow Measurement Unit for liquid applications

ProLink III	Device Tools > Configuration > Process Measurement > Flow

Overview

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

Prerequisites

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

Procedure

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

The default setting for Volume Flow Measurement Unit is l/sec (liters per second).

Options for Volume Flow Measurement Unit for liquid applications

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

Table 4-2: Options for Volume Flow Measurement Unit for liquid applications

Unit description	ProLink III label
Cubic feet per second	ft3/sec
Cubic feet per minute	ft3/min
Cubic feet per hour	ft3/hr
Cubic feet per day	ft3/day
Cubic meters per second	m3/sec
Cubic meters per minute	m3/min
Cubic meters per hour	m3/hr
Cubic meters per day	m3/day
U.S. gallons per second	US gal/sec
U.S. gallons per minute	US gal/min
U.S. gallons per hour	US gal/hr
U.S. gallons per day	US gal/day
Million U.S. gallons per day	mil US gal/day
Liters per second	l/sec
Liters per minute	l/min
Liters per hour	l/hr
Million liters per day	mil l/day
Imperial gallons per second	Imp gal/sec
Imperial gallons per minute	Imp gal/min
Imperial gallons per hour	Imp gal/hr
Imperial gallons per day	Imp gal/day
Barrels per second(1)	barrels/sec

Table 4-2: Options for Volume Flow Measurement Unit for liquid applications *(continued)*

Unit description	ProLink III label
Barrels per minute	barrels/min
Barrels per hour	barrels/hr
Barrels per day	barrels/day
Beer barrels per second[(2)]	Beer barrels/sec
Beer barrels per minute	Beer barrels/min
Beer barrels per hour	Beer barrels/hr
Beer barrels per day	Beer barrels/day
Special unit	special

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

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

Define a special measurement unit for volume flow

ProLink III	Device Tools > Configuration > Process Measurement > Flow > Special Units

Overview

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

Procedure

1. Specify Base Volume Unit.

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

   Base Time Unit is the existing time unit that the special unit will be based on.
3. Calculate Volume Flow Conversion Factor as follows:

   a. x base units = y special units

   b. Volume Flow Conversion Factor = x ÷ y
4. Enter Volume Flow Conversion Factor.
5. Enter Volume Flow Conversion Factor.

   The original volume flow rate value is divided by this conversion factor.
6. Set Volume Flow Label to the name you want to use for the volume flow unit.

7. Set Volume Total Label to the name you want to use for the volume total and volume inventory unit.

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

Example: Defining a special measurement unit for volume flow

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

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

4.2.3 Configure Volume Flow Cutoff

ProLink III	Device Tools > Configuration > Process Measurement > Flow

Overview

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

Procedure

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

The default value for Volume Flow Cutoff is 0.0 l/sec (liters per second). The lower limit is 0. The upper limit is the sensor's flow calibration factor, in units of l/sec, multiplied by 0.2.

4.3 Configure gas standard volume (GSV) flow measurement

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

The GSV flow measurement parameters include:

- Volume Flow Type

- Standard Gas Density
- Gas Standard Volume Flow Measurement Unit
- Gas Standard Volume Flow Cutoff

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

4.3.1 Configure Volume Flow Type for gas applications

ProLink III	Device Tools > Configuration > Process Measurement > Flow

Overview

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

Procedure

Set Volume Flow Type to Gas Standard Volume.

4.3.2 Configure Standard Gas Density

ProLink III	Device Tools > Configuration > Process Measurement > Flow

Overview

The Standard Gas Density value is used to convert the measured flow data to the standard reference values.

Prerequisites

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

Procedure

Set Standard Gas Density to the standard reference density of the gas you are measuring.

Note
ProLink III provides a guided method that you can use to calculate the standard density of your gas, if you do not know it.

4.3.3 Configure Gas Standard Volume Flow Measurement Unit

ProLink III	Device Tools > Configuration > Process Measurement > Flow

Overview

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

Prerequisites

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

Procedure

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

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

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

Options for Gas Standard Volume Flow Measurement Unit

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

Table 4-3: Options for Gas Standard Volume Measurement Unit

Unit description	ProLink III label
Normal cubic meters per second	Nm3/sec
Normal cubic meters per minute	Nm3/sec
Normal cubic meters per hour	Nm3/hr
Normal cubic meters per day	Nm3/day
Normal liter per second	NLPS
Normal liter per minute	NLPM
Normal liter per hour	NLPH
Normal liter per day	NLPD
Standard cubic feet per second	SCFS
Standard cubic feet per minute	SCFM

Table 4-3: Options for Gas Standard Volume Measurement Unit *(continued)*

Unit description	ProLink III label
Standard cubic feet per hour	SCFH
Standard cubic feet per day	SCFD
Standard cubic meters per second	Sm3/sec
Standard cubic meters per minute	Sm3/min
Standard cubic meters per hour	Sm3/hr
Standard cubic meters per day	Sm3/day
Standard liter per second	SLPS
Standard liter per minute	SLPM
Standard liter per hour	SLPH
Standard liter per day	SLPD
Special measurement unit	special

Define a special measurement unit for gas standard volume flow

ProLink III	Device Tools > Configuration > Process Measurement > Flow > Special Units

Overview

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

Procedure

1. Specify Base Gas Standard Volume Unit.

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

   Base Time Unit is the existing time unit that the special unit will be based on.
3. Calculate Gas Standard Volume Flow Conversion Factor as follows:
   a. x base units = y special units
   b. Gas Standard Volume Flow Conversion Factor = x ÷ y
4. Enter the Gas Standard Volume Flow Conversion Factor.

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

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

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

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

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

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

4.3.4 Configure Gas Standard Volume Flow Cutoff

ProLink III	Device Tools > Configuration > Process Measurement > Flow

Overview

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

Procedure

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

The default value for Gas Standard Volume Flow Cutoff is 0.0. The lower limit is 0.0. There is no upper limit.

4.4 Configure flow direction

ProLink III	Device Tools > Configuration > Process Measurement > Flow

Overview

Flow Direction controls how forward flow and reverse flow affect flow measurement and reporting. You can configure two flow directions - one flow direction to map to the first group of totals, and a second flow direction to map to the second group of totals. The default flow directions are: Forward for the first group of totals, and Reverse for the second group of totals.

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.

You can configure two flow directions:

- The first flow direction is configured and applied to the first totals. The default setting is Forward.
- The second flow direction is configured and applied to the second totals. The default setting is Reverse.

4.4.1 Options for Flow Direction

Table 4-4: Options for Flow Direction

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

Table 4-4: Options for Flow Direction *(continued)*

Flow direction setting from ProLink III	Relationship to Flow Direction arrow on sensor
Negate Bidirectional	Appropriate when both forward and reverse flow are expected, and reverse flow will dominate, but the amount of forward flow will be significant.

Effect of Flow Direction on flow totals

Flow Direction affects how flow totals and inventories are calculated.

Table 4-5: Effect of the Flow Direction parameter and actual flow direction on flow totals and inventories

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

4.5 Configure density measurement

The density measurement parameters control how density is measured and reported. Density measurement (along with mass measurement) is used to determine liquid volume flow.

4.5.1 Configure Density Measurement Unit

ProLink III	Device Tools > Configuration > Process Measurement > Density

Overview

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

Procedure

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

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

Options for Density Measurement Unit

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

Table 4-6: Options for Density Measurement Unit

Unit description	ProLink III label
Specific gravity unit (not temperature-corrected)	SGU
Grams per cubic centimeter	g/cm3
Grams per liter	g/l
Grams per milliliter	g/ml
Kilograms per liter	kg/l
Kilograms per cubic meter	kg/m3
Pounds per U.S. gallon	lbs/Usgal
Pounds per cubic foot	lbs/ft3
Pounds per cubic inch	lbs/in3
API gravity	degAPI
Short ton per cubic yard	sT/yd3

4.5.2 Configure two-phase flow parameters

ProLink III	Device Tools > Configuration > Process Measurement > Density

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 (Slug 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.

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 (Slug 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.

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

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

- Outputs that represent flow rate revert to reporting actual flow.

- The two-phase flow alert is deactivated, but remains in the active alert log until it is acknowledged.

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

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

4.5.3 Configure density damping

ProLink III	Device Tools > Configuration > Process Measurement > Density

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.

Procedure

Set Density Damping to the value you want to use.

The default value is 1.28 seconds. The range is 0 to 60 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. The valid values for Density Damping are: 0, 0.04, 0.08, 0.16, 0.32... 40.96.

Effect of density damping on volume measurement

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

4.5.4 Configure Density Cutoff

ProLink III	Device Tools > Configuration > Process Measurement > Density

Overview

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

Procedure

Set Density Cutoff to the value you want to use.

The default value for Density Cutoff is 0.2 g/cm^3. The range is 0.0 g/cm^3 to 0.5 g/cm^3.

Effect of Density Cutoff on volume measurement

Density Cutoff affects liquid volume measurement. If the density value goes below Density Cutoff, the volume flow rate is reported as 0. Density Cutoff does not affect gas standard volume measurement. Gas standard volume values are always calculated from the value configured for Standard Gas Density.

4.6 Configure temperature measurement

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

4.6.1 Configure Temperature Measurement Unit

ProLink III	Device Tools > Configuration > Process Measurement > Temperature

Overview

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

Procedure

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

The default setting is Degrees Celsius.

Options for Temperature Measurement Unit

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

Table 4-7: Options for Temperature Measurement Unit

Unit description	ProLink III
Degrees Celsius	°C
Degrees Fahrenheit	°F
Degrees Rankine	°R
Kelvin	°K

4.6.2 Configure Temperature Damping

ProLink III	Device Tools > Configuration > Temperature

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. The range is 0.0 to 38.4 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. Valid values for Temperature Damping are 0, 0.6, 1.2, 2.4, 4.8, ... 38.4.

Effect of Temperature Damping on process measurement

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

Temperature compensation

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

5 Configure device options and preferences

Topics covered in this chapter:

- *Configure response time parameters*
- *Configure alert handling*
- *Configure informational parameters*

5.1 Configure response time parameters

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

Response time parameters include:

- Update Rate
- Calculation Speed (Response Time)

5.1.1 Configure Calculation Speed (Response Time)

ProLink III	Device Tools > Configuration > Process Measurement > Response > Calculation Speed

Overview

Calculation Speed is used to apply a different algorithm to the calculation of process variables from the raw process data. Calculation Speed = Special produces faster and "noisier" response to changes in the process.

Tip
You can use Calculation Speed = Special with either setting of Update Rate. The parameters control different aspects of flowmeter processing.

Procedure

Set Calculation Speed as desired.

Option	Description
Normal	Transmitter calculates process variables at the standard speed.
Special	Transmitter calculates process variables at a faster speed.

5.2 Configure alert handling

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

- *Configure Fault Timeout* (Section 5.2.1)
- *Configure Status Alert Severity* (Section 5.2.2)

5.2.1 Configure Fault Timeout

ProLink III	Device Tools > Configuration > Fault Processing

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, 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.

5.2.2 Configure Status Alert Severity

ProLink III	Device Tools > Configuration > Alert Severity

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 (if available) returns to green and may or may not flash.
Informational	Actions when fault is detected: • The alert is posted to the Alert List. • The status LED (if available) changes to red or yellow (depending on alert severity). Actions when alert clears: • The status LED (if available) returns to green and may or may not flash.
Ignore	No action

Status alerts and options for Status Alert Severity

Table 5-1: Status alerts and Status Alert Severity

Alert code	Status message	Default severity	Notes	Configurable?
A001	EEPROM Error	Fault		No
A002	RAM Error	Fault		No
A003	No Sensor Response	Fault		Yes
A004	Temperature Overrange	Fault		No

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

Alert code	Status message	Default severity	Notes	Configurable?
A005	Mass Flow Rate Overrange	Fault		Yes
A006	Characterization Required	Fault		Yes
A008	Density Overrange	Fault		Yes
A009	Transmitter Initializing/ Warming Up	Fault		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 RTD Failure	Fault		Yes
A020	No Flow Cal Value	Fault		Yes
A021	Incorrect Sensor Type (K1)	Fault		No
A027	Security Breach	Fault		No
A030	Incorrect Board Type	Fault		No
A033	Insufficient Right/Left Pick-off Signal	Fault	Applies only to flowmeters with the enhanced core processor.	Yes
A102	Drive Overrange	Informational		Yes
A104	Calibration in Progress	Informational	Can be set to either Informational or Ignore, but cannot be set to Fault.	Yes
A105	Slug Flow	Informational		Yes
A107	Power Reset Occurred	Informational	Normal transmitter behavior; occurs after every power cycle.	Yes

5.3 Configure informational parameters

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

5.3.1 Configure the sensor index

ProLink III	Device Tools > Configuration > Informational Parameters > Sensor Index

You can configure the sensor index only if the connection is through a service port. If the connection is an RS-485 port, the sensor index is read-only, with each Modbus address corresponding to a different sensor. In default, Modbus address 1 corresponds to sensor 1, Modbus address 2 corresponds to sensor 2.

5.3.2 Configure the RTD cable length

ProLink III	Device Tools > Configuration > Informational Parameters > Sensor > RTD1(2) Cable Length

Overview

Configure the RTD cable length if your 9-wire cable length is other than three meters.

Prerequisites

Verify that the sensor index is correct.

Procedure

Enter the cable length (unit:m) in the RTD 1(2) Cable Length field.

Related information

Configure the sensor index

5.3.3 Configure Sensor Serial Number

ProLink III	Device Tools > Configuration > Informational Parameters > Sensor

Overview

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

Procedure

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

5.3.4 Configure Sensor Material

ProLink III	Device Tools > Configuration > Informational Parameters > Sensor

Overview

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

Procedure

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

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

5.3.5 Configure Sensor Liner Material

ProLink III	Device Tools > Configuration > Informational Parameters > Sensor

Overview

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

Procedure

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

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

5.3.6 Configure Sensor Flange Type

ProLink III	Device Tools > Configuration > Informational Parameters > Sensor

Overview

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

Procedure

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

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

5.3.7 Configure Descriptor

ProLink III	Device Tools > Configuration > Informational Parameters > Transmitter

Overview

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

Procedure

Enter a description for the transmitter or device

You can use up to 16 characters for the description.

5.3.8 Configure Message

Message lets you store a short message in transmitter memory. This parameter is not used in processing and is not required.

Procedure

Enter a short message for the transmitter or device.

Your message can be up to 32 characters long.

5.3.9 Configure Date

ProLink III	Device Tools > Configuration > Informational Parameters > Transmitter

Overview

Date lets you store a static date (not updated by the transmitter) in transmitter memory. This parameter is not used in processing and is not required.

Procedure

Enter the date you want to use, in the form mm/dd/yyyy.

Tip
ProLink III provides a calendar tool to help you select the date.

6 Integrate the meter with the control system

Topics covered in this chapter:

- *Configure events*
- *Configure digital communications*

6.1 Configure events

An event occurs when the real-time value of a user-specified process variable moves past a user-defined setpoint. Events are used to provide notification of process changes or to perform specific transmitter actions if a process change occurs.

6.1.1 Configure an enhanced event

ProLink III	Device Tools > Configuration > Events > Enhanced Events

Overview

An enhanced event is used to provide notification of process changes and, optionally, to perform specific transmitter actions if the event occurs. An enhanced event occurs (is ON) if the real-time value of a user-specified process variable moves above (HI) or below (LO) a user-defined setpoint, or in range (IN) or out of range (OUT) with respect to two user-defined setpoints. You can define up to five enhanced events.

Procedure

1. Select the event that you want to configure.
2. Specify Event Type.

Options	Description
HI	$x > A$ The event occurs when the value of the assigned process variable (x) is greater than the setpoint (Setpoint A), endpoint not included.
LO	$x < A$ The event occurs when the value of the assigned process variable (x) is less than the setpoint (Setpoint A), endpoint not included.
IN	$A \le x \le B$ The event occurs when the value of the assigned process variable (x) is *in range*, that is, between Setpoint A and Setpoint B, endpoints included.

Options	Description
OUT	$x \le A$ or $x \ge B$ The event occurs when the value of the assigned process variable (x) is *out of range*, that is, less than Setpoint A or greater than Setpoint B, endpoints included.

3. Assign a process variable to the event.
4. Set values for the required setpoints.
   - For HI and LO events, set Setpoint A.
   - For IN and OUT events, set Setpoint A and Setpoint B.
5. (Optional) Configure a discrete output to switch states in response to the event status.

Options for Enhanced Event Action

Table 6-1: Options for Enhanced Event Action

Action	ProLink III
None (default)	None
Start sensor zero	Start Sensor Zero
Start/stop all totalizers	Start/Stop All Totalization
Reset mass total	Reset Mass Total
Reset volume total	Reset Volume Total
Reset gas standard volume total	Reset Gas Std Volume Total
Reset all totals	Reset All Totals

6.2 Configure digital communications

The digital communications parameters control how the transmitter will communicate using digital communications.

Your transmitter supports the following types of digital communications:

- Modbus RTU via the service port
- Modbus RTU via the RS-485 port

Note

The service port responds automatically to a wide range of connection requests. It is not configurable.

6.2.1 Configure Modbus/RS-485 communications

ProLink III	Device Tools > Configuration > Communications > Communications (Modbus)

Overview

Modbus/RS-485 communications parameters control Modbus communication with the transmitter's RS-485 terminals.

Modbus/RS-485 communications parameters include:

- Modbus Address (Slave Address)
- Floating-Point Byte Order
- Additional Communications Response Delay

Procedure

1. Set Modbus Address to a unique value on the network.
2. Set Floating-Point Byte Order to match the byte order used by your Modbus host.

Code	Byte order
0	1–2 3–4
1	3–4 1–2
2	2–1 4–3
3	4–3 2–1

See *Table 6-2*for the bit structure of bytes 1, 2, 3, and 4.

Table 6-2: Bit structure of floating-point bytes

Byte	Bits	Definition
1	SEEEEEEE	S=Sign E=Exponent
2	EMMMMMMM	E=Exponent M=Mantissa
3	MMMMMMMM	M=Mantissa
4	MMMMMMMM	M=Mantissa

3. (Optional) Set Additional Communications Response Delay in *delay units.*

   A delay unit is 2/3 of the time required to transmit one character, as calculated for the port currently in use and the character transmission parameters. Valid values range from 1 to 255.

Additional Communications Response Delay is used to synchronize Modbus communications with hosts that operate at a slower speed than the transmitter. The value specified here will be added to each response the transmitter sends to the host.

Tip

Do not set Additional Communications Response Delayunless required by your Modbus host.

6.2.2 Configure RS-485 terminals

ProLink III	Device Tools > Configuration > Communications > RS-485 Terminals

Overview

Modbus/RS-485 communication parameters control Modbus communication with the transmitter's RS-485 terminals.

RS-485 terminal parameters include:

- Baud rate
- Parity
- Stop bits

Procedure

1. Set Baud Rate as appropriate for your network.

   The following baud rates are supported:

   - 4800
   - 9600
   - 19200
   - 38400

2. Set Parity as appropriate for your network.

   The following parity bits are supported:

   - None
   - Odd
   - Even

3. Set Stop Bits as appropriate for your network.

   The following stop bits are supported:

   - 1
   - 2

6.2.3 Configure Digital Communications Fault Action

ProLink III	Device Tools > Configuration > Fault Processing

Overview

Digital Communications Fault Actionspecifies the values that will be reported via digital communications if the device encounters an internal fault condition.

Procedure

Set Digital Communications Fault Action as desired.

The default setting is None.

Options for Digital Communications Fault Action

Table 6-3: Options for Digital Communications Fault Action

Label		Description
ProLink III		
Upscale	Upscale	• Process variable values indicate that the value is greater than the upper sensor limit. • Totalizers stop incrementing.
Downscale	Downscale	• Process variable values indicate that the value is lower than the lower sensor limit. • Totalizers stop incrementing.
Zero	IntZero-All 0	• Flow rate variables go to the value that represents a flow rate of 0 (zero). • Density is reported as 0. • Temperature is reported as 0 °C, or the equivalent if other units are used (e.g., 32 °F. • Drive gain is reported as measured. • Totalizers stop incrementing.
None	None (default)	• All process variables are reported as measured. • Totalizers increment if they are running.

7 Complete the configuration

Topics covered in this chapter:

- *Back up transmitter configuration*
- *Enable write-protection on the transmitter configuration*

7.1 Back up transmitter configuration

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

Restriction

This function is not available with any other communications tools.

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 Enable write-protection on the transmitter configuration

ProLink III	Device Tools > Configuration > Write-Protection

Overview

If the transmitter is write-protected, the configuration is locked and nobody can change it until it is unlocked. This prevents accidental or unauthorized changes to the transmitter configuration parameters.

Part III

Operations, maintenance, and troubleshooting

Chapters covered in this part:

8 Transmitter operation

Topics covered in this chapter:

8.1 Custody transfer

A custody transfer switch that controls custody transfer status is located inside the dual processor.

When the switch is off

- The transmitter works under custody transfer unsecured mode
- The transmitter can be configured
- The status LED is red
- The A027 Security Breach alert is active

When the switch is on:

- The transmitter works under custody transfer secured mode
- The transmitter cannot be configured
- Unless there are alarms, the status LED is green

8.2 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
Flow rate			
Density			
Temperature			
Tube frequency			
Pickoff voltage			
Drive gain			

8.3 View process variables

ProLink III	View the desired variable on the main screen under Process Variables. See *Section 8.3.1* for more information.

Overview

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 and other data using ProLink III* (Section 8.3.1)

8.3.1 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.

8.4 View transmitter status using the status LED

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

Observe the status LED.

To interpret the status LED, see the following table.

Restriction

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

Table 8-1: Status LED states

LED behavior	Alarm condition	Description
Solid green	No alarm	Normal operation
Solid yellow	Active low-severity alarm	Alarm has been acknowledged
Flashing yellow	Active low-severity alarm	Alarm has not been acknowledged
Solid red	Active high-severity alarm	Alarm has been acknowledged
Flashing red	Active high-severity alarm	Alarm has not been acknowledged

8.5 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 ProLink III* (Section 8.5.1)

8.5.1 View and acknowledge alerts using ProLink III

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

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: A001, A002, A010, A011, A012, A013, A029.
- 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

8.5.2 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 8-2: Alert data in transmitter memory

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

Table 8-2: Alert data in transmitter memory *(continued)*

Alert data structure	Transmitter action if condition occurs	
	Contents	**Clearing**
Recent Alerts	50 most recent alert postings or alert clearings	Not cleared; maintained across transmitter power cycles

8.6 Read totalizer and inventory values

ProLink III	View the desired variable on the main screen under Process Variables.

Overview

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

Tip

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

8.7 Start and stop totalizers and inventories

ProLink III	Device Tools > Totalizer Control > Totalizer and Inventories > Start All Totals Device Tools > Totalizer Control > Totalizer and Inventories > Stop All Totals

Overview

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

Important

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

8.8 Reset totalizers

ProLink III	Device Tools > Totalizer Control > Totalizer and Inventories > Reset Mass Total Device Tools > Totalizer Control > Totalizer and Inventories > Reset Volume Total Device Tools > Totalizer Control > Totalizer and Inventories > Reset Gas Total Device Tools > Totalizer Control > Totalizer and Inventories > Reset All Totals

Overview

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

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

8.9 Reset inventories

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

Overview

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

Tip
When you reset a single inventory, the values of other inventories are not reset. Totalizer values are not reset.

Prerequisites

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

- To enable inventory reset in ProLink III:
  1. Choose Tools > Options.
  2. Select Reset Inventories from ProLink III.

9 Measurement support

Topics covered in this chapter:

9.1 Options for measurement support

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

The following methods are available:

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

Tips

- To prove the meter against a regulatory standard, or to correct measurement error, use meter validation and meter factors.
- Before performing a field calibration, contact Micro Motion to see if there is an alternative. In many cases, field calibrations have a negative effect on measurement accuracy.

9.2 Zero the meter

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

9.2.1 Zero the meter using ProLink III

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

Important

In most cases, the factory zero is more accurate than the field zero. Do not zero the meter unless one of the following is true:

- The zero is required by site procedures.

- The stored zero value fails the zero verification procedure.

Prerequisites

Before performing a field zero, execute the Zero Verification procedure to see whether or not a field zero can improve measurement accuracy.

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

Procedure

1. Prepare the meter:
   a. Allow the meter to warm up for at least 20 minutes after applying power.
   b. Run the process fluid through the sensor until the sensor temperature reaches the normal process operating temperature.
   c. Stop flow through the sensor by shutting the downstream valve, and then the upstream valve if available.
   d. Verify that the sensor is blocked in, that flow has stopped, and that the sensor is completely full of process fluid.
   e. Verify that the process fluid is not flashing or condensing, and that it does not contain particles that can settle out.
   f. Remove or reduce sources of electromechanical noise if appropriate.
   g. Observe the drive gain, temperature, and density readings. If they are stable, check the Live Zero or Field Verification Zero value. If the average value is close to 0, you should not need to zero the meter.
2. Choose Device Tools > Calibration > Zero Verification and Calibration.
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:

- Ensure that there is no flow through the sensor, then retry.
- Set Zero Time to a lower value, then retry.
- If you want to return the flowmeter to operation using a previous zero value:
  - To restore the zero value set at the factory: Device Tools > Zero Verification and Calibration > Calibrate Zero > Restore Factory Zero. This function requires the enhanced core processor.
  - To restore the most recent valid value from transmitter memory: Device Tools > Zero Verification and Calibration > Calibrate Zero > Restore Prior Zero. Restore Prior Zero is available only while the Flow Calibration window is open. If you close the Flow Calibration window, you will no longer be able to restore the prior zero.

Restriction

Restore the factory zero only if your meter was purchased as a unit, it was zeroed at the factory, and you are using the original components.

9.2.2 Record the zeros

ProLink III	Device Tools > Diagnostics > Zero Log

Overview

Record the zero values from the zero log.
The zero log stores the last twenty zero values for each sensor, including the time stamp, maximum/minumum temperature, maximum/minimum density, and maximum/minimum drive gain.

Note

The maximum and minimum values are the values stored while the meter was calibrating each zero.

9.3 Validate the meter

ProLink III	Device Tools > Configuration > Process Measurement > Flow Device Tools > Configuration > Process Measurement > Density

Overview

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

Prerequisites

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

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

Important

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

If you plan to calculate the meter factor for volume flow, be aware that validating volume in the field may be expensive, and the procedure may be hazardous for some process fluids. Therefore, because volume is inversely proportional to density, an alternative to direct measurement is to calculate the meter factor for volume flow from the meter factor for density. See *Section 9.3.1* for instructions on this method.

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

Important

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

Procedure

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

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

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

Example: Calculating the meter factor for mass flow

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

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

The first meter factor for mass flow is 0.9989.

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

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

The new meter factor for mass flow is 0.9996.

9.3.1 Alternate method for calculating the meter factor for volume flow

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

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

Procedure

1. Calculate the meter factor for density, using the standard method (see *Section 9.3*).
2. Calculate the meter factor for volume flow from the meter factor for density:

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

Note

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

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

3. Ensure that the calculated meter factor is between 0.8 and 1.2, inclusive. If the meter factor is outside these limits, contact Micro Motion customer service.
4. Configure the meter factor for volume flow in the transmitter.

9.4 Perform a (standard) D1 and D2 density calibration

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

Important

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

Tip

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

9.4.1 Perform a D1 and D2 density calibration using ProLink III

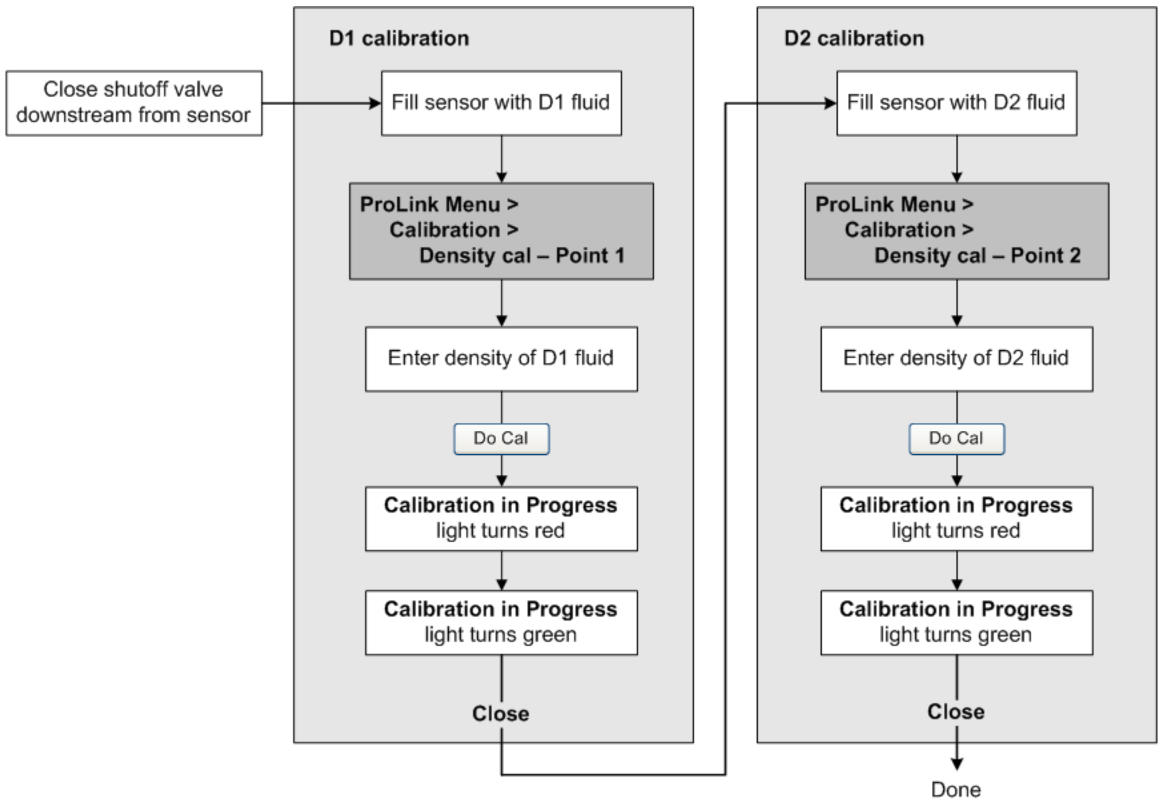
Prerequisites

- During density calibration, the sensor must be completely filled with the calibration fluid, and flow through the sensor must be at the lowest rate allowed by your application. This is usually accomplished by closing the shutoff valve downstream from the sensor, then filling the sensor with the appropriate fluid.
- D1 and D2 density calibration require a D1 (low-density) fluid and a D2 (high-density) fluid. You may use air and water.
- The calibrations must be performed without interruption, in the order shown. Make sure that you are prepared to complete the process without interruption.
- Before performing the calibration, record your current calibration parameters. You can do this by saving the current configuration to a file on the PC. If the calibration fails, restore the known values.

Procedure

See the following figure.

Figure 9-1: D1 and D2 density calibration using ProLink III



10 Troubleshooting

Topics covered in this chapter:

10.1 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.

Table 10-1: Status LED states

Condition	LED Blinking **parameter**	LED behavior
Normal operation (no alert)	N/A	Solid green
Unacknowledged corrected condition (no alert)	Enabled	Flashing green
	Disabled	Solid green
Acknowledged low-severity alert (outputs continue to report process data)	N/A	Solid yellow
Unacknowledged low-severity alert (outputs continue to report process data)	Enabled	Flashing yellow
	Disabled	Solid yellow
Acknowledged high-severity alert (outputs in fault)	N/A	Solid red
Unacknowledged high-severity alert (outputs in fault)	Enabled	Flashing red
	Disabled	Solid red

10.2 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. • Replace the core processor. • Contact Micro Motion.
A002	RAM Error	The transmitter has detected a problem communicating with the sensor.	• Cycle power to the meter. • Replace the core processor. • Contact Micro Motion.
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. • Check the wiring between the sensor and the transmitter. • Verify that internal wiring is secure and that there are no internal electrical problems. • 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. • Verify that internal wiring is secure and that there are no internal electrical problems. • Check the wiring between the sensor and the transmitter. • Contact Micro Motion.
A005	Mass Flow Rate Overrange	The measured flow rate is greater than the maximum flow rate 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.
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. • Verify the setting of the Sensor Type parameter. • If Sensor Type=Curved Tube, ensure that no parameters specific to Straight Tube have been set. • Verify that internal wiring is secure and that there are no internal electrical problems. • Replace the core processor. • Contact Micro Motion.

Alert number	Alert title	Possible cause	Recommended actions
A008	Density Overrange	The line density is greater than 10 g/cm^3 (10000 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 air in the flow tubes, tubes not filled, foreign material in the tubes, coating in the tubes, or other process problems. • Check for two-phase flow. • Verify all of the characterization or calibration parameters. See the sensor tag or the calibration sheet for your meter. • Check the drive gain and the pickoff voltage. • Perform Smart Meter Verification. • Perform density calibration. • Contact Micro Motion.

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.
			• Verify that the tubes are full of process fluid.
			• Check the wiring between the sensor and the transmitter.
			• 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.
			• Ensure that the process fluid is stable. Check for two-phase flow, high process noise, or a fast transition between two fluids of different densities.

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.

Alert number	Alert title	Possible cause	Recommended actions
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 electromechanical noise (e.g., pumps, vibration, pipe stress), cycle power to the meter, then retry the procedure.
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. • 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. • Verify that internal wiring is secure and that there are no internal electrical problems. • Contact Micro Motion.

Alert number	Alert title	Possible cause	Recommended actions
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. • Verify the setting of the Sensor Type parameter. • If Sensor Type=Curved Tube, ensure that no parameters specific to Straight Tube have been set.
A021	Transmitter/Sensor/Software Mismatch	The configured board type does not match the physical board, or the configured sensor type does not match the physical sensor.	• 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. • Verify the setting of the Sensor Type parameter. • If Sensor Type=Curved Tube, ensure that no parameters specific to Straight Tube have been set.
A027	Security Breach	The transmitter has been switched from secure mode to unsecure mode. In unsecured mode, the transmitter configuration can be changed.	• Secure the transmitter by setting the CT switch to ON. Note that additional procedures may be required to return the device to secured mode.
A030	Incorrect Board Type	The loaded software is not compatible with the programmed board type.	• 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 air in the flow tubes, tubes not filled, foreign material in the tubes, coating in the tubes, or other process problems. • 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 even if the flow tubes are full.

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. • Check the wiring between the sensor and the transmitter. • Verify that internal wiring is secure and that there are no internal electrical problems. • Check for air in the flow tubes, tubes not filled, foreign material in the tubes, coating in the tubes, 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 even if the flow tubes are full.
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.
A107	Power Reset Occurred	The transmitter has been restarted.	• No action required. • If desired, you can set Alert Severity Level to Ignore.
N/A	Density D1 Calibration in Progress	A D1 density calibration is in progress.	• No action required.
N/A	Density D2 Calibration in Progress	A D2 density calibration is in progress.	• No action required.
N/A	Zero Calibration in Progress	A zero calibration is in progress.	• No action required.
N/A	Reverse Flow	Flow through the device is in the reverse direction (against the flow arrow).	• No action required.

10.3 Flow measurement problems

Table 10-2: Flow measurement problems and recommended actions

Problem	Possible causes	Recommended actions
Non-zero flow reading at no-flow conditions or at zero offset	• Misaligned piping (especially in new installations) • Open or leaking valve • Incorrect sensor zero	• If the reading is not excessively high, review the live zero. You may need to restore the factory zero. • Check for open or leaking valves or seals. • Check for mounting stress on the sensor (e.g., sensor being used to support piping, misaligned piping). • Contact Micro Motion.
Erratic non-zero flow rate 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. • If the wiring between the sensor and the transmitter includes a 9-wire segment, verify that the 9-wire cable shields are correctly grounded. • Check the wiring between the sensor and the transmitter. • For sensors with a junction box, check for moisture in the junction box. • Purge the sensor tubes. • Check for open or leaking valves or seals. • Check for sources of vibration. • Verify damping configuration. • Verify that the measurement units are configured correctly for your application. • Check for two-phase flow. • Check for radio frequency interference. • Contact Micro Motion.

Table 10-2: Flow measurement problems and recommended actions *(continued)*

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

10.4 Density measurement problems

Table 10-3: Density measurement problems and recommended actions

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

10.5 Temperature measurement problems

Table 10-4: 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 • RTD cable length configuration is not correct	• Check junction box for moisture or verdigris. • 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. • Verify that the RTD cable length configuration matches the actual cable length for each sensor
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. • The electrical connection between the RTD and the sensor may be damaged. This may require replacing the sensor.

10.6 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.

10.7 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.

10.8 Check for radio frequency interference (RFI)

Procedure

- Use shielded cable between the output and the receiving device.
  - Terminate the shielding at the receiving device. If this is impossible, terminate the shielding at the cable gland or conduit fitting.

  - Do not terminate the shielding inside the wiring compartment.
  - 360-degree termination of shielding is unnecessary.
- Eliminate the RFI source.

10.9 Check for two-phase flow (slug flow)

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

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.

10.10 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
Sensor tubes not completely full	Correct process conditions so that the sensor tubes are full.
Plugged sensor tube	Check the pickoff voltages (see *Section 10.11*). 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.
Drive board or module failure	Contact Micro Motion.

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

Possible cause	Recommended actions
Bent sensor tube	Check the pickoff voltages (see *Section 10.11*). 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.
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
Foreign material caught in sensor tubes	• Purge the sensor tubes. • Replace the sensor.

10.10.1 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.

10.11 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
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.
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. • Test coils at sensor. See *Section 10.12.1*.
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.

10.11.1 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.

10.12 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
Moisture inside the sensor junction box	Ensure that the junction box is dry and no corrosion is present.
Liquid or moisture inside the sensor case	Contact Micro Motion.

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

Possible cause	Recommended action
Internally shorted feedthrough	Contact Micro Motion.
Faulty cable	Replace the cable.
Improper wire termination	Verify wire terminations inside the sensor junction box. The Micro Motion document titled *9-Wire Flowmeter Cable Preparation and Installation Guide* may offer some assistance.

10.12.1 Check the sensor coils

Checking the sensor coils can identify electrical shorts.

Restriction

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

Procedure

1. Disconnect power to the transmitter.

   ⚠ CAUTION!

   If the transmitter is in a hazardous area, wait 5 minutes before continuing.

2. Unplug the terminal blocks from the terminal board on the core processor.
3. Using a digital multimeter (DMM), check the pickoff coils by placing the DMM leads on the unplugged terminal blocks for each terminal pair. See *Table 10-9* for a list of the coils. Record the values.

Table 10-9: Coils and test terminal pairs

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

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

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

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

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

5. Test the resistance of junction box terminal pairs.

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

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

Postrequisites

To return to normal operation:

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

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

Appendix A
Using ProLink III with the transmitter

A.1 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.

A.1.1 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
- Modbus/RS-485 8-bit connections (Modbus RTU)

A.1.2 Connect with ProLink III to the service port

Prerequisites

- ProLink III 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. Start ProLink III.
4. Choose Connect to Physical Device.
5. 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.

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

A.1.3 Connect with ProLink III to the RS-485 port

You can connect directly to the RS-485 terminals on the transmitter or to any point on the network.

Prerequisites

- ProLink III installed and licensed on your PC
- ProLink III v3.5 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. To connect over the RS-485 network:

   a. Attach the leads from the signal converter to any point on the network.
   b. Add resistance as necessary to achieve at least one volt across the connection points.

3. Start ProLink III.
4. Choose Connect to Physical Device.
5. Set the connection parameters to the values configured in the transmitter.

   If your transmitter has not been configured, use the default values shown here.

Table A-1: Default Modbus/RS-485 connection parameters

Parameter	Default value
Protocol	Modbus RTU
Baud	9600
Parity	None
Stop Bits	1
Address	1 (sensor1), 2 (sensor2)

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

Need help? If an error message appears:

- Verify the Modbus address of the transmitter.
- Ensure that you have specified the correct port on your PC.
- Check the wiring between the PC and the transmitter.
- Increase or decrease resistance.
- For long-distance communication, or if noise from an external source interferes with the signal, install 120-Ω ½-W terminating resistors in parallel with the output at both ends of the communication segment.
- Ensure that there is no concurrent Modbus communication to the transmitter.

Appendix B
Default values and ranges

B.1 Default values and ranges

The default values and ranges represent the typical factory transmitter configuration. Depending on how the transmitter was ordered, certain values may have been configured at the factory and are not represented in the default values and ranges.

Table B-1: Transmitter default values and ranges

Type	Parameter	Default	Range	Comments
Flow	Flow direction	Forward		
	Flow damping	0.64 sec	0.0 – 60.0 sec	User-entered value is corrected to nearest lower value in list of preset values.In Special mode, the preset values are 1/5 normal. For gas applications, Micro Motion recommends a minimum value of 2.56.
	Flow calibration factor	1.00005.13		
	Mass flow units	kg/min		
	Mass flow cutoff	Sensor-specific value set at factory		For most sensors, the typical setting is 0.05% to 0.10% of the sensor's rated maximum flow rate. For some sensors, the setting may be higher. For some applications, such as empty-full-empty batching, a higher value is recommended. Contact MMI customer service for assistance.
	Volume flow type	Liquid		
	Volume flow units	L/s		
	Volume flow cutoff	0/0 L/s	0.0 – x L/s	x is obtained by multiplying the flow calibration factor by 0.2, using units of L/s.
Meter factors	Mass factor	1		
	Density factor	1		
	Volume factor	1		

Table B-1: Transmitter default values and ranges *(continued)*

Type	Parameter	Default	Range	Comments
Density	Density damping	1.28 sec	0.0 – 60.0 sec	User-entered value is corrected to nearest value in list of preset values.
	Density units	g/cm^3		
	Density cutoff	0.2 g/cm^3	0.0 – 0.5 g/cm^3	
	D1	0 g/cm^3		
	D2	1 g/cm^3		
	K1	1000 µsec	1000 – 50,000 µsec	
	K2	50,000 µsec	1000 – 50,000 µsec	
	FD	0		
	Temp Coefficient	4.44		
Slug flow	Slug flow low limit	0.0 g/cm^3	0.0 – 10.0 g/cm^3	
	Slug flow high limit	5.0 g/cm^3	0. 0 – 10.0 g/cm^3	
	Slug duration	0.0 sec	0.0 – 60.0 sec	
Temperature	Temperature damping	4.8 sec	0.0 – 80 sec	User-entered value is corrected to nearest lower value in list of preset values.
	Temperature units	Deg C		
	Temperature calibration factor	1.00000T0.0000		
	RTD cable length	3 m	0- 350m	Enter the correct cable length for more accurate temperature reading.
Pressure	Pressure units	PSI		
	Flow factor	0		
	Density factor	0		
	Cal pressure	0		
Special units	Base mass unit	g		
	Base mass time	sec		
	Mass flow conversion factor	1		
	Base volume unit	L		
	Base volume time	sec		
	Volume flow conversion factor	1		

Table B-1: Transmitter default values and ranges *(continued)*

Type	Parameter	Default	Range	Comments
Digital communications	Fault action	None		
	Fault timeout	0 seconds	0.0 – 60.0 sec	
	Modbus address	1 (sensor 1) 2 (sensor 2)	1 ~127, excluding 111	Address 1 or any other modified address will always correspond to sensor1, address 2 or any other modified address will always correspond to sensor2.
	Modbus baud rate	9600	4800 to 38400	
	Modbus parity	None	• None • Odd • Even	

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